FOR THE
IB DIPLOMA

Theory of Knowledge

Teaching for Success

Carolyn P. Henly
John Sprague

DYNAMIC LEARNING

HODDER EDUCATION

FOR THE
IB DIPLOMA
PROGRAMME

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Authors' acknowledgments

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John: This is especially for all the teachers new to the course – there are many different reasons why teachers find themselves in front of a TOK classroom and for many it is a harrowing experience. I hope that this text helps smooth that bumpy transition. Stick to it! This will be incredibly rewarding. In terms of thanks, I'd like to acknowledge all the teachers whom I've learned from and worked for, from the long-standing TOK gurus, to my fellow curriculum developers and those of you brand new to teaching the course (including you, Anita!). I hope that this text can stand tall alongside the insight and support you've given me.

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Contents

Introduction

Teaching Theory of Knowledge

This book has been designed as a companion to the student book *Theory of Knowledge for the IB Diploma Programme 4th Edition*, by Carolyn P. Henly and John Sprague, published by Hodder Education. This introductory chapter has been written particularly with the inexperienced Theory of Knowledge (TOK) teacher in mind, and discusses the ways in which teaching TOK is different from teaching other high school subjects, as well as how to approach organizing and running an effective TOK course. Chapters 1 to 12 are aligned with the student book chapters and will suggest strategies for teaching the 2020 curriculum. They also contain sample lesson plans. The final chapter of this book gives advice on how to prepare students for the two TOK assessments. That topic is not covered in the student book, however, students can, if they wish, get extra help from *Theory of Knowledge for the IB Diploma: Skills for Success 2nd edition*, by John Sprague, also published by Hodder Education.

Part 1: The unique nature of Theory of Knowledge

Theory of Knowledge is a course about how knowledge is developed, tested, verified and updated when necessary. It is about the obstacles to making knowledge and how we overcome them. You will be helping students investigate these processes in five areas of knowledge (AOKs), all of which should be familiar to your students, as they are taken from the subjects that students study as part of their regular schooling as well as in the IB Diploma Programme:

- Mathematics
- The Natural Sciences
- The Human Sciences
- History
- The Arts

In the study of those areas, you will consider how professional knowledge-makers go about their work, considering such things as how the processes that they undertake can lead us to be able to trust the knowledge that they share with the rest of society.

You will also be exploring a core theme, 'Knowledge and the Knower', which offers students the opportunity to consider how individuals, including themselves, acquire knowledge, and how understanding our own individual knowledge-making processes can equip us to better understand other people's perspectives.

And finally, you will be investigating the means by which knowledge is developed, tested and revised, in the context of some other knowledge-related topics that are addressed in the optional themes:

- Knowledge and Technology
- Knowledge and Language
- Knowledge and Indigenous Societies
- Knowledge and Religion
- Knowledge and Politics.

You are required to include at least two of those five themes in your course. An important concept to consider, while investigating all the themes and the areas of knowledge, is the idea of communities of knowers. Much of our knowledge in all these areas is developed, justified, tested and accepted or rejected by communities, rather than by individuals.

Throughout the course, you will be considering questions about the problems we face when we try to make knowledge – both as individuals and as groups functioning in the formal pursuit of new knowledge – and you will be considering questions about how we overcome those obstacles.

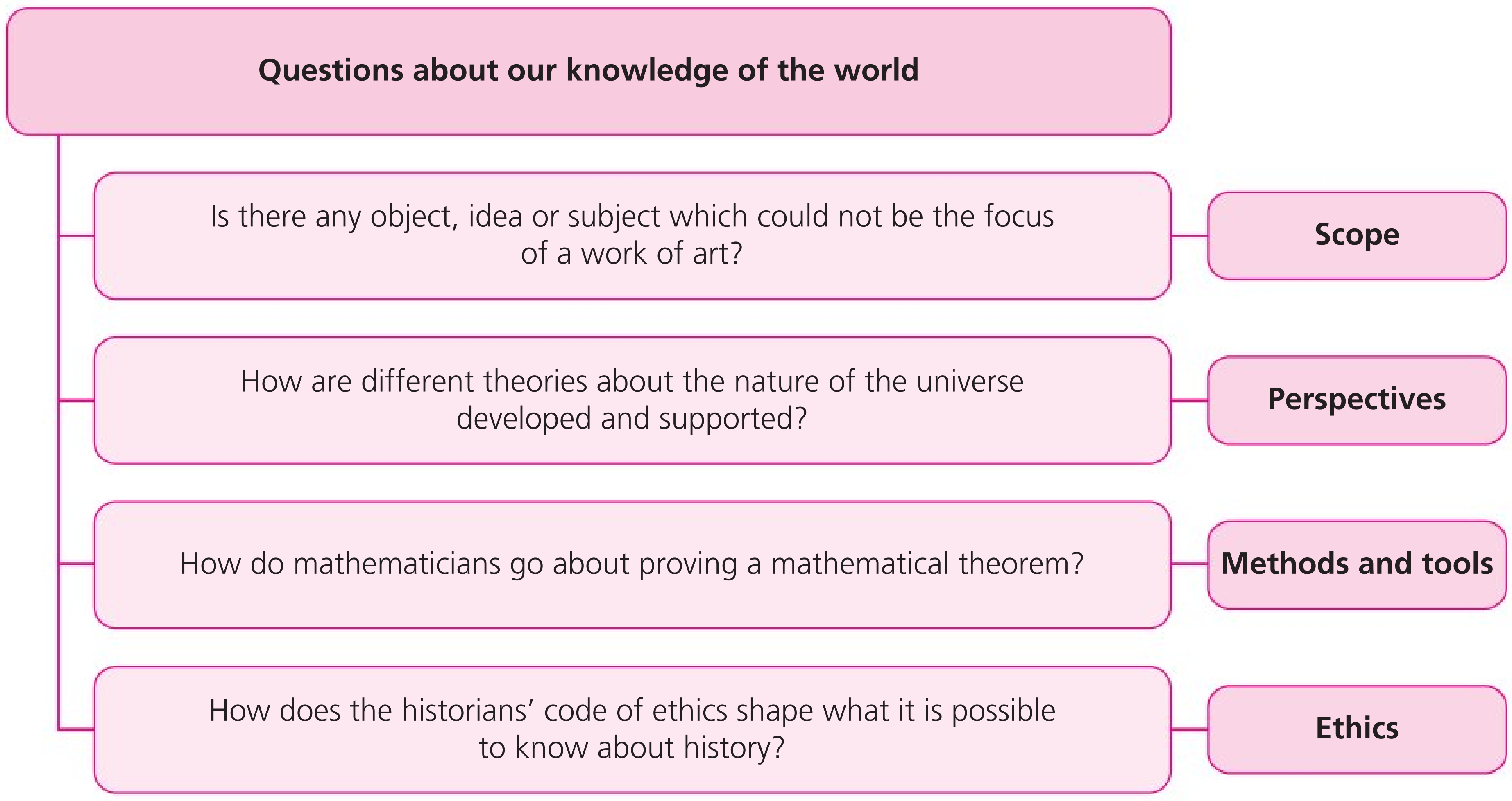
The critical understanding that any TOK teacher must have is that the TOK course is about *knowledge*. The content is essentially metacognitive: students are learning about what it means to know something in a wide variety of contexts. That sounds perhaps overly simple, but it is easy to lose sight of the knowledge generation aspect of the course, and to slide into discussions about the features of the real world. This is possibly the most tempting when it comes to considering the relationship of ethics to knowledge: students are often very engaged by questions of what is right and what is wrong behaviour; however, the ethics questions in this course have to focus on how we know what is right and wrong behaviour, as well as about how ethical concerns shape knowledge generation in the areas of knowledge and in the core and optional themes. When studying history in TOK, for example, students are not studying the events of history and why they happened; they are, instead, studying questions about how we know what happened and why.

Focus on knowledge

One way to think about the fact that TOK is about knowledge, rather than real-world events, is that in TOK we ask questions about what we know about the world and analyse the means by which we know what we know. This distinction is also covered, but for a student audience, in *Theory of Knowledge for the IB Diploma Programme: Skills for Success 2nd edition* by John Sprague, also published by Hodder Education.

Questions about the world	**Questions about our knowledge of the world**
What is the highest prime number that has been found so far?	How do mathematicians go about proving a mathematical theorem?
Is there more than one universe?	How are different theories about the nature of the universe developed and supported?
What is the definition of impressionism?	Is there any object, idea or subject which could not be the focus of a work of art?
Is it ethical for historians to make up events?	How does the historians' code of ethics shape what it is possible to know about history?

If you examine the questions in the graphic on the previous page, you can see that the questions in the first column are all questions to which there is a right or wrong answer, and the answer would be constructed by *using* a particular discipline. In the case of the question about the potential for more than one universe, there is a right answer, one established through the application of physics, although it has not yet been established with a high degree of certainty. The questions in the second column all require much more complex answers and aim to unpack a different sort of *content*. Different answers could be offered but would have to be justified with evidence and logical argument. The questions in the second column also use TOK terminology and relate to the framework, as shown below:

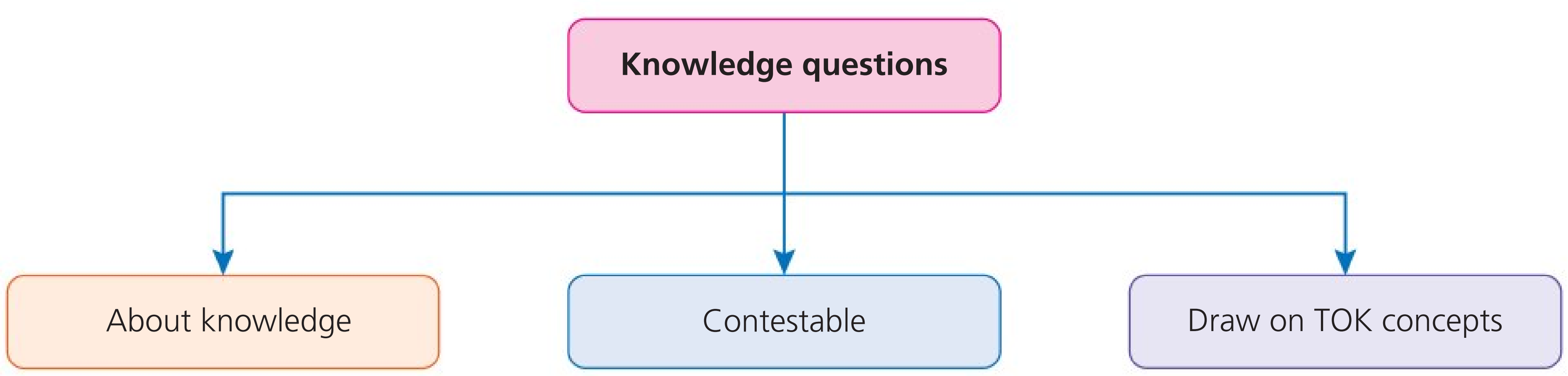


Knowledge questions (KQs)

All of the questions above are examples of 'knowledge questions'. A knowledge question is a question about our knowledge of the world. At the heart of the TOK course is the exploration of knowledge questions. Students do not have to be able to write knowledge questions, but they do need to be able to provide thoughtful answers to knowledge questions. Each of the two IB assessments requires students to explore and respond to knowledge questions.

- For the internal assessment, the exhibition, students will choose one of the 35 TOK prompts which are provided in the subject guide. Each of those prompts is a knowledge question.
- For the essay, students will be given six knowledge questions. Students will then choose one and write an essay exploring that question.

In each of the chapters in this book, we will suggest some knowledge questions from the guide which can be explored alongside the content in the student book, and we will model some ways that knowledge questions can be explored. This diagram, from page 11 of the TOK subject guide, illustrates the nature of a knowledge question:



By 'about knowledge', we mean that the question must be about how we develop, test, and revise our knowledge of the world. Probably the largest stumbling block to effective TOK discussions and analyses is that students and their teachers very easily get caught up in questions and discussions which are drawn directly out of a discipline. TOK questions are about the nature and construction of knowledge, not about the facts of the world.

Contestable questions are those for which there is some debate. Some questions about the real world are also often very debatable, so this criterion doesn't distinguish KQs from discipline questions, but is included to emphasize at least two things. First, they are generally better when they are 'open' questions ('Does the media influence our political beliefs?' is not as good as 'In what ways does the media influence our political beliefs?'), or if they are closed questions, it is better if they clearly are aimed at investigating a tension or dilemma in the construction of knowledge. 'Should psychology be considered a science?' is a closed question, but clearly is scratching at a controversy.

Second, the best knowledge questions are those which move beyond describing TOK elements and consider the significance of those elements. While, 'In what ways does the media influence our political beliefs?' is a genuine knowledge question, it is not very controversial. We already know the media does influence political beliefs! A student would be doing reasonably good TOK by uncovering the influence of the media and describing it, but the better student would be accessing even more sophisticated thinking skills by investigating the significance of that influence. Therefore, a genuinely contestable knowledge question might be something like, 'Has the influence of the media made it impossible to have a political system based on facts?' or perhaps, 'In what ways has the media made propaganda the norm in political discourse?'

Finally, good knowledge questions will often (but not always) draw directly on 'TOK concepts'. These concepts are not patented terms that will only be found in the specification – the IB doesn't have a monopoly on terms related to the critical analysis of knowledge – but there are a 'family' of terms that the course emphasizes. Twelve of those concepts are highlighted in the specification and in the student book:

- Certainty
- Culture
- Evidence
- Explanation
- Interpretation
- Justification
- Objectivity
- Perspective
- Power
- Responsibility
- Truth
- Values

Other terms that might show up in a well-formulated knowledge question could be references to the areas of knowledge, the optional themes or the cognitive tools which are some of the sources and influences on knowledge. These were previously called 'ways of knowing' and included reason, emotion, sense perception, language, memory, intuition, imagination and faith.

TEACHING TIP

Throughout the TOK subject guide, you are presented with knowledge questions, several for each element of the framework for every theme and area of knowledge, as well as the 35 TOK prompts for the exhibition. The prescribed titles for the TOK essay will be formulated as knowledge questions. We do not, therefore, suggest that you spend too much time worrying about how to formulate them; your focus should be on guiding the students to develop responses to them. If, however, ensure you feel that you would like to write some knowledge questions of your own, or if you feel that you have a need for a question on a particular topic which is not covered by any of the knowledge questions in the guide, then you are, of course, free to write your own and then use it in the context of your teaching. If and when you do, however, ensure your questions fulfil all three requirements: they are about knowledge, they are contestable (that is, there is some tension where multiple answers could be possible) and they draw on TOK concepts.

We have included many of the framework knowledge questions from the TOK subject guide at appropriate points in the chapters in this book. We have included the same questions in the student book; however, we do not wish to imply that students could read and answer knowledge questions on their own. Students must be encouraged to understand that there are no simple answers to knowledge questions, and that their understanding of the answer to any given question will develop and grow as they progress through the course and develop an understanding of how the implications of each question varies across different knowledge-generating contexts. We have also included TOK prompts in the student book at various places to encourage students to connect the ideas in the book to the internal assessment. The decision, however, as to which knowledge questions you wish to have your students pursue and when is, of course, entirely yours, so you should feel free to use our suggestions only when they are useful, and to substitute other questions if they suit your programme better.

You are not obligated to formulate knowledge questions or to teach students how to, although understanding what a 'knowledge question' is, will certainly help students (and teachers) develop good analytical responses. A knowledge question is designed to promote good TOK thinking. If you decide you wish to help students learn to develop their own knowledge questions, then it would be a good idea to ensure that you tie that activity to the learning of some particular element of the syllabus. Students will not be assessed based on any ability to develop a knowledge question of their own, so that activity is not a necessary part of the course.

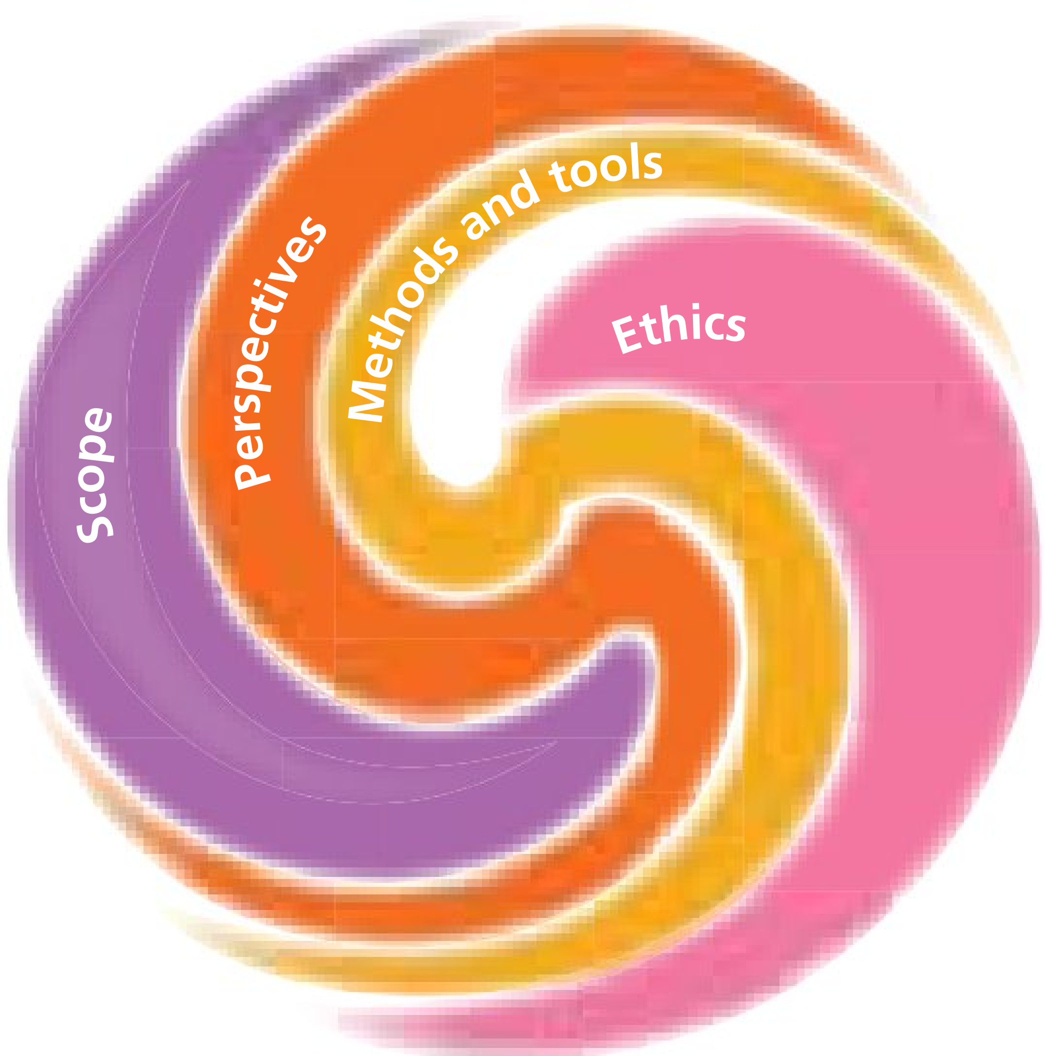
The knowledge framework

In an attempt to give students and their teachers the best opportunity to maintain close to genuine TOK thinking, the course is structured around a 'knowledge framework'. Teachers who are used to the old specification will recognize this framework in the pared down version in this iteration of the course. The idea is that the framework provides an opportunity for the learners and teachers to clearly frame the comparisons across the core theme, the optional themes and various AOKs.

There are four elements of the knowledge framework:

- Scope
- Perspectives
- Methods and tools
- Ethics.

Each element is meant to provide a series of ideas and approaches that the TOK student and teacher can apply to the type of knowledge under consideration.



Scope

When reflecting on the 'scope' of a theme or AOK, we are encouraging students to think about the nature of the theme or AOK and how it is different in intent from other AOKs. The focus is on what the point of the AOK is, when you might need to apply it and what it is designed to do (and not do). In Chapter 6, when we explore the relationship between the natural sciences and religious knowledge systems and how they might offer different types of explanations, we are thinking about where the scope of the two types of knowledge intersect. When we explore the role that a unique cultural knowledge system plays in maintaining an Indigenous identity in Chapter 5, we are exploring the scope of knowledge. Examining the scope of an AOK or theme can become quite conceptual, and sometimes these are the most challenging questions and the hardest to come to concrete conclusions about. 'What is the function of history?' for example, can be a bit unwieldy in the context of a discussion with TOK students. Even though, however, this might require a lot of conceptual analysis, teachers should always make attempts to link the discussion to what people actually do in relation to knowledge. For instance, in Chapter 11, when considering why having a shared history is important to a culture or a particular community, we use direct examples of history being used in this way (Singapore's National Day celebration and Reni Eddo-Lodge's book *Why I'm No Longer Talking to White People About Race*). In that chapter, we discuss them in the context of the role of ethics in history, but they illustrate the scope of history, as well.

The following questions are from the TOK subject guide (page 12):

- What motivates the pursuit of knowledge in these themes/areas of knowledge?
- What practical problems can be solved through the application of knowledge from these themes/areas of knowledge?
- What are the key current open/unanswered questions in these themes/areas of knowledge?
- What makes this theme/area of knowledge important?

Perspectives

Within various communities of knowers we will find a number of *perspectives*. Considering perspectives helps students think about the *choices* that experts in various communities of knowledge make when constructing knowledge. Chapter 10: The Human Sciences, for example, explores various established perspectives within the fields of economics and psychology. Other examples might include 'schools of thought' within disciplines. One might also consider different AOKs, or disciplines within the AOKs, as perspectives: in order to 'explain' some world event (the various protests in Hong Kong in 2019, for instance) you might apply an economic perspective, an historical perspective or a political perspective. None are necessarily the *obvious* route to choose but exploring different perspectives might provide different insights.

Another helpful way to think about the different perspectives involved in the knowledge provided by an AOK or theme is to break it up into considerations about three aspects of it:

- the **creation** of the knowledge (usually by 'experts')
- the **critique** of that knowledge
- the **consumption** of that knowledge.

In each of the AOKs, for example, we might consider *how the body of knowledge* was created, we might think about how we might *critique* it as 'reliable', or we might explore it in terms of how that knowledge is *consumed*, either by other experts in the field or non-experts hoping to learn more about the topic.

Perspectives on knowledge from the:

- **Creator**: what must experts in the field do to make their knowledge? What are they hoping to achieve?
- **Critic**: how do people *judge* that knowledge as 'reliable' or what makes an individual more or less reliable when making such a judgment?
- **Consumer**: how do people appropriate the knowledge? How important is specialist knowledge for non-experts in order to understand knowledge created by experts?

You will notice of course that there is already a lot of overlap between perspectives and scope, and also between the perspectives of the creator, critic and consumer. This is acceptable and expected. Unpacking those overlaps is often the core of a successful TOK analysis!

The following questions are from the TOK subject guide (page 13):

- What is the significance of key historical developments within these themes/areas of knowledge?
- What do these themes/areas of knowledge identify about knowledge that is rooted in particular social and cultural groups?
- Are some types of knowledge less open to interpretation than others?
- Is an understanding of the perspective of other knowers essential in the pursuit of knowledge?

Methods and tools

Much of the discussion of the AOKs will naturally focus on the methods and tools experts use when constructing knowledge about the world. This element of the knowledge framework focuses the discussion on the conventions, rules and methods of the construction of knowledge, and includes both the physical tools (eg, microscopes) and the theoretical tools or frameworks (eg, the 'scientific method' or the 'historical method' or 'experiment' or 'observation') of an AOK. Discussions of reliability, bias, certainty or propaganda will be closely tied to the methods used in the construction of knowledge. Thinking about how, for instance, technology or social media has influenced political discussion or an individual's construction of their own political beliefs can be cast in terms of methods.

The following questions are from the TOK subject guide (page 13):

- What assumptions underlie the methods of inquiry used in these themes/areas of knowledge?
- Does what is seen to constitute 'good evidence' vary from discipline to discipline and culture to culture?
- How is knowledge produced and communicated in these themes/areas of knowledge?
- How important are material tools in the production and acquisition of knowledge?

Ethics

In previous TOK specifications, ethics was its own AOK, but in this course, it has become part of the knowledge framework. One reason for this is that students and teachers cannot really avoid discussion of the ethical implications of knowledge. It also helps ground ethical discussions in the real-life practical discussion of how knowledge is constructed and consumed in the world, rather than overly conceptual discussions of ethical dilemmas.

It is very important to remember that students must maintain a clear focus on knowledge when exploring ethical questions. They will naturally get caught up in the attempts to solve ethical dilemmas and may forget to consider how the ethical principles were developed in the first place – how do we know what is ethical and what is not? Embedding ethics into the framework will help students consider the construction of knowledge in terms of its consequences for knowers: does it confer responsibility on the knower? Does it create unfair advantages or disadvantages depending on who has it or who controls it? Censorship is a hugely popular TOK subject with students and could be explored in relation to the ethical implications of disseminating knowledge.

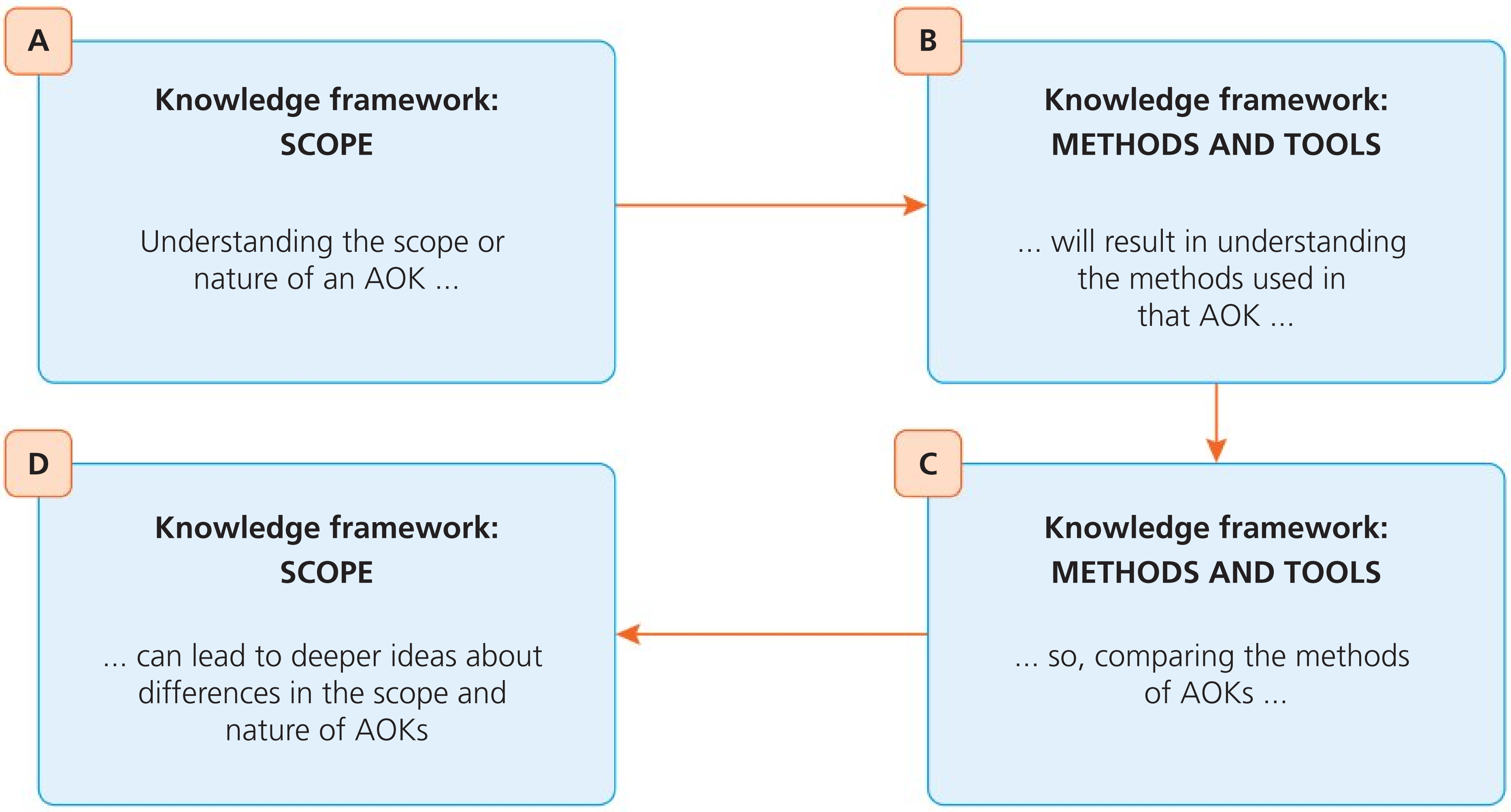
The following questions are from the TOK subject guide (page 13):

- Should the pursuit of knowledge in these themes/areas of knowledge be subject to ethical constraints?
- What responsibilities rest on the knower as a result of their knowledge in these themes/ areas of knowledge?
- How can we know when we should act on what we know?
- Do established values changes in the face of new knowledge?

TOK TRAP

When presented with a 'framework' in a specification, it is easy on the one hand, to see the various elements as being unquestionable or sacrosanct, and on the other, to see the different elements as entirely distinct. This is not the case with the knowledge framework. It is better to see the elements as loose categories of questions, ideas and approaches, rather than identifying them as rigorous or non-negotiable boundaries. They provide opportunities for discussions and analyses rather than anything that needs to be memorized, so don't feel a deep sense of rigid obligation to these ideas.

Teachers should think carefully about how they develop their learning activities in relation to the elements of the framework – we don't want students to think there are no overlapping questions or relationships between the elements. A discussion of one of the elements will more likely than not draw on other elements. Consider, for example, the relationship between the scope of a subject and its methods involved in the construction of knowledge. It is very likely that the nature of the subject will be the explanation of why certain methods are appropriate and others are not. The nature of the sciences, for instance, means that they are an attempt to understand and explain the observable features of the world around us (see Box A in the diagram shown on page 12). The methods to do that could never be entirely focused on concepts and ideas – we would need to get into the world and see what is there. This means that the 'scientific method' requires observation and experimentation in the real world (see Box B in the diagram shown on page 12). Conversely, considering which methods are generally enacted by experts in the field helps us understand the nature of the subject. The use of axioms, deduction and logical inference in mathematics (see Box C in the diagram shown on page 12) help us understand the inherently conceptual nature of the subject (see Box D in the diagram below). It also, however, gives us an opportunity to explore the seeming contradiction of why, if mathematics is so conceptual, does it seem to so well describe physical phenomenon in the world.



THE SHORT VERSION

Making connections across the knowledge framework

Use the various elements of the knowledge framework to make points about other elements of the knowledge framework.

Use explorations of one AOK to make points about other AOKs.

For teachers, being able to identify and use these similarities and differences across elements of the knowledge framework and across AOKs takes some time to develop. Don't give up.

The nature of an effective TOK lesson

The fact that knowledge and questions about knowledge define the TOK course does not mean, however, that TOK is not concerned with the real world. The exploration of knowledge must be grounded in the real world. Students will use examples from the real world for both of their assessments. Although you might sometimes begin with an abstract knowledge question (which is where the TOK essay begins), often you will find it to be very effective to begin the exploration of that knowledge question with an investigation of a real-world situation, from which students can extrapolate the knowledge issues. You will find a number of examples of this kind of lesson idea in the chapters which follow, but just by way of demonstration, here is one example:

Begin by showing students a short clip from British comedian Stephen Fry's BBC show *QI*, which can be accessed using the QR code in the margin.

The clip shows a strange optical illusion and makes the point that we cannot NOT see the illusion, even if we try. Ask students to notice what is happening and see if they can come up with an explanation of why it happens. To support this discussion, students could read Chapter 4 of Daniel Gilbert's *Stumbling on Happiness*. The chapter is called 'In the Blind Spot of the Mind's Eye', and you may wish to have students begin at the section called 'Filling in Perception'. A very important part of this lesson is that students must then take what they learn about how and why the brain generates optical illusions from various phenomena and apply it to one or more knowledge-making contexts. It is not sufficient for the aims of TOK for students to be able to say that one limitation of our perception is that we are prone to optical illusions, some of which we cannot visually overcome. They must be able to discuss how that fact affects our ability to make knowledge. Does the fact that we can be fooled by optical illusions affect our knowledge of science? History? Politics? The arts? At this point, students are exploring a knowledge question, but we got there by starting with quite a simple real-world situation.

TEACHING TIP

It is easy to fall into very interesting, creative and productive discussion in TOK about all manner of things. However, teachers must take care to stay alert for when the conversations shift away from TOK thinking or analysis and into discussions about phenomena in the real-world which don't contribute to students' understanding about how knowledge is generated, tested, or revised. One of the reasons for removing the emphasis on the 'ways of knowing' (WOK) as stand-alone entities in the current guide was that students were getting rather too caught up in talking about the WOKs, rather than making the point about them and then relating that point to the construction of knowledge in the context of an AOK. In the new course, the term 'ways of knowing' has been eliminated. The kinds of methods that individuals use to make knowledge are now best called something like 'cognitive tools'. Cognitive tools are a fantastic way to explore the means by which our understanding of the world is shaped and influenced, but don't let the students stop at a description of those cognitive tools – coax them into applying those ideas to AOKs.

That last step in the lesson described on the previous page is the crucial one which makes it a TOK lesson, rather than a content lesson in, say psychology or art. You can see in the video clip of the optical illusion how engaging it is – the guests on the show react with surprise and excitement. We can expect that students will, too. Many of the real-world situations that you introduce into class will be equally engaging. Students can become very involved in a discussion, say, of whether and how to provide health care services to immigrants, or whether it was ethical for Marco Evaristti to create an artwork out of putting goldfish in blenders which audience members could, if they chose, turn on (you can read more about Evaristti's artwork by using the QR code on the left).

It can be easy to mistake the excitement that comes from an impassioned debate for engagement in TOK learning. However, the goal of TOK is the investigation of the ways that we generate knowledge, so the health care discussion must turn to how knowledge is made in politics, or possibly history or economics (or all three) and the goldfish discussion must move on to a consideration of how ethical concerns do or do not constrain artists and why, in terms of the aims of the arts. Notice that this consideration moves the discussion from the specific to the general, and that is always where we want to go. Ultimately, we want students to be able to offer insightful observations about how different aspects of the framework function in the area of knowledge or the theme in general. Sometimes, a single generalization cannot be made, because the mechanism is contingent on some context. In such a case, students who can explain how different contexts result in different generalizations are demonstrating a truly sophisticated TOK skill!

THE SHORT VERSION

How to explain TOK to parents or other interested people

TOK is a class in which students learn how knowledge is developed, tested, validated and, when necessary, revised. It prepares students to be able to judge for themselves whether the claims they are presented with are sound or whether they are incorrect or even deliberately misleading.

Part 2: How TOK differs from other academic subjects

As we have seen, one important way in which TOK differs from other academic subjects is that TOK focuses on questions of how knowledge is made in all the other academic subjects – and in other contexts – rather than on the content of those subject areas. Another significant difference, and one that students often struggle with, is that TOK requires students to delve into the reasons that we might not know 'the right answer', and why 'the right answer' may, in fact, be unknowable – at least at the present time with the present technologies available to us.

Knowledge and learning in the context of schools is often a somewhat artificial process because so much of what students do is amass a body of knowledge developed by others long ago. Students, therefore, have a lot of experience with being told what is true and what is not, and very little experience of grappling with any nuances or questions about whether or not what they have been told is true really is, or how certain we are about it or how we came to establish that truth. Many students, by the first year of the IB Diploma Programme, have learned to accept what they are told without questioning it. Many students have come to believe that if they don't know or understand something, that failure is due to something about them and their lack of ability, rather than due to any complexity in the knowledge-making process itself. Many IB students, because they care a great deal about their marks and what those marks mean in terms of college admission and scholarship awards, are particularly keen to know 'the right answer' so that they can give it back on tests.

Being faced with a course in which they are not told the answers to learn and remember for the test can, therefore, be quite a difficult experience for some students – especially in the first year of the Diploma Programme – and especially because you are showing them that this is a reality of the real world, the world that they will have to cope with as adults once they are done with their schooling. Students, who have spent much of their lives functioning inside an institution which seems to imply that adults have all the answers and that students need only get those answers from the adults and then remember them for themselves, can find it difficult to accept that adults do not have all the answers and that they, themselves, may one day be charged with finding answers that humanity does not have right now. You may find yourself having to deal with the consequences of a kind of culture shock as the students adjust to a class which requires a whole new kind of thinking. Many students find TOK a challenge, even though they are doing extraordinarily well in other subjects. TOK is quite a different sort of thing and the transition is often difficult. When students find themselves uncomfortable in TOK, it might be a sign that it is working.

We should not underestimate the challenge the course presents to the *teachers* trying to make sense of it in the classroom either. Many teachers have come to TOK through no desire of their own, sometimes because their course load is light, or because someone higher up thinks of them as 'a TOK kind of teacher'. Whatever the case, stepping out of the comfortable confines of subject teaching and into a TOK course is a genuine challenge. So while students may find this shift into the messy world of knowledge difficult, there is no doubt that teachers will also find it so. This grey area of undefined answers is an uncomfortable space to be in, but it does get better with experience.

TEACHING TIP

Remember that, 'I don't know, good question' is a perfectly suitable response to a student's question. It takes bravery to admit to a class full of students that you've never thought about that before, or that you have, but you haven't yet developed a response. But this is exactly the sort of experience your students are also having. This is an excellent opportunity to model good TOK learning. Try, 'I don't know, good question. How could we go about developing an answer using what we have unpacked in the course so far?' and then follow along the student's journey. In our experience, the more of these interactions there are, the better it is for us as TOK teachers.

Theory of Knowledge should promote a healthy scepticism towards knowledge

Central to the course is the general worry that what we think we know about the world might not be entirely right. TOK investigates the fact that different subjects of AOKs describe the same world in different ways, and that the methodologies involved often are prone to error in a number of ways. This means that one aim of TOK is to promote a general scepticism towards what we claim to know. We want our TOK students to take knowledge with a grain of salt, but this doesn't mean we want them to deny that knowledge is possible. This is both irresponsible and incorrect. We do gain knowledge about the world, and we have pretty well-established rules when that knowledge is well grounded. We don't want our students to leave our class thinking 'we can't know anything'.

Here we introduce two 'levels' of scepticism: scepticism on the part of the individual and scepticism on a global or philosophical level. The ideas in both of these sections make for good TOK, but students should contextualize these discussions by applying them to how experts in the AOKs manage these worries or to their effect on the AOK, rather than simply settling into an overly philosophically sceptical position.

Limitations of our individual cognitive tools

At the individual level, we might say that we gain knowledge through a variety of psychological or cognitive features of human beings, which, we know, can get it wrong. For one example, we might consider the relatively limited ability of humans to perceive the world through the five senses. We can understand the problem of the limitations of our senses and, consequently, of our ability to perceive the world through them, by considering the fact that many animals have sensory capacities which are vastly different from ours. Bats, famously, have quite limited eyesight but can navigate the world in darkness because they use something like our sonar. This gives them a picture of the world which consists of sounds bouncing back to them off the surface of objects. It is almost impossible for sighted humans to imagine what this 'vision' of the world is like (though some blind people have learned to use echolocation themselves and they can, presumably, understand the bats-ear

A mantis shrimp

view of the world!). Bees and butterflies see in the ultraviolet spectrum, while some species of snakes see in the infrared spectrum ('What colors do animals see?'). Mantis shrimp have many more cones in their eyes and so can '… detect circularly polarized light, which is what happens when the wave component of light rotates in a circular motion. They also can perceive depth with one eye and move each eye independently. It's impossible to imagine what mantis shrimp see, but incredible to think about' (Franklin). Our inability to perceive the world the way these creatures do illustrates the problem of how our perception limits what we can know. If we cannot see the world in the way a mantis shrimp does, for example, then what might there be out there that a mantis shrimp, if it could be a scientist, would know to investigate, but which *we* don't even know is there? If the study of the physical properties of the universe is dependent on our ability to perceive what is actually there, and if, as we have seen, there are many situations in which we cannot observe some aspect of the universe at all, we are confronted with questions about *our* ability to provide a full description of what's out there.

Individuals make knowledge using their sense perception, reason, emotion, language, imagination, intuition, memory and faith (among other things). You might think of other personal tools for making knowledge which are relevant and important to bring up. There is no requirement in the 2020 curriculum for teaching specific sources of knowing, however, you will find that these different ways of knowing are relevant in various places in the course under the heading of Methods and tools. These personal ways of knowing are particularly relevant to the core theme, which specifically requires investigation into the ways that individuals make knowledge. However, you will also find that it is sometimes helpful to consider the kinds of cognitive tools that help – or hinder – the creation or discovery of knowledge in some of the themes and areas of knowledge. Emotion, for example, can be a strength in trying to make accurate knowledge about politics, because our political beliefs tend to be founded on deeply felt values. It can also act as a barrier to political knowledge, however, because if we are too driven by our emotions, we can be led into all kinds of errors such as cognitive bias or refusal to accept facts. In the arts, emotion is one of the primary means of making knowledge; much art is intended mainly or solely to trigger an emotional response. The natural sciences are fundamentally observational, so sight, hearing and sometimes taste or touch are important means of collecting data.

Reason is essential to the making of knowledge in mathematics, and so on. In each case, however, TOK students must shift from the discussion of how our cognitive tools might be unreliable, to a discussion of what this means for experts in the various disciplines trying to construct knowledge.

Some important points for you to consider when asking students to investigate the role of these personal tools for making knowledge in knowledge development are outlined below.

- These cognitive tools never operate in isolation. Sometimes students like to have things nice and compartmentalized and so will try to claim things like: 'Mathematics uses reason' (as if no other kind of mental process is ever relevant) or 'History only uses memory'. The various cognitive tools are used in clusters and simultaneously. It is difficult, for example, to separate the experienced mathematician's reasoning from their language (reading or speaking), imagining, remembering and intuiting. The historian must use sight, language, reason, memory, imagination and so on.
- It is not always necessary to discuss the role of these cognitive tools. If a particular example relies heavily on, or reveals the use of, the various tools that individuals use to make knowledge in a significant way, then it is appropriate to discuss them. Otherwise, there is no requirement to do so.
- It is as important to recognize the value of the cognitive toolkit as it is to recognize the limitations.

Fundamental limitations on our ability to know

Beyond the concerns about the role that our cognitive tools might have on an individual human's ability to construct knowledge (and the aggregate effects of that for a community of knowers), there are deeper issues at work that may lead to a profound scepticism which runs the risk of scuppering the project of constructing knowledge altogether.

Students are, of course, to some degree, already accustomed to the idea that in some situations multiple answers are possible. The interpretation of a work of art, for example, depends a great deal on the knowledge and experience of the person who is doing the interpretation. If I am reading WD Snodgrass' poem 'Returned to Frisco, 1946' (see page 417 of the student book), which has a narrator who is a soldier in the Second World War, and I am *not* from San Francisco, I might reasonably interpret the title of the poem as meaning that the speaker of the poem *is* from San Francisco and has been sent home from wherever he was posted abroad. If, however, I am a reader who *is* from San Francisco, and I know that locally 'Frisco' is considered to be an insulting way to refer to San Francisco, then I would reasonably interpret the title as meaning that the speaker of the poem is *not* native to San Francisco, but is being sent from one foreign environment to another, and I might see the 'returned' as being ironic. If I am a reader from Frisco, Texas, then I might consider that the speaker is from *my* hometown – at least until I get to the references to the coastline and bay, since Frisco, Texas, is a land-locked town. Any of these readings of the title constitutes a reasonable interpretation of the words on the page.

Even in such a situation, however, some students will be inclined to want to know which one is the 'right' interpretation, and, so long as they can learn a viable interpretation, even the most dogmatic of the students will be happy. Importantly, too, the interpretation of a work of art isn't a kind of knowledge on which we rely for our day-to-day survival. Getting something approximating the 'right' answer in some questions can be rather more important.

Consider the difference between this situation, however, and one in which the knowledge in question is the kind of knowledge which does make our everyday lives possible.

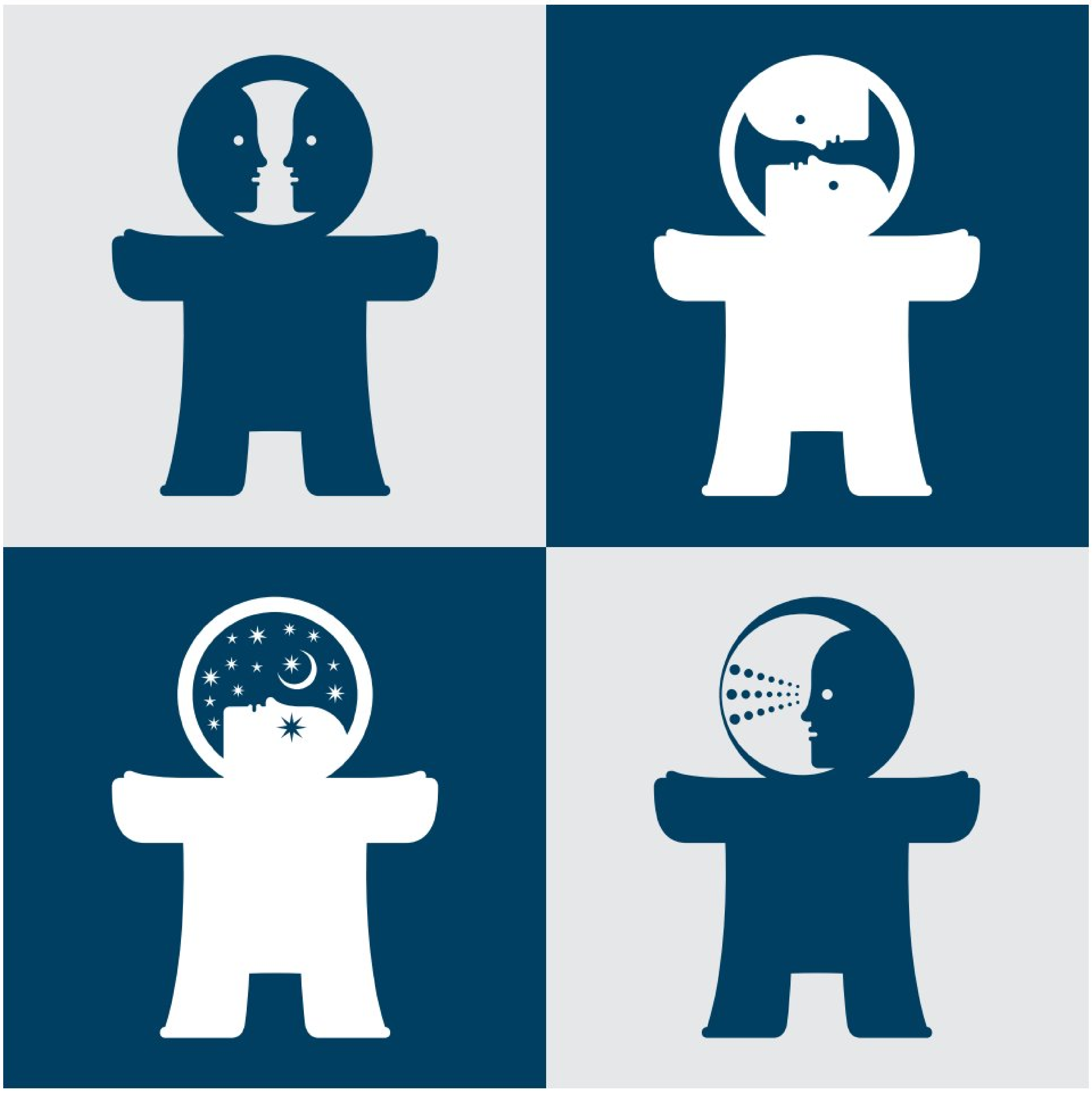
We are accustomed to thinking of knowledge which is generated by natural scientists as being highly reliable. It allows us to predict how things will work in the future. It has been responsible for a great many of the developments which allow us to live lives which are assisted by an enormous range of technologies, including medical technologies that prolong life itself. Yet scientists themselves know that science cannot solve all problems and that it may not be possible for science to answer some of the greatest questions that we might like it to answer: questions about consciousness or about the beginning of the universe, for instance. In April 2019, a two-day meeting was held at the Institute for Cross-Disciplinary Engagement at Dartmouth, in New Hampshire in the United States, during which scientists and philosophers explored this problem. The meeting was called 'The Blind Spot: Experience, Science, and the Search for "Truth"' ('Public Dialogues and Workshops'). During that workshop, participants discussed questions about what knowledge natural scientists are capable of developing and whether there are some questions about physical reality which science simply cannot answer (Falk). (Interestingly, exploring the 'limits' of practitioners of disciplines (what they can and cannot 'know') makes for good TOK!)

The root of the problem is a classic one which goes back to philosopher René Descartes, who realized that we cannot get outside of our own experience of the world to determine objectively whether what we experience is accurate or not. He argued that we do not have independent access to the world, so we cannot know whether or not what we think about the world is just a *constructed* reality. This resulted in his famous statement, 'I think, therefore I am', which was the first claim that Descartes could make with certainty, given that restriction of viewing the world from inside his own head. However, 'Thought is occurring to me' doesn't lead to much.

Scientists today are still grappling with that problem. According to Dan Falk, who was present at the Dartmouth conference, scientists '… admit there is a certain kind of science that works incredibly well, when a little portion of the universe is cordoned off for study, with the scientist positioned outside of the carefully defined region under investigation.' Quite a bit of science works just this way: scientists observe processes of which they are not a part. Results over hundreds of years have shown us that the scientific methods for this kind of discovery work very well. (The student book goes into these methods in some detail in Chapter 9.)

The problem arises, however, when it comes to questions that involve aspects of the physical nature of the universe which touch directly on our ability to perceive and understand things – the nature, in other words, of our consciousness. The organizer of the conference, Marcelo Gleiser, co-wrote an article in which he and his co-authors defined three particular problems for which our inability to get outside of our own consciousness raises questions about whether we can ever attain accurate answers to the questions: one is the question about the nature of consciousness itself, one is about the history of the universe and the nature of time – we cannot get outside of the universe or outside of time in order to view it from an objective position – and one is about the nature of matter (Frank, *et al*). The article by Adam Frank (a professor of astrophysics at the University of Rochester in New York, USA), Marcelo Gleiser (a theoretical physicist at Dartmouth) and Evan Thompson (a professor of philosophy at the Peter Wall Institute for Advanced Studies at the University of British Columbia in Vancouver, Canada) is available online. You can use the QR code on the left to read it. The article deals with quite sophisticated ideas but is not loaded down with a mass of highly technical language and is pretty accessible to the layman.

How do we know what is outside of our own minds?



The problem discussed at the Dartmouth meeting is not a new one for science. An even bigger problem for the long-held idea that science will one day be able to give us a unified theory of everything, is the one which Gleiser and his co-authors point out in their article: we cannot get outside of our own consciousness in order to see whether what we perceive is an accurate representation of reality. They point out three big questions for which this is a problem, but if we think about it, we can see that it is actually a problem for all of science. We *observe* the behaviour of lizards in order to describe the life cycle of those lizards. We *observe* the process of photosynthesis in order to describe the process of photosynthesis. We *observe* the characteristics of light and sound in order to describe how light and sound work. Descartes and many other philosophers argued that those observations are perceived inside our minds, and we have no way to verify the precision of those perceptions relative to what happens in reality. An important underlying assumption of the natural sciences, then, is the belief that we can perceive accurately enough to be able to describe the world in useful ways. Our ability to subsequently predict and shape the world provides confirmation.

The problem of quantum physics and the fact that the act of observing atoms and particles alters their behaviour is by now a fairly well-known phenomenon. One famous example is the Schrödinger's Cat thought experiment in which physicist Erwin Schrödinger demonstrated a confounding idea about the nature of matter on the atomic scale, which is that tiny particles exist in two different forms at one time. However, we are not capable of observing that, so our observation of nature on the atomic scale changes the status of what we are observing. That failure in our abilities has to do with the nature of our consciousness and the limitations on our powers of observation. A good explanation of the Schrödinger's Cat experiment and its implications for modern technology, such as the computer, can be found by viewing the TED-Ed video linked to via the QR code on the left.

With regards to the problem of direct observation in the natural sciences discussed above, even though we cannot double-check our perceptions directly, we can, and do know that our observations are accurate enough to be counted on. We know this because the predictions we make, using the knowledge we created using our observations, work. We know that our knowledge is sound because the inventions that have been developed using that knowledge function as we want them to. We know our scientific knowledge is accurate because we can successfully complete such projects as sending men to walk on the Moon, bringing them back home again, and broadcasting the event around the world using live television and radio – undertakings that depend absolutely on the accuracy of a vast body of scientific knowledge of many kinds.

Ideas about the limitations of our ability to know are the kind of ideas which are relevant to TOK, and they are also likely to be strange to students (and to teachers too!). The suggestion that the world we perceive is not the world as it is can also be disturbing and difficult to take in. You may find that your students, faced with the fact that much of our knowledge is not, and cannot be absolutely certain, may be inclined to slingshot to the belief that, if we cannot know everything then we cannot know anything, and that there is, therefore, no such thing as knowledge. It is very important that you work with your students to correct that kind of strongly dichotomous thinking. We absolutely do not want students to emerge from a two-year course in TOK thinking that there is really no such thing as knowledge!

Some teachers don't develop these deeply sceptical arguments in their classrooms though, and there is no suggestion that you should. They often do, however, arise naturally in the minds of the students, familiar as they are with movies like *Inception* (is it all just a dream?) or *The Matrix* (is it all just a virtual reality?) or *The Truman Show* (is it all just a reality TV show?). The key to guiding students through these discussions, however, is to return to the notion of experts working in communities of knowledge. You might explore the issue by asking, 'Given these deeply sceptical arguments, how do you think a scientist deals with it?' By transferring discussions to different AOKs you can unpack many different conclusions. It is also helpful to remind students that, while these are fun questions to ask, in practice we are quite happy to accept the belief that the external world is real and we demonstrate this belief in our everyday activities of stepping out of the way of moving traffic, taking medicine to cure diseases and taking exams in preparation for the 'real' world.

The importance of knowing that we *can* know

As you develop your course, you will want to ensure that you spend as much time and energy focusing on exploring the conditions under which we *do* know things, and why we can say that we know them, as you do on the conditions under which we *cannot* know things – or at least cannot know them at this time in history. There is always the possibility of knowing more later! One important tool in helping you to accomplish this goal will be the use of the course concepts. In particular, the concept of certainty can help you to demonstrate to students the idea that we do not need absolute certainty in order to be able to say that we know something, and that we can know quite a lot about something while still being open to revisions in our understanding of the details or nuances. Other concepts that can be used to help students understand the care that knowledge-makers take in developing and presenting their findings to the world are truth, objectivity, responsibility and values.

Two other important elements of the TOK course which should be used to help students focus on the strengths of our knowledge are the investigation into methods and the investigation into ethics in each of the different course parts. If students understand first and foremost the ethical demand for *accurate* knowledge – no matter what the context –

then they will also understand that the methods employed by responsible practitioners in each area (including individuals such as themselves!) exist because they are the methods best able to give us accuracy. Once they understand the methods, students will be better able to make determinations about whether the knowledge claims they encounter in the world are sound or not.

One academic subject with which TOK is commonly confused is Philosophy. Use the QR code in the margin to access an in-depth discussion of how the two subjects differ.

THE SHORT VERSION

The difficulty and the charge

Students sometimes find TOK presents a daunting prospect, because it demands that they abandon the facile assumption that what they are told is automatically true. The course requires that students develop a nuanced understanding of the relationship between process and product in the context of knowledge generation, and that their ability to judge the quality of the process will determine their ability to know which knowledge they can trust and which they cannot. The role of the teacher is to ensure that students don't, as a reaction to being faced with problems of making knowledge, resort to an entirely sceptical position and deny the existence of knowledge.

Part 3: Preparation for teaching Theory of Knowledge

Perhaps the biggest challenge for the new TOK teacher is the fact that the course content is wide-ranging enough that there is no college preparation for teaching TOK. The TOK teacher needs to know how knowledge is made in mathematics, the natural sciences, the human sciences, history and the arts. They have to know how individuals acquire their own personal knowledge, both in social contexts and in the formal areas of knowledge. The TOK teacher must also know how knowledge is made in at least two other contexts: religion, politics, technology, language or Indigenous cultures.

Some universities may offer a single course in the philosophy of a particular subject – the University of Oxford, for example, offers an online course in the philosophy of science – and those courses do provide some of the kind of insights needed for teaching TOK. The Oxford course, for instance, lists on the website topics such as the nature of the scientific method, the difference between science and non-science, and scientific realism as being central to the course (University of Oxford), but it puts those questions in the context of bigger questions of a philosophical nature. Few people complete, as part of their teacher preparation coursework, any course in the philosophy of their particular subject. Having a degree in, say, comparative literature and a teaching qualification to teach English does not require any overt study of what knowledge there is in literature and how it is attained. Having a degree in psychology and a licence to teach it in secondary school does not require any overt study of what it means to say that we have knowledge of human psychology and the degree to which we can consider that knowledge to be certain. Certainly, the college degree in our own subject is helpful, and certainly by attaining it one will have necessarily absorbed some understanding of these questions – in one's own subject area. But no one has degrees in at least eight of the eleven topics in the IB Theory of Knowledge curriculum.

That said, we have found that it is very helpful to begin your own TOK education by unpacking your own subject, simply because you do have some formal professional training in that subject and so will very likely have come across TOK issues in that context. Scientists are trained to take seriously any potential bias in the design, execution and interpretation of their experiments. Historians are intimately familiar with the need to identify and manage bias. Artists have considered carefully the connections between the purpose and communicative functions of art. Economists have already considered the role that models and various assumptions play in describing hugely complex social interactions. These sorts of questions might not form part of your teaching, but you will be sensitive to these types of TOK issues. Once you explore the structures provided by the TOK course to think through these issues, you will find that you are already sensitive to them. That's a great start.

Nevertheless, being appointed to teach TOK can be an intimidating experience. However, one can also look at the opportunity as just that: an opportunity. One of the fundamental IB aims is to promote lifelong learning and one of the real joys of teaching TOK is the fact that it provides a teacher with the chance to develop new understanding in a wide range of subjects – far beyond what most professional development training allows for.

This kind of learning takes time, of course, so there are two important points to be made here:

- First, there are resources to help ensure that you will be able to teach the course during the first couple of years while you develop your personal knowledge of the subject.
- Second, you will need to be patient with yourself when you are not as much of an expert on a particular subject as you would like to be. All teachers who dedicate themselves to developing their craft get better over time; teaching TOK is no different in this regard.

■ Where to start

■ RESOURCES

✔ Your most important resource is the **Theory of Knowledge subject guide**. If you have not yet read it thoroughly, then you should do so before continuing with this book. Keep the guide somewhere where you can access it easily – download it to your computer and/or bookmark it as a favourite in the programme resource centre (PRC). Your coordinator can give you access to the PRC if you do not already have it. The guide lays out for you everything that you are required to include in your course, and the aims and objectives you need to accomplish.

✔ In terms of preparing the content to teach, begin with the **core concepts and the four parts of the framework**. The framework gives you guidance about what it means to teach a theme or an area of knowledge. Each of those topics must be considered through the lenses of those four parts of the framework: Scope, Perspectives, Methods and tools and Ethics. The guide also provides you with knowledge questions that you might explore under each of those headings. You will see, as we go through each of the themes and areas of knowledge, that we have suggested how some of those knowledge questions might be answered and how they relate to the content in the student book.

✔ Another excellent source of help for many aspects of teaching the TOK course is the **teacher support material (TSM)**, also available on the PRC. Among other things, you will find some additional information about the role of the course concepts in the TSM. Chapter 1 of the student book is a resource chapter which contains detailed discussion of the meaning and significance for knowledge of each of the course concepts. Students should bookmark the beginning of the chapter and then return to it as needed throughout the course.

■ Begin your preparation with an examination of your own subject

The worksheet linked to by the QR code can be used to help you develop an understanding of the various themes and areas of knowledge. Begin with your own subject, the one in which you have developed the greatest expertise. Even if you haven't considered your subject in terms of these specific questions before, you likely know enough to answer most of these questions in detail; it will be more a matter of thinking about what you do know rather than learning a lot of new material. Once you have considered your own subject from the TOK perspective, you can move on to other subjects.

The questions on this worksheet have been developed to correlate with the four parts of the TOK curriculum framework – the four topics which must be considered in the context of each of the themes and areas of knowledge you study in your course. The questions on this document are more general than the specific knowledge questions that you will be asking your students to investigate. This exercise is intended to help you develop a general understanding of the particular topic. From there, you can work on more specific knowledge questions, such as those provided in the TOK subject guide.

We have also provided you with a model of a completed worksheet, which can also be accessed by using the QR code above. Rather than complete the model for one area of knowledge, we have answered some of the questions for each area of knowledge. This will give you an idea of how deeply to think about the questions, but will still require you to do much of your own thinking about your subject. The answer to the first question is shown below.

You will find that the responses in the model distill much longer discussions from the student book. Having students complete some or all of this worksheet at the end of each unit can be a very useful synthesis activity.

Note that none of the answers in the third column below are 'right' answers in the sense of being the only and definitive way to answer the question. Much more could be said in response to each question, so answers will differ from person to person. If students are completing some or all of the worksheet, they need to understand that they are presenting their personal understanding and that they need to convince their readers through accurate statements, sound reasoning and, where appropriate, documented evidence.

Area of knowledge worksheet

Question	Element of the knowledge framework	Area of knowledge
1	*Scope A: Aim of the endeavour* What is the aim of this area of knowledge? What do practitioners want to know? What does the practitioner of this area of knowledge aim to explain, describe, discover, develop or create? *Hint: This is a question about intent!*	**History** Historians want to know what happened in the past. (IB stipulates that an event must be more than 10 years old in order to qualify as history.) When we think of history, we generally mean the history of humankind, which means the history of humans' actions. Historians also want to know why people behaved as they did, how past events are related causally to each other and how that past has led to the present. All of the areas of knowledge and the topics of the optional themes also have a history: we can investigate the history of politics, say, or the history of language or the history of the natural sciences or art.

In order to educate yourself about the nature of the knowledge-generating processes in each of the themes and topics, you will need to seek out resources which are specifically about knowledge in that area, rather than resources which are intended to share knowledge from the subject area. So, for example, a standard high school history textbook is not likely to be as helpful a resource for you as something like EH Carr's *What is History*? That book, published in 1961, is a collection of a series of lectures that Historian Edward Hallett Carr gave at the University of Cambridge. The lectures are, as the title suggests, all about defining history as an epistemological endeavour. The works cited section in each of the chapters in this book will suggest some resources which you might find helpful in terms of learning how knowledge is generated, tested, validated and revised in each of the themes and areas of knowledge. The student book also references many sources which you may find useful for your own edification, or for use with students.

Organizing the course

One important decision that you will have to make is how to organize your course. There is no 'right' way to do this; you can choose whatever organizational structure makes sense to you.

In designing your course, you must begin with the practical consideration of how many hours are allotted and when during the students' two-year Diploma Programme. TOK courses are scheduled quite differently in different schools: many schools offer only the 100-hour minimum, while others have the course scheduled as a regular class for two years, just like an HL IB Diploma Programme course. Once you know the number of teaching hours you have available, you might want to first work out how many hours you need in order to complete the two assessments. The TOK subject guide provides some suggestions about this for teachers who have never taught the course before. Once you've allotted the time for the assessments, you will know how many hours you have for each of the required topics: the core theme, two of the optional topics, and the five areas of knowledge. Regardless of how you decide to organize your course, you should allow for an equal amount of time to be spent on each of those required topics.

The student book, of course, could only be organized one way, so we made a choice to organize it around the themes and areas of knowledge, with one chapter devoted to each. We have cautioned students, however, that the book may not be organized the same way their course is, and that they must, therefore, pay close attention to the teacher's instructions about which chapters to read when. The chapters are not dependent on each other, so students do not have to read them in a particular order.

The student book is organized as follows:

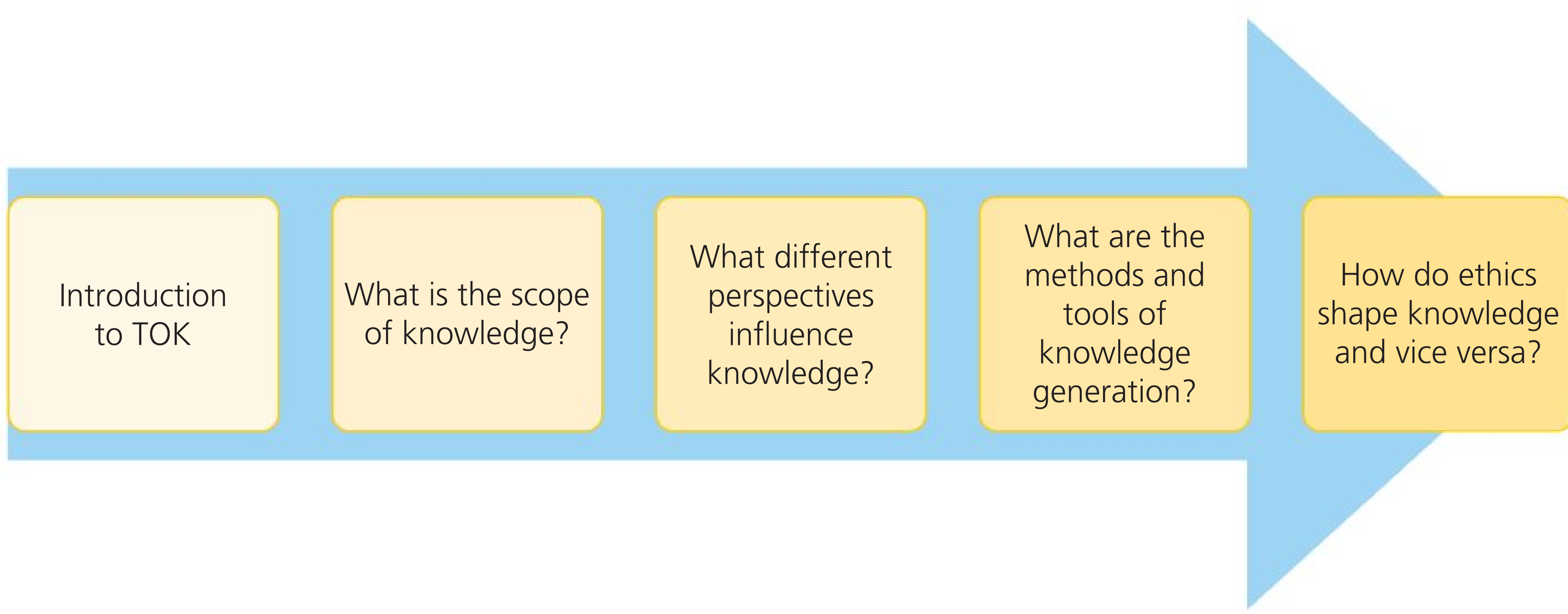
- Introduction
- Chapter 1 Course Concepts
- Core theme (one chapter):
  - Chapter 2 Core theme: Knowledge and the Knower
- Optional themes (five chapters):
  - Chapter 3 Knowledge and Technology
  - Chapter 4 Knowledge and Language
  - Chapter 5 Knowledge and Indigenous Societies
  - Chapter 6 Knowledge and Religion
  - Chapter 7 Knowledge and Politics

- Areas of knowledge (five chapters)
  - Chapter 8 Mathematics
  - Chapter 9 The Natural Sciences
  - Chapter 10 The Human Sciences
  - Chapter 11 History
  - Chapter 12 The Arts

The introduction is an overview of the Theory of Knowledge course, describing what students should expect to find in the course. The next chapter (Course Concepts) is a resource chapter, to which students will likely need to return many times during the course. This chapter discusses each of the 12 concepts in detail, including examples. In Chapter 2, we start the discussions of the main themes in the course, with the core theme: Knowledge and the Knower. With these elements firmly embedded we can then later develop them in the context of the optional themes and the areas of knowledge. There is also a resource chapter on ethics, titled 'Introduction to Ethical Theory', which is provided online for students who wish to pursue a more detailed study of ethics in general, outside the context of a particular theme or area of knowledge. This teacher guide also has an accompanying online resource on ethics, 'Introduction to Teaching Ethical Theory'; you can access it using the QR code. The chapter on ethics provides a background in ethics, including relevant technical terminology, so that students can read the discussion of ethics in each of the remaining chapters with a solid basis of understanding the issues which are involved in making knowledge about ethics.

The optional themes and the areas of knowledge are organized similarly to how they are organized in the TOK subject guide. We have made some changes in order to exploit some connections among the themes, and so that the areas of knowledge are organized in terms of which areas can provide the most certainty to which areas can provide the least, but it is not critical that you read the chapters in the order in which they are presented. Note, too, that the question of which areas of knowledge generate more certainty than others is open for debate and can be considered by the students in your class. Even if you decide to organize your course around the themes and areas of knowledge, you do not have to feel constrained by the order of the chapters in the student book.

Another way to organize the course would be around the elements of the framework. You could choose to explore all the various themes and areas of knowledge in comparison and contrast to each other. Each of the four elements of the framework – Scope, Perspectives, Methods and tools and Ethics – could be approached as a separate unit in which the particular aspect of the framework is considered for all the themes and areas of knowledge in turn. Such a course might look something like this:



In such an organizational structure, students would not read the entire chapter on each theme or area of knowledge at once; instead, they would read the Scope sections, followed by the Perspectives sections in the next unit, followed by the Methods and tools sections, followed by the Ethics sections. You could, of course, arrange the framework topics in any order which suited you.

Another comparative approach would be to design the course around the teaching of the core concepts. In that design, each concept could be a unit, and you would determine an effective order in which to introduce and teach the concepts, and then, within each unit, you would include aspects of each theme and area of knowledge. You would have to track the development of the course to ensure that all of the themes and areas of knowledge were explored through the lens of each of the four aspects of the framework. One possible organizational structure for that design might look like this (note that for the purpose of developing this model, we chose technology and language as our optional themes):

<table>
<tr><th colspan="3">Course plan organized by core concept</th></tr>
<tr>
<td>Unit 1: Truth
Core theme: Scope and Ethics
Language: Ethics
Technology: Ethics</td>
<td>Unit 2: Perspectives
Core theme
Technology
Language
Mathematics
The Natural Sciences
The Human Sciences
History
The Arts
Perspectives</td>
<td>Unit 3: Objectivity and certainty
Mathematics: Methods and Ethics
The Human Sciences: Methods and Ethics
Technology: Methods</td>
</tr>
<tr>
<td colspan="3">Unit 4: Evidence, explanation, justification and interpretation
Language: Methods
The Natural Sciences: Methods and Ethics
The Arts: Methods</td>
</tr>
<tr>
<td colspan="2">Unit 5: Culture and values
Technology: Methods
History: Scope, Methods and Ethics
The Arts: Scope and Ethics</td>
<td>Unit 6: Power and responsibility
Core theme: Methods
Technology: Scope
Language: Scope
Mathematics: Scope
The Natural Sciences: Scope</td>
</tr>
</table>

There are many possible permutations of this kind of course organization, and you will decide how much time to spend on each unit depending on the amount of content in each one.

One more potential organizing strategy is the use of some big thematic questions. You can develop conceptual questions around which to organize the course and divide up the content similarly to the way it was divided up for the concept model. The internal assessment prompts provided in the subject guide might be a good source of such questions. An example of a set of questions which might be used to create such a course is:

- What is knowledge?
- Why is knowledge valuable?
- How do individual knowers acquire knowledge?
- How do we know when we don't know?
- How do we know when we do know?
- How do the aims of knowledge-seeking affect the knowledge we acquire?
- Who is responsible for the knowledge we generate?

As with the concept-based organizational model, any number of sets of questions could be used as a basis for organizing your TOK course. These suggestions are examples only and other organizational structures are of course possible. The TOK subject guide and the TSM also have several examples of possible ways to organize the course. There is no reason that you should consider any of these different models as being 'better' than any other. A good course organization is one which allows you to include all of the requirements laid out in the guide, as well as to prepare your students for the two assessments.

One important consideration when you are choosing a design for your course is your personal comfort with the content of the themes and areas of knowledge. If you choose one of the inherently compare/contrast models, that will mean that you will have to feel comfortable that you understand several themes and areas of knowledge for each unit, right from the beginning of the course. If you are not comfortable with that at this point in your TOK teaching career, then perhaps organizing the course around one theme or area of knowledge at a time will allow you better opportunity to learn the content for yourself as you go along.

A final point to be made about the organization of your course is that the TOK essay is a compare/contrast task. Students will be required to respond to the question they choose with discussion of two different areas of knowledge. We have seen that the latter three of the sample organizational structures provided are inherently comparative, because you would be asking students to consider the framework element, concept or big question in the context of several themes and/or areas of knowledge together. If you choose an

Comparing and contrasting are important TOK skills

organizational structure which works through themes and areas of knowledge one at a time, you will have to ensure that you work in the compare/contrast aspect of the course deliberately. You can do this through lessons and through assessments internal to your programme.

The role of the core theme

The core theme, 'Knowledge and the Knower', is intended to help students explore both the way in which they personally make knowledge (or fail to do so!), and the way in which individual knowers in general do so. The purpose of the exploration is for students to identify the habits of mind which shape an individual's knowledge, so that once they understand the way those habits work in themselves (where they come from, how they shape knowledge and how they can block a person's ability to know) then they can recognize those forces at work in other people. For instance, students who have a good appreciation of the way that culture, preconceptions and the limitations of our physical senses both support and constrain our knowledge are better able to appreciate that other people with their differences may also be right (as stated in the IB mission statement). Because the topic of the individual knower and knowledge is called the 'core theme', it can be easy for students to develop an unacknowledged attitude that personal knowledge in general – and their knowledge in particular – is the most important element of the course. However, this is not the case. You will have to guard against any tendencies toward a narcissistic attachment to their own approaches to knowing and their own knowledge. The course is not intended to lead students to believe that whatever they think they know is good enough. In fact, all of us are wrong sometimes, and the ability to recognize when we are wrong and why is one of the skills that will help students thrive in the real world.

As with the course in general, you have many options for how you incorporate the core theme into your course. You may want to introduce the course with the core theme, or you may want to bookend the course with investigation into the core theme. You may want to introduce it and then revisit it in the context of the other topics, considering, for example, how individual knowers learn politics, language, mathematics, arts and so on. You may want to end the course with the core theme. Or you may want to combine some of these. It is important to remember, however, that in terms of time, the core theme constitutes one eighth of the course, just as each of the optional themes and the areas of knowledge do.

Comments about assessment

One reason that it will be important for you to allot equal time to each of the themes and areas of knowledge is that the two assessments are divided among them. The TOK subject guide suggests that the internal assessment (the exhibition), will be completed based on work done in the core and optional themes. The prescribed titles for the essay will require students to write about the areas of knowledge. The last chapter of this book will provide you with specific advice about how to prepare students for the two assessments. There is also a student skills book, *Theory of Knowledge for the IB Diploma: Skills for Success 2nd edition*, by John Sprague, published by Hodder Education, which gives students advice on how to prepare for their assessments.

Working with other IB teachers

A final responsibility you may find that you have as your school's TOK teacher is to work with the subject area teachers in order to help them incorporate relevant elements of TOK into their courses, as required by the IB. Some important points you can help your subject area colleagues understand are shown below.

- It is not the job of the subject teachers to teach TOK or to prepare students for their TOK assessments.
- The inclusion of TOK elements in the subject areas is intended to help students understand the subject areas better.
- Subject teachers are almost certainly already asking students to do some TOK thinking in their courses without realizing that they are doing so. Finding where this is already happening might be a good way to ease subject teachers into an awareness of what we do in TOK and a willingness to support our efforts.

Theory of Knowledge is one of the three elements of the Diploma Core. The other two are the extended essay and creativity, activity, service (CAS). These three elements are central to the Diploma experience because they should help students to do a better job of learning in all of their Diploma subjects. The three specific aims of the DP core, as presented in the TOK subject guide, are shown below:

Aims of the DP core

The three elements of the DP core are intended to complement each other and to work together to achieve three common aims. These are:

- to foster international-mindedness and encourage students to become responsible and actively involved global citizens
- to develop students' self-awareness and sense of identity, and provide an opportunity for reflection on their development of the attributes of the IB learner profile
- to enrich and add value to students' overall learning experiences through the core – supporting, and being supported by, their academic studies in the rest of the programme.

(TOK subject guide, page 4)

All three of these aims reflect the IB mission statement and are completely consistent with the aims of the subject areas, so the effort to incorporate TOK is not an additional responsibility for subject teachers.

■ RESOURCES

- ✔ One resource that can be very useful is the worksheet discussed on page 23. Subject teachers can complete some or all of the questions for their own subject areas. This exercise will help them think about their own subjects in terms of how knowledge is constructed. Many teachers will not have been asked to think this way before. Once they have completed the worksheet, the subject teachers will have a nice resource to pull from at appropriate moments during their curricula to help students think about their subjects from a TOK perspective. If they share their responses with you, you will have a helpful resource too, to help you learn more about how knowledge is made in the different subject areas.
- ✔ There are a number of excellent resources from the IB for working with TOK in the subject areas. There is a Category 3 workshop called TOK for Subject Teachers which is extremely helpful and will provide you with many resources as well as teaching ideas for the subject teachers. Ideally, some of your school's subject teachers can go and bring ideas back for their departments, but if not, someone in your school who will be instrumental in coordinating the work with subject teachers (IB coordinator, core coordinator, TOK coordinator or you!) can go and bring the ideas back to your school. There are also a good many helpful resources on the PRC, including videos about concept-based teaching, inquiry-based teaching, TOK and psychology and a video on understanding knowledge questions. The easiest way to locate those videos is to log in to the PRC and type 'video' into the search bar. Once you locate the videos you want, be sure to click on the 'add to my resources' button at the top of each of the individual pages so that you can find them easily later.
- ✔ One final resource is the set of 'Works cited' pages in this teacher book and in the student book. Each chapter has its own works cited list, and many of the articles referred to could be used both for your own edification and as a means of having students explain the exploration of the concepts in the particular chapter you have assigned. One thing to keep in mind, however, is that few, if any, of the articles, websites and books are themselves written to support the TOK course. Their use in the student book, then, can serve as model for 'finding TOK in the wild'.

Conclusion

As you can see, teaching TOK is a complicated effort but is hugely rewarding. If this is your first time with the course, do your best, but do not hold yourself to unrealistic standards. Rely on your resources, ask for help from other TOK teachers and commit yourself to learning as you go. If you are doing that, you are doing a good job and you will get better at teaching the course as you become more experienced. Teaching TOK offers you a fabulous opportunity to grow intellectually and to engage students in a kind of question that they do not get to explore very often in school. TOK is a course that many students report, in retrospect, was the most valuable one they had in high school. Enjoy being part of it!

How to use this book

The remaining chapters in this book align to the chapters in the student book. Chapter 1 of the student book is a reference chapter, and you will find some additional advice in this book, but the student book probably contains most of the information you will need as you work through the course.

Chapters 2–12 are organized, as the student book is, by the elements of the framework in the guide. Within that structure we have suggested some knowledge questions, usually from the subject guide, but occasionally additional questions, that could be used as you explore that aspect of the framework. We have provided a detailed example of how one of those questions might be explored, and we have provided some suggested activities – in addition to those which are included in the student book. Each chapter contains one fully developed lesson plan, again, as a model for how lessons might be developed. We have also provided some ideas about how the content of that theme or area of knowledge might be connected to the core theme – Knowledge and the Knower.

As we noted earlier, there are many ways to organize the course. We could organize the book in only one way, so we chose to organize it based on the themes and the areas of knowledge. This organization might create an unintended impression that the themes and the areas of knowledge all occupy particular niches in the course and in the world, but such an idea is overly simplified. In fact, as you will see (even in the student book) the different topics in the TOK course often overlap each other. When it comes to working with real-life situations, you will very often find that more than one theme or AOK is relevant to the knowledge-making in that situation. Knowledge generation in the real world is a complex process which does not take place in isolated situations, and exploring these processes will help students to develop a more sophisticated understanding of knowledge in their lives and in the world at large than considering the various themes and topics in isolation would do. When it comes to writing the TOK essay, furthermore, students will have to be able to compare and contrast two different areas of knowledge, so during the course they need to develop experience in considering how the different areas of knowledge are similar and different in terms of their knowledge-generating processes and implications. In this book, therefore, we have also made some suggestions about connections that might be made between the theme or area of knowledge in that chapter and other themes or areas of knowledge.

One final important point that we need to make is that none of the chapters – either in this book or in the student book – covers all the possible concepts, knowledge questions, answers to knowledge questions or connections to other parts of the course that could be covered for any of the themes or areas of knowledge. Nor are the topics which were chosen for inclusion the only possible topics which could be investigated in a TOK course in order to fulfil the aims and objectives. The possibilities of what to investigate are almost endless, and the particular points that you raise with your students will necessarily depend on the choices you make about which optional topics to include, the resources available to you for use in class, your expertise in particular areas and your personal preference. Our aim, therefore, is not to provide you with the definitive model for teaching the course; rather, our aim is to demonstrate a number of different ideas and approaches that you might use in the teaching of the required topics and themes as described in the guide, and then to encourage your creativity in designing your own lessons to replace or augment what you find here.

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Certainty

TEACHING TIP

Students sometimes struggle with the concept of certainty, thinking that 'certainty' equates to 'absolutely certain'. Students also sometimes assume that unless we can say that something is 'certain', we cannot call it knowledge. It's a short distance from those two (usually unacknowledged) assumptions to the idea that we cannot know anything. It is important, therefore, that students understand that we can be certain enough about something to call it knowledge without being absolutely certain. It will also be important for them to understand just what it means to call something 'absolutely certain' and how rare that is.

Most of our knowledge does not meet the standard of absolute certainty. Instead, the methods by which we make knowledge in any given situation have been developed specifically in order to give us the highest degree of certainty possible in that situation.

The various methods used in the different areas of knowledge can be characterized in terms of some truth tests. The section on truth that follows (page 41) provides details of several truth tests (two of which are discussed in Chapter 2 of the student book – pages 45–46). The truth tests are relevant to the concept of certainty, because only one of the truth tests is capable of delivering absolute certainty. We can consider each of the truth tests in turn in terms of their ability to deliver certainty.

Truth by correspondence

We cannot ever be absolutely certain that what we think is true corresponds exactly to what is actually out there in the real world outside of our heads, because everything that we perceive must come to us through our perception. We cannot, in other words, get outside of our heads to check to see if what is inside our heads is also what is outside our heads. Nevertheless, we can use this test of truth to ascertain the truth of many claims: 'it is raining right now' or 'my shirt is yellow'. The aim of natural science is to establish truth by correspondence – to be able to make claims which match the physical reality outside of ourselves. So, we can use truth by correspondence to try to verify a certain type of claim; however, we cannot use it to establish absolute certainty. We back up our claims of truth by correspondence over time, as those claims are validated by experience and not undermined by new discoveries.

Truth by coherence

We cannot establish absolute certainty using truth by coherence either. We can, and do, use the fact that certain observations cohere with what we already know to establish confidence in what we know, and, as with truth by correspondence, the more time that passes and the more knowledge that coheres with what we know, the better our confidence and the more certain our claims become. In Chapter 5 of this book, there is a case study of the Polynesian Wayfinders (page 127). The means by which the Wayfinders know where they are relies heavily on observation. The knowledge of where the place is that they are going can be derived by coherence, even though they cannot see the place they intend to go to. The navigators know where they are in relation to the stars and what the waves, fish, birds, wind and dolphins all suggest about where they are in relation to various land masses. By understanding the implications of all those facts, they know where they are in the larger scheme of things; thus, they can know where the place they intend to go is, because that knowledge coheres with all the other facts that they already know. The certainty is not absolute, but it is sound enough to ensure that the Polynesian Wayfinders arrive at their destination.

The knowledge is functional, and so true. Ultimately, of course, they can test their knowledge of their destination by correspondence, when they arrive there, and then they do know with absolute certainty.

Truth by authority

Truth by authority is absolutely certain, because when someone has the authority to create a reality, then what that person creates is the reality – until that person or some later person or group changes it. So, for example, my name is my name because the people who had the legal authority to bestow it (my parents) did bestow it. Once people are adults, should they wish to change their names, they can, in many countries, undertake a legal process to have their name changed. In that case, the authority of the law confirms the new name. The naming of things is one of the most common types of reality over which humans have control, and since the power is ours, the reality we create is absolutely certain. In July 2019, an international committee of scientists changed the standard by which the kilogram will now be measured. Prior to this, the kilogram was measured against a physical object – a platinum iridium cylinder kept in a vault in Paris. From November 2019, a kilogram will instead be calculated using Planck's constant, an equation available to everyone, so that any scientist who wishes to do so can calibrate an exact kilogram (Chen). All of the scientific weights and measures are being systematically changed to align with unchanging physical constants. You can use the QR code on the left to read a more detailed explanation of this.

Scientists have the authority to make these changes, and so where once all scientists were absolutely certain of what the old standard was (the cylinder, for example), now all scientists will be absolutely certain of the new standard. Note that truth by authority is very different from the acceptance of some authority. That difference is discussed in the truth section on page 41.

Truth by consensus

Truth by consensus is closely related to truth by authority. In countries with representative democracies, the decision of who will be the leader or who will be the representatives to the local and national legislatures is made by consensus. The consensus, of course, must be among the people in the relevant community of knowers. Biologists, for example, did not get a say in what the definition of 'planet' should be. The important consensus was among the members of the International Astronomical Union. The example of the categorization of Pluto can be found in the student book on page 4. Decisions within a legislature are also made by consensus. The committee of scientists mentioned above who decided about the standard for weights and measures is a group of people whose consensus established what the truth would be from here on. All these groups who are empowered to make decisions constitute the authority which, in certain very specific situations, have the power to make something be so. Those decisions are absolute, until something happens to change them – new elections, new legislation, lawsuits, a new committee and so on. Absolute certainty, in other words, is not necessarily permanent when there are authorities who can change reality.

Truth by pragmatism

As the name suggests, truth by pragmatism cannot provide certainty; it requires a (logical) leap of faith. The acceptance of an external reality is the primary 'truth' for which we rely on pragmatism (see the section on truth that begins on page 41). That truth is verified as time goes on by its utility. If we assume that there is an external reality and act accordingly, we can get along well. If we cease to believe in an external reality, we run into problems pretty quickly.

The various areas of knowledge, as well as the knowledge-generating processes within the contexts characterized by the core theme and the optional themes, rely on validation methods which can be represented by these truth tests. No situation relies on only one of these tests – except possibly for knowledge that is made by authority, as no other test is needed in those cases. The natural sciences, for example, rely heavily on observation, which aims for correspondence, but they also rely on coherence for continuing and strengthening the confidence in the knowledge claims which have been established. Historians, on the other hand, rely more directly on coherence, since direct observation is a much more difficult proposition. Interpretation of artworks requires both of those, and sometimes consensus plays a role in establishing the value and meaning of various works of art, and so on. As part of the exploration of the methods and tools of each of the course topics, students should consider the basis for establishing what is true in that area.

A critical point for students to understand about certainty is that once something has been established beyond reasonable dispute, we can call it certain. That is, we can call it knowledge. For example, there is an international consensus among scientists that human activity has accelerated global warming dramatically, and we are certain that this is true. The very small number of dissenting voices among scientists is insufficient to pose a credible challenge to the knowledge. Some claims are tentative. Some are fairly well established, but many questions remain. Some have been established thoroughly enough to be beyond contention. We don't have to have absolute certainty in order to have knowledge, and we do have knowledge of a great many aspects of the universe and its inhabitants.

Culture

The explanation in the student book of the concept of culture as it pertains to knowledge focuses on large-scale culture of a community or nation. It can also be very useful to consider the culture of smaller entities, such as organizations. Businesses controlling the manufacture of medications, for example, have particular cultures (almost always a culture of secrecy arising from the desire to keep proprietary information from competitors) which shapes the making of knowledge about what kinds of medications will solve which problems. Secrecy reduces the amount of testing, peer review and replication that can be done.

The consideration of how their own culture has shaped – and continues to shape – their own knowledge is a very useful way for students to begin to understand why they might believe or know things that are different from what people from other places believe and know. Focus on the concept of culture, furthermore, is a good way to incorporate internationalism into the TOK curriculum.

The US State Department's Bureau of Educational and Cultural Affairs has posted a short YouTube video with a number of interesting quotations that get at different aspects of culture. You can view it using the QR code on the left.

One helpful case study which you can use when exploring the relationship between knowledge and culture is the role of the didgeridoo in Indigenous cultures in Australia.

How culture shapes what we can know: Indigenous Australian women and the didgeridoo

The didgeridoo is an instrument made and played by many different Indigenous peoples of Australia. In recent years, a great deal of controversy has arisen over the question of whether women are allowed to play it. In 2008, a representative of the Victorian Aboriginal Education Association objected to the publication of a book which included a didgeridoo lesson for girls.

> Dr Rose says the didgeridoo is a man's instrument and touching it could make girls infertile, and has called for the book to be pulped. 'I would say from an Indigenous perspective, [it is] an extreme mistake, but part of a general ignorance that mainstream Australia has about Aboriginal culture', he said.
>
> ('Didgeridoos a don't for girls: expert')

Dr Rose's position is, however, at one extreme of the controversy. Many other sources suggest that the taboo does not apply to all Indigenous cultures and that, in fact, it has arisen only in areas where the didgeridoo has most recently been adopted. The Victorian Aboriginal Education Association, in fact, is a group located in Victoria and represents the Koorie people of Victoria, in the south of Australia, which is the area of Australia in which the didgeridoo is a more recent innovation.

Another perspective, however, is provided in a well-documented example of a tribe with specific practices involving the didgeridoo that have associated taboos for women playing them. The Yolŋu are the Indigenous people of what is known as the Arnhem Land in the Northern Territory of Australia. Among the Yolŋu, women do not play the yiḏaki, the Yolŋu name for the didgeridoo, by tradition ('Should non-Aboriginal women play the didgeridoo?'). Didgeridoo player Randin Graves suggests that there are some exceptions, but only in situations which do not constitute formal ceremony:

> There are times when Yolŋu women do in fact play yiḏaki. They assist in the crafting of instruments, or even make them by themselves. Brief testing of the tone is often done by women in these cases, although away from prying eyes, and usually with a wink and a laugh. Some Yolŋu tell stories of women playing for ceremony in the unlikely event that no man is around to play. In fact, nearing conclusion of many dhapi, or boys' initiation ceremonies, there is a fun and festive role reversal in which some men and women switch roles, so that women might sing and play yiḏaki while the men wear dresses and dance the women's parts! Most Yolŋu say that this is not real yiḏaki playing, but 'only for dhapi'. It is a big joke that results in laughter and is not serious or skilled playing.
>
> (Graves)

Graves emphasizes, however, that the Yolŋu people express disapproval at the idea that women might play the yiḏaki in public. He suggests that although even Yolŋu women are not offended by the idea that non-Aboriginal women might learn to play the yiḏaki, those women should be very careful about where they learn and where they play it.

> If you are in Arnhem Land or in the presence of people from Arnhem Land, carefully check that no one will be upset before playing. Be aware that it may be shocking and may inspire the laughter that women playing does in initiation ceremonies. Yolŋu women have their own business and like to stick together and stick to their customs. You will not win any friends and begin a relationship of open sharing with Yolŋu by forcing your point of view and will likely alienate Yolŋu women who could otherwise become friends.
>
> (Graves)

We can see in this example, then, that the cultural practices surrounding the playing of the yiḏaki shape who can know how to play it and in which situations. The Yolŋu women can only know a limited amount about how to play the yiḏaki – even though they are the usual makers of the instruments ('Should non-Aboriginal women play the didgeridoo?'), and those cultural practices have implications for what non-Aboriginal women can know about playing the yiḏaki. Even where they can learn to play the instrument, the taboo against their playing in the specific situations for which it is intended in the original culture necessarily shapes the kind of understanding they can get about what it means to be a master of the instrument. A non-Aboriginal woman learning to play the yiḏaki brings to it a completely different knowledge of history and culture from what the Yolŋu men (and even the Yolŋu women) would bring to the art, and the experience can be in no way comparable.

We don't know why the mores which restrict the playing of the yiḏaki in public to men originally arose, but we can easily understand that they did arise because of beliefs that were held in the tribe at the time the yiḏaki was developed or introduced to the tribe. In the present day, we can recognize the influence of history and tradition on perpetuating that cultural practice. Originally, we might surmise, there were beliefs about what was ethical (right and wrong) behaviour for men and women in general, which were then extended to the playing of the yiḏaki. Later, we see how historical knowledge and knowledge of culture itself shapes the present-day cultural practice.

In the case of the yiḏaki and its role in the cultural ceremonies of the Yolŋu people, we can see both aspects of our interest in the relationship of culture to knowledge: we see both how knowledge can shape culture and how culture then shapes knowledge.

Evidence

Evidence, opinions and beliefs are not necessarily true or relevant to the specific situation in which they are offered. As all knowledge claims must be, evidence, opinions and beliefs must be tested before they are accepted. None of these in and of themselves constitute proof. Proof will require that a compelling justification must be given as to why that evidence, fact, opinion or belief provides a good foundation for knowledge.

One important issue pertaining to evidence as a concept has to do with the fact that many of the terms in this section are commonly misused in colloquial speech. The word 'fact', for example, has a precise meaning, but it tends to be very loosely used in colloquial English to mean anything that someone thinks is true or wishes to be true. In TOK, students need to be much more careful. In Chapter 2 of the student book, we suggest that 'facts', strictly speaking, are not the sorts of things that are considered true or false. They just are how the world is. Beliefs, claims and judgments are true or false because they either reflect a fact or they do not. Facts provide the truth conditions, but they themselves are not true. A 'false fact' is a claim that is false.

The concept of 'opinion' can be a particularly tricky one. In recent years, the idea that 'I am entitled to my opinion' has become quite popular, but the statement is not true in all cases and in all situations. People are certainly entitled to their own opinion in any case in which opinion is the deciding factor: which movie is better, do I like or dislike eating broccoli, which is my favourite sports team and so on. There are many occasions in which opinion is the arbiter. There are, however, a great many situations in which opinion is not the determining factor for what is true or not, and in those cases, people are not 'entitled' to use their own opinion as the deciding factor. A useful resource on this subject is the interesting and provocative opening chapter in Jamie Whyte's book *Crimes Against Logic*. You can read more about the book by using the QR code in the margin.

In order to fully achieve the first three aims from the guide, students must understand the difference between fact, knowledge and opinion, and be aware of the conditions under which each one should be referred to.

The other important point which is made in the student book's section on evidence is that none of the elements discussed there are in themselves sufficient to establish or convey knowledge.

Explanation

The focus in the student book's discussion on explanation is on the fact that much of our knowledge provides an explanation of something. The discussion raises the point that explanations, like evidence, facts and beliefs, can be good or they can be ineffective or wrong. A key point is that in the natural sciences, the term 'theory' has a precise meaning which is not the same as the meaning which is often employed in colloquial English: a scientific theory is an explanation which has been established beyond reasonable doubt.

Interpretation

The section on interpretation points out that, as with many of the other processes among the course concepts, an interpretation is not necessarily logical or effective.

The other important aspect of the discussion in the student book is that the concept of interpretation is applied to the work the students will do on their two TOK assessments. Students will have to make and provide interpretations for both assessments.

One point which is not made, but which might be useful, is the relationship between opinion and interpretation. An interpretation is an opinion, but it relies on a careful incorporation of the facts from the object, event, pattern or process which is being interpreted. An interpretation is, at least ideally, a conscientiously informed opinion.

Justification

This concept differs from explanation in that a justification is something provided to others in order to convince them of the soundness of your claims. All knowledge in all of the AOKs, the core theme and the optional themes requires justification. No one gets to just proclaim that something is so and then expect to have others believe it.

The student book demonstrates the requirement for students to justify their claims in their two TOK assessments.

TEACHING TIP

There is a kind of historical tradition of using Plato's definition of knowledge – Knowledge = Justified True Belief or K = JTB – as a definition of knowledge for TOK. However, K = JTB is not, and was never any kind of official definition, and, indeed, it is fairly problematic. For one thing, consider the fact that Plato offered a tripartite definition: justified and true and belief. In order to demonstrate that something is knowledge, then, we must be able to establish that all three parts of the definition are present. The problem with that, however, is that we have no way to establish the truth of anything without justification. So, the 'true' part of the definition is redundant – or the justified part is. But if we take one of those out and try to think instead that:

K = JB

or

K = TB

then we have different problems. We certainly wouldn't want to agree that everything anyone claims to believe and can offer a justification for is knowledge, because so many times the justification offered is not a sound one. If we tried to argue that knowledge is anything that is true and believed, we have a different problem, because how do we establish that something is true? We cannot get along in the world just accepting everything that anyone claims is true.

Plato, it seems likely, would have claimed that God was the arbiter of what was true, but in the twenty-first century, and in Theory of Knowledge, we do not count on a deity to know things on our behalf. We expect to be able to know things ourselves and to explain why.

An additional problem with Plato's definition is that it leaves it to individuals to determine what knowledge is, and it is quite possible that individuals might claim that they believe true things and can justify them. As we have seen, justifications are not always effective and many individual people think they have 'knowledge', although they are wrong.

The K = JTB concept became pervasive, leading to many problems with students making fairly dogmatic, but poorly reasoned, statements in the assessments, particularly in the TOK essay. As a result, a few years ago, the metaphor of the map (which you can find in the TOK subject guide on page 6 and which is discussed in some depth in Chapter 2 of the student book) was included in the official curriculum in order to provide teachers with some assistance for how to define knowledge in a more nuanced way.

We bring up the K = JTB definition here because sometimes students will find it on the internet, and you might need to be able to discuss its problematic nature with them. In the student book we discuss these ideas when distinguishing between the concepts of 'knowledge', 'belief' and 'opinion'.

Objectivity

This section in the student book makes a case for the importance of objectivity as a prerequisite to our being able to understand the universe as it is, rather than as we would wish it to be. One resource is suggested in the student book for understanding various kinds of bias that can creep in and distort our thinking. Another excellent source is the Geckoboard website, which you can access using the first QR code shown in the margin.

The site also includes a free poster showing the various data fallacies, and there is a link to a checklist that students can use as a way of checking claims for their objectivity and reliability. The checklist can be accessed using the second QR code in the margin.

The discussion of objectivity also includes the fact that there are some kinds of knowledge, such as the arts, which are not offered objectively. Recipients of knowledge must, in all cases, remain as objective as possible, but in the arts, the creator of the artwork does not have to be objective; indeed, one of the main purposes of art is for the artist to convey their subjective view of the world.

Perspective

Perspective is one of the four aspects of the knowledge framework which must be investigated in the context of all the themes and areas of knowledge in your course, so it is pervasive. Perspectives are covered in every chapter in addition to the lengthy discussion in the concepts chapter, so there is not much more to offer here. A key point is that differing perspectives can be helpful, harmful or irrelevant, depending on the knowledge-making situation.

Power

The concept of power and knowledge is at the heart of the aims of TOK. One of those aims states that the TOK course will:

- Help to equip students to effectively navigate and make sense of the world, and help prepare them to encounter novel and complex situations.

The implication of this aim is that knowledge, and the understanding of how knowledge is made and how we know what is true, gives us power. People who can navigate the world effectively and encounter novel and complex situations have power over their own lives. The concept of power takes us to the heart of why knowledge is important and useful in the first place.

A second aspect of the concept of power is one that most students (and indeed most people) don't realize or think about: that what knowledge gets developed in the first place and then disseminated (and to whom), is directly influenced by people and institutions that hold power in any society, particularly in terms of funding.

It will be important to help students understand both of those roles that power plays with regard to the development both of personal knowledge and of knowledge shared in societies.

Responsibility

Responsibility is the corollary to power. The irresponsible use of knowledge is an abuse of power, and so is unethical. The knowledge framework does not include either power or responsibility directly. However, because the study of knowledge in all the areas and themes now requires a consideration of the role of ethics, knowledge and power are embedded in the study of the nature of knowledge in all knowledge-construction situations.

Truth

Possibly the most important aspect of the concept of truth in TOK is that a foundational assumption of the course is that truth exists. Another foundational assumption is that we are capable of ascertaining some or all of the truth about many aspects of the universe and our experience in it. While it is of essential importance to help students learn when knowledge claims are problematic, and the reasons that knowledge can be difficult to establish, it is of equal importance to help them learn when and why we *can* claim, with confidence, to know that something is true.

Truth tests are not a required part of the TOK curriculum, and students will not be expected to be able to discuss them in their exhibitions or essays. The truth tests can, however, be a useful tool to help students understand the means by which practitioners of various areas of knowledge go about establishing the validity of the knowledge claims that they make in their area. Chapter 2 of the student book explores two common truth tests in detail: truth by correspondence and truth by coherence. There are a few other truth tests which might be useful.

The ramification of these truth tests about certainty was explored in some detail in the section on certainty above (see pages 34–36).

Truth by authority

We have truth by authority whenever we have a person who has the authority to make something true. In Chapter 6 of the student book, students are prompted to consider whether religious leaders are *an* authority (in the sense that they are a reliable source of knowledge) or *in* authority (in the sense that they are in a position of authority). We can see that the latter is not necessarily the former – you can probably think of problems which have arisen in businesses, schools, governments and other institutions because someone who did not have the necessary expertise was nevertheless put in a position of authority. This problem brings us to two points.

1 Sometimes people who have the authority to make a decision are not qualified to make it but do so anyway. That lack of qualification does not, then, make the decision any less true or powerful. It might be useful to have students do some research into examples of whistleblowers as people who felt that decisions being made by people in authority were legally or morally wrong, and often dangerous. An instance of this in September 2019 led to impeachment hearings in the United States House of Representatives against President Donald Trump. The Supreme Court in the United Kingdom ruled unanimously, also in September 2019, that Prime Minister Boris Johnson had acted improperly in proroguing Parliament, and Parliament was immediately reconvened. Such cases illustrate the problem of knowledge being in the hands of people who either do not know enough or who deliberately misuse their power. Other examples abound: the chapter on politics in the student book uses the example of the explosion of the Challenger space shuttle (page 229). The problem resulted from people in positions of authority (in terms of having the right to make decisions) overriding the judgment of people who actually had the authority (in terms of being reliable sources of knowledge).

2 The acceptance of authority is not the same thing as being able to validate a claim on the basis of authority. Parents have the authority to name their children. The President of the United States has the authority to declare a national emergency. A teacher has the authority to assign homework and to determine the quality of work handed in by awarding marks. The truth-by-authority test refers to that sort of authority. Believing whatever people say simply because they are in authority positions is not the same thing as believing what is true.

TEACHING TIP

Students are often easily confused between people who have the kind of authority which means that they have the power to make something actually be true and people who are, or seem to be, authorities on a particular subject. Young people are accustomed to believing what they are told by adults, because adults in general have more authority than children or teenagers do. Very often, the adults who are making claims about what is and what is not true are strangers (experts on television, for example, or writers of newspaper articles and textbooks), so we eventually grow accustomed to accepting the word of strangers who speak with confidence, and therefore seem to know what they are talking about.

This habit of unthinking acceptance has turned out to be a liability in the twenty-first century in the context of the internet, which allows anyone and everyone to present themselves as experts, whether or not they have any knowledge, expertise or authority. It is important for students to learn to tell the difference between a person who is an actual expert (an authority on a subject) and a person who is in an authority position – or who just claims authority for themselves without having actually earned it. They must be able to ascertain when those two things converge, so that the person who is the authority is the person in the authority position – an ideal situation! Students must also learn to assess whether people who present themselves as authorities do, in fact, have the appropriate expertise which makes their claims trustworthy.

Truth by consensus

This is a subset of truth by authority. In the case of truth by consensus, the authority is vested in a group. An electorate is a group of people with authority to decide. A legislature is a group of people with authority to decide. The board of a business is a group of people with authority to decide. Many situations involve committees or other collections of people who make decisions and set rules. When that body of people has the actual authority to set those rules, then we have truth by consensus.

Notice that with both truth by authority and truth by consensus, the truth that people are empowered to make is absolute but might be temporary. When some reality is under the control of human decision, then it is under the power of human decision to change.

Truth by pragmatism

This is much less useful than the other truth tests, because it can be applied in fewer situations. We resort to truth by pragmatism when we have no other way to determine whether something is true. The sole situation in which we turn to truth by pragmatism as our test for whether something is true or not is the acceptance that there is an external reality, independent of the human mind. As mentioned previously, we have a fundamental problem which seems to be intractable: we cannot get outside of our minds to verify whether what is in our mind matches what is outside. In its most essential form, this problem means that we cannot absolutely verify that there is an external reality. We have, therefore, to accept, as a matter of pragmatism, that reality exists, because that assumption is functional.

If I try to assume that there is no external reality, and that all experience and all other people and objects exist only inside my individual mind (a position known as solipsism), I will find that such an assumption is not useful. I cannot assume away a truck barrelling down the road at me. I cannot assume away my tax bill, or my need to eat and breathe. I cannot run headlong into a brick wall without injuring myself. I cannot think myself into an acceptance on scholarship to a prestigious university. If I try any of these, I will discover in very short order that my assumptions lead me into consequences I do not wish to experience.

If, on the other hand, I act on the assumption that the world I perceive is actually out there, and if I live in accordance with the procedures, laws and agreements society has instituted in order that we may get along as well as possible together, I find that that assumption is far more useful. I have a much better chance of achieving what I wish to achieve.

TEACHING TIP

Occasionally a student might proffer the argument that none of the consequences are real either: that the universe I have constructed inside my mind is logical and consistent, and that my mind, outside of my conscious control, ensures that if I don't follow the rules of the imaginary reality, I will suffer consequences which feel real, but which are equally imaginary. This is a very sophisticated argument for solipsism, and if a student understands so much, then that student is likely to do quite well in the course. The argument, however, is effectively meaningless. If, indeed, the universe inside my mind operates exactly as a real universe outside my mind would operate, then there is no meaningful difference, and I must proceed as if that universe exists.

Values

Values underlie every knowledge-making endeavour. We don't seek to learn about anything we don't value. The valuing can be specific to an individual who pursues a particular kind of knowledge, or it can be a communal value. An essential value which connects all the areas of knowledge and the optional and core themes is the value of truth – accuracy – so that our knowledge can be functional. All the methods in the various areas have developed as the best means known for generating accurate knowledge, at least for the time being. As other methods are developed which can help us make better knowledge, we will adopt those.

LESSON PLAN: CHECKS LAB

Introduction

The Evolution and Nature of Science Institutes at the University of Indiana has posted a large collection of lessons pertaining to the nature of science developed over the course of many years by classroom teachers. One such lesson, known as the Checks Lab, was developed to help students explore the nature of scientific investigation, but works equally well in Theory of Knowledge as an exploration into the nature of the work that historians do, which is how we will consider the lesson here. The activity relates directly to the methods and tools part of the framework but will also generate different perspectives on the basic problem (Randak, *et al*). You can find the lesson by using the first QR code shown on the left.

Note: The ENSI collection is due to be archived in December 2019, so if the direct link in the first QR code does not work, you can get to the lesson by using the second QR code in the margin and then selecting the section on the Nature of Science Lessons:

You will provide students with a set of checks (known as cheques in some countries) all written, apparently, by members of the same family over a period of years. Students are becoming less and less familiar with these documents in the era of electronic payments and transfer of funds from individuals via apps such as Venmo. The checks were evidently prepared specifically for this activity, so they are, in actual fact, fictional. However, for the purposes of this activity, students must suspend their disbelief and accept the checks as if they were real. This question will sometimes come up when they notice that the handwriting on all the checks is the same, even if the signatures are different.

Working in groups, students examine a few of the checks and try to ascertain what story they tell. After some time has passed, students are allowed a few additional checks – in the nature of a fresh discovery of artefacts. Students must adjust their hypothesis in order to account for the new data. After a third round, students are then told that they will not have access to any remaining checks. This parallels the lot of the historian, who almost certainly never has all of the information that it is theoretically possible to have. Neither does the historian ever know whether they have all the information. Historians must work with the artefacts they have and keep an open mind in case something new comes up some day.

Groups then share the stories that they came up with to account for the data. Stories will inevitably differ, and they should discuss why that is so.

Teaching advice

One particularly valuable aspect of this activity is the fact that there is no known answer. Students will almost always want to know from you what the 'right answer' is, but of course you cannot tell them, because you do not know. This fact mirrors precisely the position of historians in relation to their material. There is no 'back of the book' in which to look up the 'right answer', and there is nowhere to turn for verification of their interpretation. The responsibility is entirely theirs to make their story logical, reasonable and supportable, based on the evidence. This is a great way to help students understand the important responsibility that all historians (as well as people constructing knowledge in many other arenas) bear for being able to stand behind their work.

Possible reflection/discussion questions

The lesson plan as developed includes a number of support documents, including a student worksheet with some reflection questions. For the purposes of Theory of Knowledge, you may wish to replace the questions that currently appear on the student worksheet with a set such as the ones shown below.

Question	Teacher notes
As you were working, what problems did you encounter?	Lack of familiarity with the kinds of businesses to whom checks were made out. Lack of understanding of the relative cost of things from the dates on which the checks were written (one set is from the 1960s and another from the 1990s). In the 1960s set, for example, there is a check to Liquor Barn, which students very often assume must have been for liquor for a wedding. However, \$1200 in 1963 was the equivalent of more than \$10 000 now. That amount would purchase a truly incredible amount of liquor! *(Note: You can use an online inflation calculator to make this determination, such as the one shown at the link via the QR code. This online calculator can do calculations for the US, UK, Canada, Australia and the Euro.)* Lack of knowledge about the places indicated by the checks.
You assumed that all of the checks were part of the same historical story. Was that a reasonable assumption? Why or why not?	The names and dates and similarities among the checks (numbers, bank addresses, names of animals) make this a reasonable assumption. We also assume that all the checks were found together in one place. However, our assumption is not absolutely certain, but is good enough for now, until something comes up to suggest that the assumption is problematic.
Did you use all the checks in developing your story? If not, why not? Could an historian choose simply to ignore some of the artefacts?	Sometimes a group will ignore a check entirely because it doesn't fit with the story that that group had worked out. Obviously, historians cannot do that; they must account for all the data.
Did you use all the data on the checks or did you discount some as being unimportant? If you discounted some of the data, why did you do so? Could an historian choose simply to ignore some of the data?	Very commonly students will ignore things like the address of the bank, the routing numbers at the bottom of the check and the image on the checks. (If the images do not show well in the copies, the names of the animals shown are at the top of the checks. They differ from check to check.) It is worth having an example ready to demonstrate how that kind of information might be important: perhaps someone in the family was a park ranger, and the animals reflect that profession. If we were to assume that someone was a park ranger, we might interpret the whole set of checks differently.

Cont ...

What further research might an historian do in order to create a more detailed and accurate context for these artefacts?	City records, genealogy databases, birth and death records, marriage records, an inflation calculator, a dictionary and historical maps would all be useful. Students may think of other examples. It is often a useful discovery for students to realize that historians wouldn't try to develop a complete hypothesis just from a set of obviously related artefacts, but that they would instead do considerable research using existing knowledge and many other resources in order to improve their understanding of whatever it is they have found and are working on.
Once you developed your original story, did you treat the new artefacts objectively, rethinking your story to account for new data, or did you try to find a way to fit the new artefacts into your existing story?	Emotional attachments to the hypothesis develop very quickly, and then confirmation bias will very often drive the way students wish to interpret the new information.
Once you developed your original story, did you find it difficult to revise or abandon it in order to account for new findings? Why or why not?	Often students will find it quite difficult to change course once they have developed an initial hypothesis.
What were some of the biggest differences among the stories that the groups came up with? What accounts for the differences in perspectives?	Some of the main factors that account for difference will be: ▪ different groups having somewhat different artefacts, as different groups will have drawn different checks out of the envelopes and will have drawn the same checks at different times in the process ▪ background knowledge and assumptions of the 'historians' differs ▪ different use of imagination and reasoning.
Did you learn something from other groups that helped you to revise your story or to understand it better or differently? If so, what?	This question helps students to consider the value of different perspectives on the same question. Some people will inevitably see things that other people did not see, and sharing the findings improves their knowledge.
Given the difficulty of establishing a story with a high degree of certainty from these facts, what procedures do historians use in order to validate their knowledge?	Truth by coherence and openness to change when new information arises are two important understandings here.

You may not have time for all these questions, or you may wish to give different questions to different groups and have them share. Other questions are, of course, possible, so you will develop those that meet your needs.

Relevant course concepts

The table that follows on the next page shows some ways in which each of the course concepts could be connected to this lesson. Other connections are certainly possible, and you would be unlikely to use all 12 course concepts with any one topic. Therefore, the intention here is to demonstrate the versatility of the concepts and to show how easily they can be woven into the activities you do in the course.

Course concept	Connection to the activity
Certainty	This activity demonstrates the difficulty of establishing certainty in an historical investigation. We can be certain about some things: what the checks say, for example, but when we try to establish a logical relationship among the various artefacts, we are forced to rely on imagination and logic in order to develop an **interpretation** (see below). Both need to be rigorously tested, but they will not result in certainty. At the level at which this activity operates, historians would not claim to have knowledge; instead, they would claim to have hypotheses and possibilities. Further work would be required in order to develop more certainty.
Evidence	The checks themselves are the evidence in this study. Each check is one individual historical artefact. However, each of those artefacts has a great deal of information that can become evidence in support of an **interpretation**. As we saw earlier, even the fact that the checks have animals on them could turn out to be evidence of an historical reality. All the information on the checks are facts. The facts become evidence when the person studying them constructs an hypothesis and uses the facts to support that hypothesis.
Explanation	The story that the students construct is an explanation of the relationship among the checks. This mirrors the fact that the story any historian tells is an explanation of the relationship among the artefacts being studied. In this activity, the students are also asked to stand up and explain to their classmates the story that they constructed. The fact that there are these explanations does not, however, mean in and of itself that the explanations are good ones.
Interpretation	The act of interpretation is reflected in the development of the story that the students came up with to explain the relationship among the historical artefacts. Interpretation requires careful observation of the facts (in this case, the checks and all of the information on them), imagination in order to develop possible explanations for what each of the artefacts suggests and how they might relate to each other, and reason, in order to ensure that the imaginative process does not exceed the bounds of plausibility. Effective interpretation requires considerable knowledge and care, as we saw with the questions in the previous table. If the historian doesn't know what some of the artefacts are, or what the elements of them mean, then they cannot make a compelling interpretation.
Justification	Justification is the process of using the **evidence** to explain to others why the **interpretation** that was made is sound. The groups of historians must justify their thinking to each other in order to come to some agreement as to what the group interpretation will be. They must then provide a justification to the whole class when they explain their stories in an effort to convince others that they have the most likely interpretation.
Objectivity	This activity demonstrates nicely the importance of objectivity. If historians become too enamoured of their own ideas, they lose objectivity and will not be open to all of the possibilities – especially as new information comes their way. Confirmation bias occurs when objectivity is lost.

Perspective	As noted previously, this activity generates a variety of perspectives in the shape of the different stories that the groups come up with. Those perspectives in turn were the result of the fact that the historians took different perspectives with them to the activity. Historians have different background knowledge and so can understand the significance of certain facts differently. They also bring with them different ways of working – different abilities to imagine possibilities, for example. This difference in perspective among historians reflects historians in the real world and is one important reason that historical knowledge benefits from multiple historians working on the same events in history, especially with some historians revisiting historical knowledge after some time has passed. The variety in perspectives inevitably reveals different aspects of events, and history is richer the more perspectives we get.
Power	In this activity, the aspect of the idea of power which is important is the power that the students have for creating an historical explanation from the artefacts provided. The fact that no one else can give them a right answer means that they have the power to decide. You might also ask students to consider how the different groups in the class interacted during the group discussions. Did some groups dominate the discussion? Were some groups' ideas overlooked? The way the groups functioned in this activity can be seen as a microcosm of how social dynamics influence the construction of knowledge.
Responsibility	The **power** that lies in the hands of the historians, however, comes with a very serious responsibility. To just make up a story that seems fun or to ignore evidence or pretend that certain artefacts don't exist (once in a while a student will go to great lengths to disregard a check – hiding one under a book, for example!) is a violation of ethical historical practice. Accurate history matters, and the fact that historians have the power to tell the rest of us what happened and why also necessarily means that they have the responsibility to get their stories as right as it is possible to get them, as well as for them to acknowledge what the boundaries of their knowledge are.
Truth	Truth, though difficult to establish in historical investigation, is nonetheless the goal. In this activity, we see that it is not possible to establish the truth with the limitations of time and resources that we have. Students, who are very often accustomed to television programmes that resolve problems in 45 minutes and class lessons which give them the right answer in no more than a day, must come to grips with the understanding that for an historian, to make sound knowledge about the events represented by those checks, would require a great deal more time, work and resources. A study which could generate a reasonable amount of truth about these checks could take months or longer.
Values	This activity reveals some of the important values which underlie historical investigation: precision, careful observation, logical explanation, honesty and objectivity. These values determine what does and does not constitute ethical practice. It is that set of values which requires historians to use all the data available to them, to develop careful justifications and to withhold judgment and refrain from making dogmatic claims when the evidence is too thin to support them. That set of values also dictates the open-mindedness with which historians must treat all historical knowledge: the willingness to change in the face of new facts is fundamental to the construction of historical knowledge. The fact that historians value accuracy to the highest degree possible also means they would require a great deal more work on this subject in the form of further research: flying out to California to access materials there, for example. This activity, by helping students to understand some of the important values that historians hold, can open them up to the understanding of how much time, work, expense and patience go into the development of historical knowledge.

We hope that this detailed consideration of how each of the 12 core TOK concepts could be applied to a single activity will help you see that it is not difficult to weave the course concepts into your lesson planning. You can always choose which of the concepts are the most relevant to what you want to accomplish in any given lesson, but you must ensure that all the concepts are incorporated multiple times over the course of the two-year programme. An understanding of what the concepts reveal about any of the themes or AOKs also provides students with a mechanism for comparing them to and contrasting them with each other. That ability is particularly important regarding the areas of knowledge, as the TOK essay will require students to compare and contrast two different areas of knowledge in the context of the prescribed title they choose.

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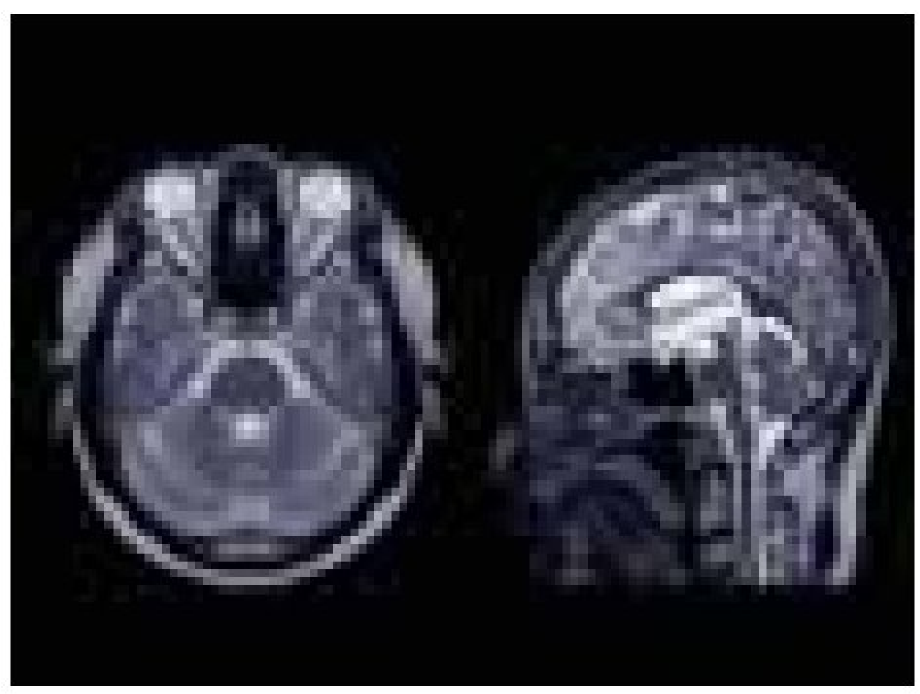
The Arts	A page from a student's art sketchbook or workbook	Proper artistic training and education is a requirement for someone's art to be considered 'good'. Learning the conventions and expectations of a community limits the individual expression of the artist. **Possible IA prompts:** 13 How can we know that current knowledge is an improvement upon past knowledge? 22 What role do experts play in influencing our consumption or acquisition of knowledge? 30 What role does imagination play in producing knowledge about the world?
The Human Sciences (psychology)	A copy of the *Diagnostic and Statistical Manual of Mental Disorders*	Knowledge in any AOK is historically contingent (it depends on the circumstances, values and knowledge of the times). The social and political values of the time might make knowledge unreliable. Knowledge in the human sciences is an interpretation of facts, rather than an explanation of facts as it would be in the natural sciences. **Possible IA prompts:** 11 Can new knowledge change established values or beliefs? 21 What is the relationship between knowledge and culture? 24 How might the context in which knowledge is presented influence whether it is accepted or rejected? 33 How is current knowledge shaped by its historical development?

What might these objects tell us about the scope, methods and tools, perspectives or ethics of knowledge in different contexts or AOKs?

$$e^{i\pi} + 1 = 0$$



ACTIVITY

Create a table like the one beginning on page 50, but leave some of the boxes empty. Ask students to fill in those boxes. For example, in the table that is shown on page 52, students would be expected to fill in the boxes containing question marks. Encourage students to be as creative as possible and offer unexpected or surprising ideas, not just the first ideas that come into their minds. A copy of the table that is shown on the next page is available by clicking on the QR code.

AOK/theme	Object	Discussion points
?	Prayer beads (Islamic misbaha, Catholic rosary, Sikh mala)	• ?
History	?	• An historian's job is to interpret the available evidence, not to find out 'what really happened'.
Economics	The aggregate demand–aggregate supply mode	• ?

Scope

This section of the student book is largely focused on the nature of knowledge and offers two perspectives on this, though these are not explicitly treated separately in the student book. The first aspect is conceptual in nature, exploring the concept of knowledge and the ideas related to it. The second is the social aspect of knowledge. In this book we break these elements out to provide another framework for your discussions in class.

The concept of knowledge

Students need to come to terms with the definition and application of the idea of 'knowledge' and there are a number of discussions that appear to be quite conceptual in the opening of the student book. Despite the fact that 'Knowledge and the Knower' is a core theme that comes at the beginning of the student book (and subject guide), this does not mean that you must begin your teaching there. In our experience, saving some of these discussions for later lessons is helpful because students will have more practical discussions upon which to draw when being confronted with the conceptual analysis of the idea of 'knowledge'.

Some of the more conceptual discussions will analyse:

- the difference between knowledge, belief and opinion
- the differences between 'facts', 'claims' and 'propositions'
- different conceptions of what 'truth' might mean
- how 'knowledge' is thought of as 'justified' and what that means
- various forms of 'knowledge' (eg, propositional, ability).

RESOURCE

A handout exploring four general conditions for accepting knowledge as justified can be accessed using the QR code below.

When considering the difference between knowledge, belief and opinion, many will suggest that knowledge is justified in a way that belief or opinions are not. Just how we decide what a 'good' justification is, however, is a matter of debate. Here are four traditional approaches to deciding when a claim is 'justified' enough to be called knowledge (as opposed to merely being a belief). A claim can be said to be 'justified' when:

- the claim has been constructed using reliable methods
- the claim has used the accepted methods or rules of that community of knowers
- we approach the construction of the claim in good faith, by consciously seeking out any biases or influences
- when there is no knowledge which, if known, would have kept us from accepting the claim.

It has often been the case that claims have at one time been considered knowledge for one or more of the reasons above, but as further facts were uncovered, or other knowledge was developed, those claims are actually shown to be false. This is just how knowledge works; we do our best to construct knowledge, but often find out that we were mistaken.

These discussions might seem dangerously close to philosophy, and indeed, any teachers (or students) familiar with the branch of philosophy known as **epistemology** will recognize many of those questions immediately. (Use the QR code to access 'How TOK differs from philosophy', which provides an in-depth discussion of how the two subjects differ.) The key here is that some awareness and understanding of these issues will open the door for later conversations about knowledge in the AOKs that you might wish to have. For instance:

- What ability knowledge do we need to have to be an effective and reliable knowledge-producer in the sciences?
- Does it seem right for us to call the arguments and thoughts of art critics 'knowledge', or are they better thought of as 'opinion'?
- Is it a biased view to limit any religious beliefs only to being 'beliefs'? Under what conditions can we call them 'knowledge' and who decides on those conditions?
- Does it matter that we can never be certain of historical facts, but that we nevertheless make many claims about those facts?

If the discussion questions in the handout linked to on page 52 were a bit 'philosophical', then this last set of questions are decidedly TOK types of questions. The teaching point here is that some conceptual analysis of knowledge is entirely appropriate to the course; however, teachers must take care not to let these conceptual discussions dominate. They best serve the aims of the course when used to illuminate the real-life and practical issues that knowledge constructors and consumers face.

Knowledge as a social activity

Another concept that is given great emphasis in the guide is that of 'communities of knowers', which is discussed at length in the student book. The concept is meant to highlight the social and embedded nature of knowledge. This is to suggest first that constructing, accepting and having knowledge can be seen as being a social affair. Individuals rarely construct knowledge on their own. They collaborate as part of groups of people who follow agreed-upon conventions and methods and use agreed-upon concepts. The same sort of issues that individuals face outside formal 'knowledge making' environments (like laboratories or universities) will follow them into these spaces and will have an impact on the construction or acceptance of knowledge. Any activity where students have the opportunity to genuinely collaborate, with minimal guidance from the teacher, will quickly uncover interesting social dynamics: some individual students will dominate, some friendship groups will dominate, while others might lose their voice entirely.

Constructing knowledge is a social activity

ACTIVITY

In this activity, the teacher is not meant to play any role, other than recording the activity on a white board. (For a full discussion of this activity, see Chapter 11 in this book, page 255.)

1 Set the room up with chairs in a circle, with two or three note cards on each chair. Each note card has one 'clue' to a murder mystery written on them. The teacher's only instruction is, 'Do not physically share the cards'. In addition to the learning objectives around understanding the historical method, teachers should discuss the social nature of the activity:
   a Were some voices heard more than others?
   b Were some voices not heard at all?
2 Ask students to reflect honestly on the social dynamics of the classroom:
   a How many different friendship groups are present?
   b Are there in-school social dynamics which can affect the activity?
3 Reminding students of these dynamics about half-way through the lesson can be a powerful reminder of how groups of people, even when they are *trying* to collaborate effectively, might suffer from existing social dynamics. The point is that even in the world of knowledge-construction (labs, classrooms, universities), social dynamics can still have an effect on whose voices are heard. You might draw on wider social dynamics surrounding minority representation in the construction of knowledge:
   a Have some groups of people (women, racial or national minorities) traditionally been left out of conversations?
   b How has this affected what we think 'we' know?

   Once reminded of this, groups often show more cohesion and care as they progress through the rest of the lesson.

At the level of individuals, then, social dynamics are a real feature of knowledge construction. Knowledge can also be characterized as embedded, meaning that knowledge and knowledge construction often takes place in the context of communities who have developed rules and methods to construct it and processes to disseminate it to individuals new to that community. Examples of such groups might be 'psychologists' or 'astrophysicists' or 'IBDP teachers' or any other group of people involved in a discipline. Of course, these groups are not social groups (most of them don't know each other), but they are all grouped together around a set of questions or processes they find interesting enough to study, as well as by a set of appropriate core values on how to construct knowledge in that field. They understand and accept a number of key concepts applied to the world, and might even all share a similar educational or training background. The specification makes use of the idea of 'communities of knowers' to highlight this embedded knowledge idea and this is discussed in the student book.

Knowledge is built by communities

The Knowledge and the Knower chapter also encourages students to think about themselves as knowers. The role of the knower in TOK has shifted throughout the years. In an early iteration of the course (pre-2013), one of the big problems that arose was the problem of the course becoming really egocentric – all about the student and their own knowledge, without much regard for any kind of systematic development or checking of knowledge. The most recent course emphasized the AOKs, but knowledge was often thought of by students as something other people called 'historians' or 'mathematicians' or 'scientists' did, rather than something the students themselves were involved in.

The new TOK course's inclusion of the core theme 'Knowledge and the Knower' is an attempt to create a more obvious place where teachers can provide opportunities for students to think about all the sorts of things we've just outlined. This theme is at the 'core' of the TOK course, meaning that students are encouraged to think of themselves as knowers, both in terms of their contributing to various 'communities of knowers' (the AOKs) and in terms of their status as creators of knowledge.

■ What is a community of knowers?

There will be some teachers who want to impose a very strict understanding of 'community' as having to do with a location (such as a village or neighbourhood) or some formal characteristics like a formal club. However, the subject guide's intention is far less restrictive than that. 'Community' refers more broadly to like-minded people, or people with common experiences or interests. Consider something like the 'Irish community' in a city, or the 'gaming community' as being more like how the subject guide intends it.

One thing that is definitely intended by the term 'community of knowers' is that the common feature of those in that community should have something to do with knowledge. This will clearly apply to 'historians' or 'scientists' as a community, but might also apply to a group such as the 'rugby community' (in terms of shared awareness of rules, skills) or maybe even a group like the 'black community', the 'white community' or the 'LBGTQ+ community', in terms of a shared set of experiences or a shared history which impacts their knowledge about the world.

Individuals might choose to identify with these communities or not; indeed, others might lump an individual into one of those communities whether the individual identifies with it or not. These dynamics can all be explored in the context of TOK, provided the priority is to uncover and explore how they impact upon our knowledge, beliefs, opinions, claims or understanding.

Students are like apprentices, learning the AOK trades

TEACHING TIP

The TOK course is designed with the knower in mind. We want students to have new attitudes and dispositions to knowledge as they begin their academic and life journeys. For that reason, throughout the course, teachers should reinforce the idea that the students are themselves knowledge producers. The notion of their own education being an 'apprenticeship' is one way of driving this point home and bringing the new core theme to life.

The activity on page 53 of the student book asks students to list the communities of knowers they are members of. This is an excellent way to set the tone for the rest of the course because it can introduce key ideas to do with the embedded and social aspects of knowledge, including:

- experts and non-experts
- the reliability of individuals within a community
- the requisite knowledge to be in that community (membership criteria)
- gatekeeping (who decides who gets to belong to communities)
- demonstrating the requisite skills and abilities to join communities (including admissions tests!)
- communities specific to culture, age, race, economic class, social class, religion, etc.

Students should be encouraged to identify (not necessarily 'identify with') as many of these communities as possible. They might not consider academic communities like those represented in the AOKs, but they certainly are part of those communities, though perhaps only at the 'apprentice' level. We have developed this metaphor to provide an opportunity to consider the role of training and ability in communities of knowers and to analyse the role of 'experts'. It is rare that there is only one expert, but rather people of varying levels of expertise. You might also be able to draw on the common experience of computer games: we all start a computer game at level 1, but work towards higher and higher levels, knowing full well that there will always be more to learn.

In addition to academic communities, students will likely identify all sorts of groups of people which can be, perhaps with some imagination, considered 'communities of knowers'.

Apprentice

- Developing and practising skills and methods
- Developing intuitions
- Understanding and learning facts
- Accepting values

Expert

- Mastery of skills and methods
- Reliable intuitions (relative to community)
- Constructing knowledge in field
- Using and possibly challenging values and methods

TEACHING TIP

If you are comfortable to do so (and you should work to be comfortable to do so), be open with the students about your own status as an 'expert'. It is unlikely that you are an expert in every discipline, and indeed some of the students will have 'more expertise' than you, but you certainly are more of an expert in some areas. Be honest about where you land on the apprentice–expert continuum in a particular community, and then explore how it is that you have progressed further along that continuum. Explore how students might have progressed along the continuum in communities in which you are not a member or in which you are only an apprentice.

In addition to academic communities, students should be encouraged to identify other forms of knowledge communities, like skateboarders, football players, gamers, jugglers, gymnasts, martial artists or musicians. There really isn't a limit, but in each case, the community must be analysable in terms of knowledge of some sort. It might be ability knowledge (eg, skateboarders, jugglers, musicians) or propositional knowledge (eg, knowing the rules of video games or football, or understanding concepts like 'key' or 'harmony' for musicians) or even knowing what something is like (eg, being bereaved, addicted or 'saved'). You might question whether being a particular ethnicity or nationality, or whether having physical characteristics (for example, being visually impaired or in a wheelchair) means that a person is in a particular community of knowers. If that characteristic has impacted how they construct knowledge in the world, then why not? Perhaps being part of a particular ethnic community (one based on race) has provided them with certain insights into how political or social organizations wield power (insights based on shared experience).

What do you need to know to be an expert skateboarder? What do you need to know to be an expert physicist?

The TOK point is not whether the notion of a 'community of knowers' is a distinct concept, or one that can be rigorously defined. The point is for students to consider themselves as having a wide variety of knowledge and therefore belonging to a wide variety of 'communities of knowers'. They have lots of propositional, ability and acquaintance knowledge in a wide range of areas, which means that they have ample opportunity to explore their position as knowers.

TEACHING TIP

As previously suggested, the elements of the knowledge framework overlap in many places. This activity is one good example. By identifying a number of different 'communities of knowledge' (Scope), the students will have identified different perspectives. Considering the similarities and differences between various communities is a good way of developing a genuinely comparative approach (building on a descriptive approach) and practising articulating these comparisons will be helpful for the essay on a prescribed title.

ACTIVITY

1 Recreate the apprentice–expert continuum on a display board or whiteboard. Ask students to place Post-it notes on the board with their initials and the type of community of knowers of which they are a part.
2 Ask the students to discuss why they placed themselves at that point on the continuum:
   a What knowledge do they have already (using propositional and ability knowledge) and what knowledge are they in the process of learning?
   b What knowledge do they think they need to become 'experts'?

Core theme

This unit is called the 'core' theme, which obviously underscores its wider importance for the course. How teachers manage this importance is not something dictated by the TOK subject guide. Teachers might wish to address the core theme prior to the optional themes and areas of knowledge (as the student book has), or they might wish to make a very practical start by beginning with a unit on a relevant AOK or optional theme, and then draw out the links to the individual knower. Whatever approach is chosen, students should be given opportunities to continually return to the types of questions about the role of the individual knower in relation to the optional theme or the AOK. These general questions might include the following:

- How do communities of knowers pass on their knowledge to individuals?
- How do the personal characteristics of a knower influence their acceptance of the knowledge of a community?
- How do the personal characteristics of a knower influence their acceptance into some community of knowers?
- What methods are in place by a community of knowers to manage the personal knowledge and experience of an individual? Is a subjective outlook accepted in that community or is there a method to limit the effects of personal subjectivity?
- What knowledge (propositional, abilities) or what values should be accepted by an individual to become an expert in a community of knowers?
- What methods or rules must an individual follow in order to be a responsible member of that community of knowers?

CONNECTION TO: ASSESSMENT

The essay on a prescribed title prompt (released at the beginning of the students' second IB year) will focus on the AOKs, in that the questions themselves will reference the AOKs. It is expected (but not required) that the students will explore the optional themes and the core theme in the TOK exhibition. However, as with all the TOK structural components, students should be encouraged to make use of opportunities to apply ideas from different themes or AOKs in any of their assessments. Perhaps, for example, students find themselves exploring the historical method, discussing the role of archaeological evidence being used in developing historical claims. The student might want to apply an analysis of carbon dating technology to date materials or LiDAR ('light detection and ranging') in finding new ruins. This is only one example, but students must take care not to digress into a separate evaluation of the optional theme or AOK – they must keep a 'sustained focus' on the task at hand (to borrow language from the assessment criteria).

Given its status as the 'core theme', students are encouraged to think about the role of the individual in the communities of experts in AOKs as well, perhaps by drawing on how communities manage the contributions of individuals, or ensure a transfer of knowledge from the community to the individual. Again, however, students must avoid digressions from the task at hand. Everything a student adds to their assessments should be directly linked to their response to the question or task.

Perspectives

The perspectives section of Chapter 2 of the student book is really devoted to two general points:

- What we believe or 'know' is influenced in many different ways by many different factors.
- The ways we describe, explain and make sense of the world are the result of choices we make. These choices then shape our knowledge about the world.

The first point is brought out through a close reading of a very famous text: Plato's *Allegory of the Cave*. Plato uses that story as a way of suggesting that what seems real might be a sort of illusion – that the way the world really is is quite different from how we think it is. Students might think more easily about this using the concept of virtual reality: what if the world around us is really the result of a virtual reality machine feeding us all our experiences?

LESSON PLAN: WHO ARE YOUR PUPPET MASTERS?

The lesson plan presented here tries to help unpack the notion of puppet masters using Plato's *Allegory of the Cave* as the vehicle. It is suggested that you run this classroom lesson prior to the students reading the textbook. The textbook is meant to stand alone (in case you choose not to have this lesson), but it will help embed the ideas if read after the classroom activity.

Aims

After this lesson, students will be able to identify and evaluate who and what has influenced the knowledge they hold.

Objectives

Students will be able to:

- listen and identify the key elements of Plato's *Allegory of the Cave*.
- share and discuss in small groups who and what has influenced their beliefs.

Required resources

Video projection/TV, audio, whiteboard.

Activities

1. Identify a volunteer to draw a picture.
2. Play Plato's *Allegory of the Cave* video or use the QR code in the margin to link to an extract from *The Republic* which can be read out. While watching/reading, the volunteer student tries to draw the story. They shouldn't see the video – they can only listen. Perhaps ensure their back is to the screen.

Students offer labels as a way of reviewing the various elements and embedding understanding.

3 Discuss: 'What does each element represent?'

After the extract is read, label the image drawn by the volunteer – which elements of the video have been captured by the drawing. Is there anything missing?

4 Allow discussion and questions to evolve naturally. The important element here is to encourage discussion and embed an understanding of the material. Key ideas to draw out:

- The prisoner's reality is illusory. It is not the whole story. Their 'reality' is based on a misunderstanding of the way things actually are.
- What does the journey represent? As we grow and learn and experience the world, we find that our earlier beliefs change, develop, deepen, grow, shift and alter.
- Key: In what ways are YOU (the students) like prisoners? Can this allegory be an allegory to describe your own journey towards being a 'knower'?

5 Discuss: 'If we are the prisoners in the cave, who do the people on the bridge represent?'

- Plato likens these shadow-casters to 'puppet masters'. They provide and shape the images that the prisoners mistake as 'reality'.
- Think, pair, share activity: Suppose you are a prisoner. Who are the puppet masters you have encountered on your journey towards being a 'knower'? Who/what influences the way that you see the world, the things you know, the things you believe?
- Some puppet masters might not be people or institutions:
  - Might being born in a particular country give you a different attitude towards the study of certain historical events?
  - Might being in a particular economic class influence you? Might being devoutly religious influence how you approach the study of biology?
  - Might being male or female influence your approach to certain ethical issues (eg, abortion, contraception, marriage, business ethics)?
  - Does being educated in a certain way influence your understanding of what it is to be 'smart', 'intelligent' or 'clever'?
- Record: Create a table with three columns (see example below). Share ideas, and listen to and record each other's ideas. Teacher can drop in on conversations, encouraging students to be specific in their identification of ideas for each column.

Students might identify things other than people or institutions!

Puppet master	Specific beliefs or knowledge you have which can be (partly) attributed to the influence of your puppet master	In what ways is this a reliable source for your beliefs and knowledge?
Eg: my mother	'Good grades are only one part of a good education.'	Experience: she has developed a really good career, but in something that wasn't related to any of her academic success.
Eg: our school	'Students need to spend a lot of time running about and exercising, in addition to classroom learning.'	Research: the school leaders have read and implemented research into the development of young people and how they learn.

Specificity promotes relevance, individuality and a more critical approach.

The reliable column is a crucial element for TOK as it encourages reflection on reliability of sources early, and often promotes good TOK dispositions.

6 If there is time (or leading into next time), begin identifying and evaluating the reasons which make puppet masters more or less reliable. Generally, is personal experience a good way of making you more reliable as a source of knowledge?

Plenary

- Encourage students to share a few interesting examples which you have heard about during 'drop-ins' to their discussions.
- Review the allegory, focusing on the puppet masters.

7 As a follow up, interview an individual who has acted as a (reliable) puppet master in your own learning:
- Explain the notion of what it means to be a puppet master.
- Explain what specific impact they have had on your learning/knowing. (You might identify a specific belief or set of beliefs which they have influenced.)
- Explain what you think makes that individual reliable.
- Possible interview questions:
  - Were you aware that you are a puppet master in my journey as a 'knower'?
  - What have been your intentions in your acting as a source of knowledge in my life?
  - How do you measure whether I have been taking on this knowledge or learning?
  - Do you think you are reliable in terms of a puppet master or as a source of knowledge?
  - In what ways might you be unreliable or are there limits to your reliability?
- Do not limit your 'interview' to just these questions – let the conversation flow. You want to focus on the person as someone who has influenced your knowing/learning.

8 On A3 paper, students create visual representations of their puppet masters. They could:
- create a pie chart of their various puppet masters and how much influence they think each puppet master had
- create a map with various puppet masters drawn out as states, territory, cities, rivers, mountain ranges, etc, labelled as their various puppet masters (creating images will help learners analyse and evaluate their puppet masters)
- create a 'floorplan' of a building where their puppet masters each have a room/office.

The second bullet point in question 8 in the lesson plan is developed through the use of the 'map metaphor'. The metaphor works as an analogy, suggesting that our knowledge of the world is like a map of a landscape.

You might break up the steps in understanding the 'map metaphor' into four segments:

1. Maps are not the territory.
2. Maps distort the reality they describe, and reading a map properly is learning the ways in which maps are distorted or inaccurate.
3. Our knowledge of the world is not the world.
4. Our knowledge distorts the reality it describes. Critically reflecting on our knowledge is to understand the ways in which our knowledge is distorted or inaccurate.

While the map is not the landscape, the maps we use to navigate that landscape guide us, shape us and influence our understanding of that landscape. However, maps can lead us astray, especially if we are not reading them correctly, if we do not understand the assumptions the map is making, or if the map itself has features which do not really refer to anything in the landscape.

In what ways do maps give distorted representations of the landscape?

What do I need to know in order to read a map correctly?

What assumptions does the map make in how it represents the world? What *choices* has the mapmaker made?

Does the map ignore certain features or include features which are not there?

Is the reasoning appropriate for the map also appropriate for other maps or the actual landscape?

In the same way, perhaps our knowledge is like a map – we use our knowledge to describe the world, but like maps, our understanding of the world around us might be unreliable. The same sorts of questions we use to critically reflect on when it comes to maps might be used to critically reflect on our knowledge of the world.

The next step in the process of unpacking the map metaphor is to think of the various areas of knowledge as different sorts of maps, each picking out different elements of reality to describe or explain. However, we must keep the same sorts of critical questions in mind.

Areas of knowledge

- History
- The human sciences
- The natural sciences
- Mathematics
- The arts

In what ways do AOKs give distorted representations of the world?

What do I need to know in order to understand an AOK correctly?

What assumptions does the AOK make in how it represents the world? What *choices* have the experts in the AOK made?

Does the AOK ignore certain features or include features which are not there?

Is the reasoning appropriate for the AOK also appropriate for other AOKs or the actual landscape?

TEACHING TIP

Teachers should read the student book section on the map metaphor and work to understand it well. Because the idea will be entirely new to students and may be new to teachers as well, teachers are encouraged to use the student book as a way of developing an understanding of the map metaphor.

We feel that the map metaphor is a hugely helpful and fruitful way of thinking about the essence of the TOK course as a whole. For that reason, teachers are encouraged to keep the metaphor in mind throughout the course and use it when appropriate to unpack any number of ideas related to the course.

> The student book follows the lead of the subject guide in not overusing the map metaphor. For some teachers and students, the map metaphor does not illuminate the concepts, so overuse of it might not be helpful. However, if it is useful, we think you will find it something that helps in nearly all aspects of the course.

The table below contains notes about each of the maps featured in the activity on page 62 of the student book.

	Key points to develop
1	**The Mercator Projection:** ■ This map is a composite of satellite images so this is precisely the geographic features you would expect to see from space (there is lots of beige sand in the Sahara, and dark jungles in the Amazon). ■ Size of land masses at the poles is massively distorted, so the map suggests that Greenland is roughly the size of Africa (though Africa is 14 times larger). Imagine if Antarctica was really that big? ■ Good for showing what is directly north, south, east or west of some point. ■ Good for showing the rough shape of the landmasses. ■ There is no political information on this map (names of countries, cities, borders), but that Europe is in the centre might be a political implication (see below).
2	**The Galls-Peters Projection:** ■ Same geographical features. ■ Developed to adjust for distortion. Land masses no longer can be relied on to show shape, but they are relatively proportional. Notice how Greenland is now tiny compared to Africa.
3	**The 'upside down' map – McArthur's Universal Corrective Map of the World:** ■ This map makes different choices, in terms of what is represented (political features) and what is at the top of the map. It is still 'accurate' but has chosen accuracy to mean 'political features of the planet'. ■ The term 'orienteering' comes from the Latin for 'east', and originally meant that east was the top of the map because that was where (from Europe) the Holy Land was and this was therefore the most important orientation. ■ Can be considered a clear political statement. ■ Beginning to unpack values written into the maps: why should North be 'up'? Might this have something to do with colonialism or 'the north-south divide'? ■ If the valuing of north in 'normal' maps, is highlighted by this map, then who is 'top and centre' in the first two maps: northern Europe. This might open a discussion of why global maps were important (colonial conquest) and why Europe is nearly 'top and centre'. ■ The Greenwich Line is still at the centre. What values does this suggest?
4	**Americas at the centre:** ■ Another choice about what is in the 'middle' of the world; this time it is the Americas. ■ Many school children might never have seen a map in which North, Central and South America are not in the centre of the map. ■ What sense does it make to cut the entire continent of Asia in half?
5	**Pacific at the centre:** ■ Another choice about what is in the 'middle' of the planet, this time East Asia and the Pacific. ■ Encourage students to reflect on terms like 'the Middle East' (still commonly used) or the 'Far East' (less common). 'East' of what? ■ What does it suggest part of the planet has been named with reference to Europe? ■ For European students, think about what being far out on the edge of the world might suggest about value?
6	**Polar Azimuthal Equidistant Projection:** ■ This 0 map illustrates direction and distance from some centre point – little else is 'accurate'. ■ Creates massive distortion of the landmasses the further away from the centre point you get. ■ In this map the furthest point (the 'antipode') from the north pole lies on a land-mass (Antarctica), which then gets distorted into a ring of land around the outer edge of the map. ■ Useful for directional radio or missile maps. ■ Used as the projection in the UN Emblem, and in many of the 'flat earth' maps.

RESOURCES

Use these accessible resources to introduce students to the idiosyncrasies of maps and to motivate discussions about how our knowledge maps might influence individuals' and communities' views of the world.

- ✔ BBC: 'Maps have "north" at the top, but it could've been different'
- ✔ GeoSpatial World: 'Why maps point North on top?'
- ✔ Al Jazeera America: 'How the north ended up on top of the map'.
- ✔ Worldmapper.org: This activity centres around some of the 'cartograms' available on the Worldmapper website.

Given how helpful the map metaphor can be, here are some brief discussions of the map activities presented in the student book.

Which map is 'accurate'? (page 62)

- Students are asked to rate the maps according to 'accuracy', but do not let the students draw you into a discussion of what you think 'accuracy' should mean. They need to make decisions about what they want to offer as an interpretation of 'accurate'. Students will naturally look to you for the way to do this, but compelling them to make a conscious decision, to clearly articulate that decision and then interpret the maps against their chosen definition promotes all sorts of learner profile attributes, especially risk taking. One way of managing this is to take the ratings down on the board from various groups (eg, Group A: 1, 5, 3, 4, 2, 6; Group B: 2, 5, 4, 6, 1) then to challenge the groups to articulate and defend why they suggested the most accurate to be as they did.
- Articulation and defence of their understanding of accuracy is key here, not which map they think is accurate. Hopefully, you will have a good initial range, but you can uncover other forms of accuracy as you discuss each map in turn.
- Whether the map is accurate depends entirely on what we mean by 'accurate' and there are different ways of understanding this. Reading a map for information that it was not designed to illustrate is to mis-read the map. Our misunderstanding of its nature has led us into false beliefs about the world. Thinking 'the United States is purple' after looking at Map 5 is to make a pretty serious error in interpretation.

Timeline of your life (page 65)

- Asking students to develop a timeline of their lives encourages them to reflect on a number of things. Do not tell them what needs to be on the 'map', let them decide. They will be creating a 'time map' of their life and they will have to make a number of choices that we have seen illustrated in the maps on page 61. What features are important enough to include? What features are not included? The map of their journey of themselves as knowers is a good way of identifying and exploring the communities of knowers they feel a part of. Social media feeds are very much like maps: certain features of students' lives are prioritized over others, this time with a clear intent – to tell other people about them (even if that intent is not fully articulated).

Map of your school (page 65)

- The students' maps of the school will likely show what they think is significant about their everyday activities in school. We might, therefore, extract what a student thinks is valuable by reflecting on their map. You might ask them all to start with one colour, then shift to other colours during the time allotted for the activity, allowing you to see what parts of the map they made first. Are sporting activities most important to the student whose map clearly identifies the playing fields? Is the parking lot or are the approach roads more important to students who drive? Are the science labs/library/canteen/leisure spaces more prominently displayed?

Maps provided by IB Diploma Programme subjects (page 66)

- This is where students will make the jump from map-maps to AOK-maps. The territory has changed from physical locations to a 'map of knowledge'. It is still the world being described but in a different way.
- The idea will be to start a comparison between the AOKs in terms of their scope and methods. Just as we must understand and accept what a map is trying to describe in order to read it properly, so too do we need to understand and accept the specific aims of an AOK.

Both of these points about the puppet masters influencing our understanding of the world and the idea that our knowledge is like a map of the world emphasize a basic premise at work in the whole TOK course – that our understanding of the world and the world itself are different sorts of things and that our understanding might not accurately reflect the way the world is.

Given these two ideas, then, we can start the process of encouraging students to think about their own perspectives, what or who has been instrumental in developing them, and what choices and assumptions they make as they build their own understanding of the world.

Methods and tools

Cognitive tools

KNOWLEDGE QUESTIONS

Relevant knowledge questions from the TOK subject guide:

- How do we acquire knowledge?
- Are intuition, evidence, reasoning, consensus and authority all equally convincing justifications for a claim?
- Are our emotions a useful potential source of knowledge or an obstacle to knowledge?
- What tools are available to us as knowers to help us evaluate claims?

The knowledge questions above all open up opportunities to discuss a number of cognitive tools. In this section we explore relatively briefly what might be called cognitive tools. In other TOK material that you may find left over from previous iterations of the course you will see these discussed as 'ways of knowing' (WOK), of which there were eight.

- Reason
- Sense perception
- Emotion
- Language
- Memory
- Imagination
- Intuition
- Faith

The student book chapter makes the following points:

- Our cognitive tools are managed by communities of knowers.
- Simply discussing the tools is NOT an adequate knowledge-focused analysis.
- The cognitive tools are intermingled.
- They are influenced by our experience and culture.
- Sometimes our cognitive tools are trustworthy, but sometimes they are misleading.

In previous TOK materials you might find the WOKs being given full chapters of discussion. There are a number of reasons why the cognitive tools are not discussed in great detail here, although they are found as part of the discussions in both the student and teacher's books. The primary reasons are listed as the last two bullet points above, and it is worth keeping the following in mind when exploring cognitive processes and tools.

In relation to the first bullet point above, nearly every discussion in TOK can be grounded squarely in the context of an AOK or optional theme. We mentioned before that the TOK course is really about embedded knowledge, that is, the construction of knowledge within the context of a community of knowers (sometimes, for instance, in an AOK). We do not suggest here that the cognitive tools mentioned on page 65 are not important, but that there are bigger issues at stake which any discussion of cognitive tools outside the context of these issues might leave out.

TEACHING TIP

In Chapter 1, we mentioned a general worry about putting too much emphasis on the 'cognitive tools' with which we construct knowledge and we mention it again here to underscore the importance of this point. One of the pitfalls students and teachers were falling into during the last iteration of the course was treating a discussion of the WOKs as if they were themselves fully developed second-order analyses. When focusing on these ways of knowing, the discussions naturally were aimed at the internal psychological processes of an individual. For example, you might have discussed how optical illusions lead us to make false beliefs. This is interesting, important and engaging for students. However, the fact discussed above about knowledge being embedded in a community means that we need to take the point about sense perception being faulty at times and link it to some community of knowers. For instance, we might need to broaden the discussion to an investigation about how scientists, who prioritize observation in their method, manage this worry.

Similarly, pointing out that language and memory can both be used to influence an individual's beliefs, even leading them into false memory, is again, interesting, important and engaging. Here again, however, we need to embed the discussion into some community of knowers by asking, for instance, how an historian will manage this worry? Should, and under what circumstances can, eyewitness testimony be reliably used?

This does not mean that the individual nature of these cognitive tools (ie, they happen to individuals) are not important, it just is to highlight the fact that when constructing knowledge, individuals work within the context of communities who in some sense manage the contributions of individuals to the knowledge of that community. Before accepting the knowledge of the individual, the historical or scientific community will review the contributions of that individual in order to guarantee that the knowledge is as reliable as it can be, given the limitations of our cognitive tools.

In relation to the second bullet point in the list shown on page 66, the real tension at the heart of the course is not about the actual sources of knowing, but how they relate to the construction of knowledge. The twelve core concepts of the course are offered as a way of maintaining focus on issues relating to knowledge:

- Certainty
- Culture
- Evidence
- Explanation
- Interpretation
- Justification
- Objectivity
- Perspective
- Power
- Responsibility
- Truth
- Values

To make the most of discussions about the cognitive tools we use to construct knowledge, we suggest linking the discussion of concepts like the 12 concepts above. Each of these is given a full analysis in the student book.

Some relevant knowledge question would be:

- How does the use of reason impact the level of certainty in religious claims?
- How might cultural influences on emotional reactions impact the transmission of ethical knowledge?
- How might an historian manage the fact that human memory is not very reliable?
- Does the impact of human imagination make scientific explanations of phenomenon we cannot experience more or less convincing?
- Does faith in an educational system limit the available historical knowledge of a culture?
- How might experts manipulate language and emotion in order to maintain power over what knowledge is thought to be acceptable and what knowledge is thought to be taboo?

ACTIVITY

- One possible activity would be to develop a series of note cards including the eight cognitive tools mentioned on page 65 along with any number of others (like technology or authority or consensus) and another series of cards with the twelve key concepts. Ask students to randomly choose a card from the cognitive tools pile and one from the twelve concepts and try to develop knowledge questions which link or include the two. They might choose more than one from each pile as well.
- Another possible activity would be to create a similar exercise to develop links between the cognitive processes, the twelve concepts and the IA prompts. This will help students structure their discussions of the IA prompts in a way that maintains a clearly knowledge-focused approach. The activity is discussed in Chapter 13 of this book.

The importance of embedding knowledge questions

Take a moment to consider the knowledge questions (KQs) listed on the next page, which are taken from the core theme Methods and tools section in the TOK subject guide (page 15).

Knowledge and the Knower: examples of knowledge questions from the Methods and tools section

- How do we acquire knowledge?
- What constitutes a 'good reason' for us to accept a claim?
- Are intuition, evidence, reasoning, consensus and authority all equally convincing methods of justification?
- Does knowledge always require some kind of rational basis?
- How do our expectations and assumptions have an impact on how we perceive things?
- What are the advantages and disadvantages of requiring that all knowledge is verified by a group?

What do you think is missing from each of the questions, that might be present from the examples of knowledge questions in other themes or AOKs?

Compare these with the examples of knowledge questions taken from The Natural Sciences Methods and tools section in the TOK subject guide (page 32):

The Natural Sciences: examples of knowledge questions from the methods and tools section

- Is there a single 'scientific method'?
- What is the role of imagination and intuition in the creation of hypotheses in the natural sciences?
- What kinds of explanations do natural scientists offer?
- Why are many of the laws in the natural sciences stated using the language of mathematics?
- What is the role of inductive and deductive reasoning in scientific inquiry, prediction and explanation?
- Does scientific language have a primarily descriptive, explanatory or interpretative function?

In the case of the KQs from the natural sciences section of the TOK subject guide there are very clear and explicit references to the AOK, but these are missing from the KQs in the core theme section. In the core theme section, the KQs are very general, and this is no mistake – they are meant to open discussions which are not necessarily tied to one AOK or theme or not necessarily tied to any AOK or theme. When discussing communities of knowers earlier, it should be clear that that there are many more possible communities of knowers than the five AOKs and five optional themes in the TOK subject guide.

Nevertheless, we hope that it becomes very clear, very quickly, that the answers to these KQs really depend on the context provided by the specific type of knowledge activity that the knower is involved in.

Consider any one of the KQs, for instance, 'What constitutes a "good reason" for us to accept a claim?'

The responses to this are as varied as the communities of knowers that it is applied to. Suppose it was a claim from the sommelier community (professional wine servers) or the rugby-playing community or the mathematicians' community? Each of these communities can be seen as a community bound together by having certain forms of knowledge, but what makes a 'good reason' to accept a claim in each could be quite distinct. Indeed, it is not even clear that a claim in one is anything like a claim in another. The sommelier must appeal to a well-trained subjective experience of flavour to make claims about wine, the rugby player might need to base his acceptance of his coaches' claims on authority and the mathematician will prioritize logical inference.

Suppose a student replies to the question above by saying, 'A good reason to accept a claim is one which is justified by direct objective evidence and the use of reason as a source of knowledge'. This sounds entirely plausible, but might not work as well in history, if there is only circumstantial evidence for a claim. Religious believers might also think that personal subjective experience should sometimes be prioritized. Many people think that ethical principles are best arrived at through intuition rather than logical inference. The point is that without a clear context, any answers to these questions remain too general to contain any real intellectual bite or rigour. Always encourage students to develop responses with the context of some community of knowers squarely in mind.

Imagine now that you added '... in the human sciences' to the end of each of the knowledge questions shown in the Knowledge and the Knower table on page 68: 'What constitutes a 'good reason' for us to accept a claim in the human sciences?'

You can see that the question has a clear context and a response will be able to draw on facts about how the community of human scientists genuinely do their work. An answer will now clearly require a bit of precision and context and, ultimately, a bit of real-world rigour. This does not mean that a response has to be descriptive or merely analytical. The best responses could offer an evaluation or a critical commentary on the process of constructing knowledge, perhaps through a comparison with other processes available within the AOK/community of knowers, or a comparison across contexts, or through an application to one of the 12 main concepts of the TOK course (certainty, evidence, etc).

It is always a good idea for students to frame their discussions with clear links to AOKs or other real-life communities of knowers

TEACHING TIP

It is usually a good idea to encourage students to link their analyses to real-life, solid examples of knowledge construction in relation to a community of knowers. Using genuine examples from the real world helps students ground their analyses. Too often, particularly in essays, students make hugely general claims without any links to how knowledge is actually constructed. This leads to plausible sounding and possibly correct claims, but often only plausible or true if a particular community is identified.

Ethics

We have explored a number of the knowledge questions that are related to knowledge and which are posed in the TOK subject guide, in various places throughout this book and the student book.

In Chapter 2 of the student book, we explore a real-life ethical dilemma faced by the parents and doctors of the conjoined twins known as 'Mary' and 'Jodie'. The discussion is an application of the map metaphor and an illustration of how we create and apply different models or maps onto a situation in order to understand it and in order to help us navigate through it. The activity asks students to consider the choices that go into the initial framing of an ethical dilemma or choice – the facts we identify as relevant and the ways we then process those facts have huge consequences for how that dilemma is ultimately solved. The following discussion of one of the KQs listed under the ethics section of the core theme is an attempt to highlight these choices and the consequences of their use.

KNOWLEDGE QUESTIONS

Relevant knowledge questions from the TOK guide:

- Is there such a thing as a moral fact?
- Can moral disagreements be resolved with reference to empirical evidence?

The first of these questions is explored from a more theoretical angle in the 'Introduction to Teaching Ethical Theory', which can be accessed using the QR code in the margin. Although it focuses on the first knowledge question, the handling there could also be applied to the second. Here too, our handling can be applied to both.

One approach to these knowledge questions would be to explore which facts are considered as relevant to the ethical theory which is being applied. In other words, which features of the situation would appear on the different ethical 'maps' which could be used to navigate the situation?

The student book contains an activity that asks students to consider an ethical dilemma they have encountered and to think about the different possible approaches to it (page 75). For this activity you might ask the students to fill out a table similar to the one on page 71 of this book. This table draws on the material from the online 'Introduction to Ethical Theory' that accompanies the student book. The activity is designed to develop a comparative analysis, one whose goal is not to 'solve' the dilemma in terms of finding what the right answer to the dilemma is, but rather to explore the issues at the level of a comparison of approaches. The point should be that what the relevant 'facts' of the case are, depends on the map being applied to that case. This is an idea you might come across in other AOKs like history (historians select evidence based on what questions they ask and what perspectives they apply) or human scientists (eg, economists or psychologists will characterize the situation and interpret the data in different ways depending on their perspective) and shows the breadth of application of the map metaphor.

	Relevant facts for:			
(These might be considered different 'maps' of the situation)	**Utilitarianism** (relevant facts are the facts about the consequences of the surgery)	**Rule-based ethics** (relevant facts have to do with what rules or duties are being followed)	**Virtue theory** (relevant facts have to do with the character of the people involved)	**Your own map** (relevant facts depend on which principles you enact) For example: 'Act in such a way as to promote knowledge and expertise for the doctors and hospital.'
Case of Mary and Jodie	The happiness of Jodie. The suffering of Mary. The suffering and happiness of their parents. The knowledge/ expertise gained by the doctors helping other conjoined twins in the future.	The doctors have a duty to help save as many patients as they can. The parents have a duty to look after their children (by not taking action which results in their deaths, or by taking actions which saves them). The country has a duty to help those people living in the country.	The parents are acting out of **compassion** by not allowing doctors to 'kill' one of their children. The doctors are acting **responsibly** by attempting to save Jodie. The doctors are acting **compassionately** by ending the suffering of Mary.	The surgery is complicated so could help doctors develop their skills in the separation of conjoined twins. The hospital might use any success to argue they need more funding to provide better care for other patients. The doctors might use their knowledge to improve their careers. (The 'facts' mentioned here are speculative (and quite uncharitable). A full and proper response would draw on the genuine facts of the case.)
Students' own ethical dilemma or choice				

Conclusion

The new core theme 'Knowledge and the Knower', will be an incredibly rich and exciting addition to the TOK curriculum and should serve the general aims of the course well. The best thing a TOK teacher can do for the students throughout the course will be to find opportunities for the students to see themselves as knowledge constructors in all sorts of contexts, not just the AOKs. The students are building their perspectives on the world in all sorts of arenas – politics, identity, academic and social contexts are all places where knowledge and skills are required.

Even in the AOKs, remind students that they are being 'apprenticed' or are 'interns' in the fields they study; they are not empty vessels being filled with knowledge, they are at the building sites of knowledge construction and should be reflecting on the skills they are learning and applying.

on the dictionary, they may only find definitions that emphasize modern high-tech technology like robots, computers and complicated laboratory equipment.

Our purpose in leading students into a wider understanding of technology as something like 'a tool created for a specific purpose' is to encourage them to focus on the crafting element of technology (developed with reference to Aristotle's *technê*). The point then is to see knowledge constructors as craftspeople, who, in the process of creating knowledge, will make use of whatever is available to do so. In addition to having propositional knowledge, they also have ability knowledge.

Having developed this broad understanding of technology, we can narrow the focus to those technologies that aid the knowledge-maker in their construction of knowledge. Writing utensils and paper, though low tech, were revolutionary in the construction, storage and transfer of knowledge, but this might be overlooked if students only consider their smartphones as examples of technology. The same would be true of the humble book. Have a look around your teaching room and consider what would happen if only this room was found by an alien race at some point in the future. What knowledge is captured in that room? If you have paper and books laying around, there is probably quite a bit of human knowledge stored there, even if the computers won't boot up. Students might miss out on discussions about the historical development of specific disciplines or knowledge in general.

Some students might balk at the idea that paper and books can be considered technology, but having this in mind might open doors to new conversations that would otherwise not have been considered.

This broad definition of 'technology' leads us to consider just how embedded it is into every aspect of our lives (as unpacked in the activity asking students to imagine a world without technology on page 79 of the student book). The rise of information technology which helps us create, store and transfer knowledge gives us an opportunity to explore just what we mean by 'knowledge' in this new context. Is knowledge just a different type of 'information'? Is there a difference between having information about the world and knowing information about the world? If not, then does anything which stores information also know it?

The TOK subject guide introduces a number of concepts and distinctions which we think are ways of analysing the concept of 'knowledge' in the context of technology. For example, 'big data' is a form of knowing which has been made possible by technological advances. In addition, different types of thinking are mentioned (critical, computational and algorithmic), raising questions about whether technology (eg, computers, driverless cars) can engage in these types of thinking. Are our normal modes of 'human thinking' really as unique as we think they are?

Scope

■ Data, information and knowledge

Before we get there, however, we want to take some time to develop the distinction, introduced in the Scope section of the student book (Chapter 4), between 'data', 'information' and 'knowledge'. This distinction is at the heart of what we mean by 'information technology' and will provide a helpful framework for students to discuss questions about whether machines can 'know'. We like to think of knowledge as a relatively sophisticated 'thing', that we know we have. But where does it come from? How is it related to information and how does this relate to the basic data that we gather?

KNOWLEDGE QUESTION

Relevant knowledge question from the TOK subject guide:

- What is the difference between 'data', 'information' and 'knowledge'?

The student book explores the differences and provides some ways to distinguish the three from one another. This distinction might help open discussions in all sorts of other contexts.

In summary, we might define the terms in the following way:

- **Data**: Raw, static, facts of the world represented by numbers or symbols (ie, the data we record are not the phenomena themselves). For example, the temperature of the air on a day is 'captured' by a thermometer and described and recorded in terms of numbers and a particular scale.
- **Information**: Data that has been processed, perhaps through being related to other data or other phenomena. For example, the raw numbers of day-to-day temperatures are put into a grid to measure their longer-term fluctuations or their collective average over time, or even further, these temperature fluctuations are compared to some other phenomenon like solar activity.
- **Knowledge**: Information (and data) that is placed within a framework of understanding, and which represents a position or attitude within that framework. For example, the information about the comparison between average temperature and solar activity shows us that there is no correspondence between solar activity and average temperature. The context or framework here is 'related to a debate about human activity and climate change'. Some argue that the rising temperature of the planet is the result of increased solar activity, but the information and data suggest this is untrue ('Climate Change: Vital Signs of the Planet').

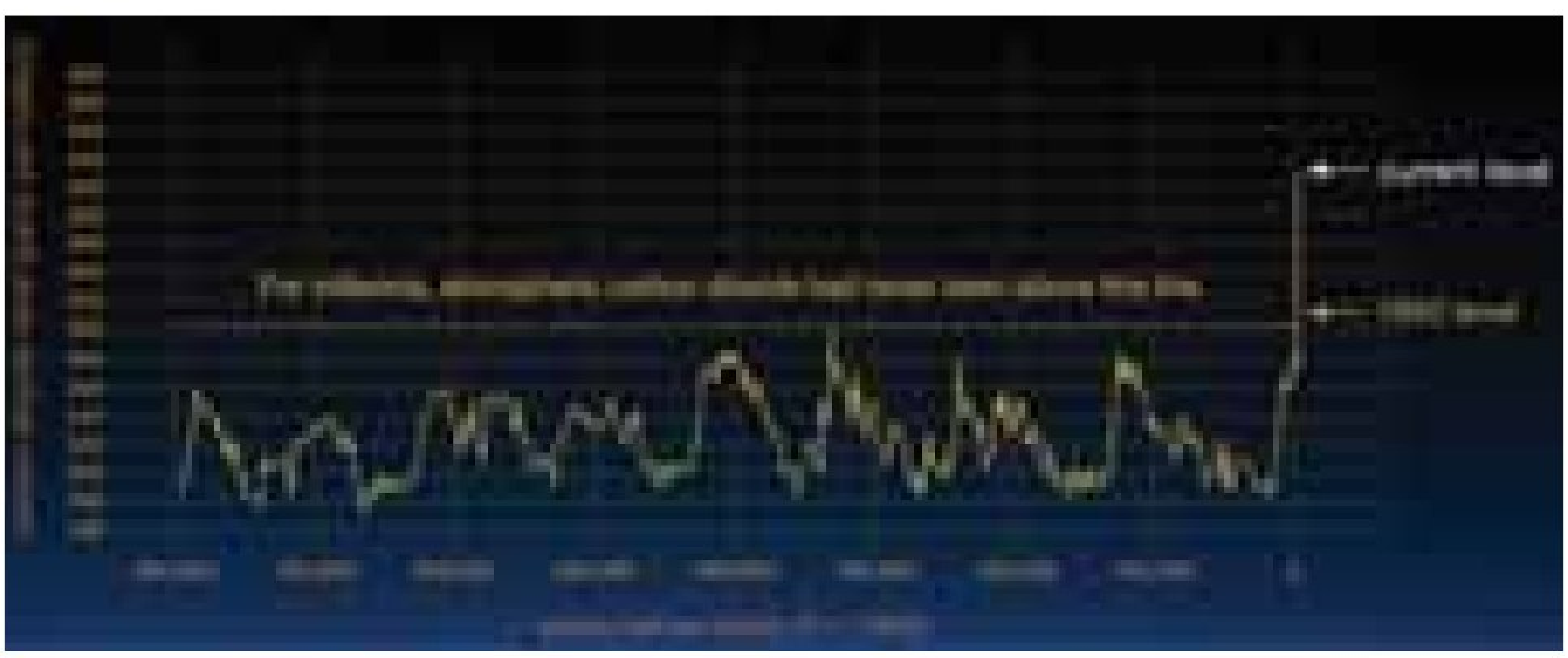
Students should remain critical of this distinction, perhaps asking whether or not there is such a thing as 'raw' data. If we have to translate natural phenomena, like how warm it feels, into a system to measure it (degrees, Fahrenheit scales, Celsius scales) requiring new technology (a calibrated thermometer), does it make sense to say that that data is not processed? This idea of having to apply a 'map' or a conceptual framework on the world to even understand the world, is a theme we touch on throughout these books and during the course.

In the activity on page 85 of the student's book, students are given the opportunity to identify these differences and discuss their significance in relation to a real-world context by using a QR code to look at NASA's website devoted to data, information and knowledge about climate change. The QR code is also given here on the left.

This website is an interesting mix of 'cold, hard' data, articulations of what that data tells us (information) and then an application of that information to a particular context or argument (knowledge).

Here are some ideas to discuss in relation to the data, information and knowledge presented on the various different tabs on the website.

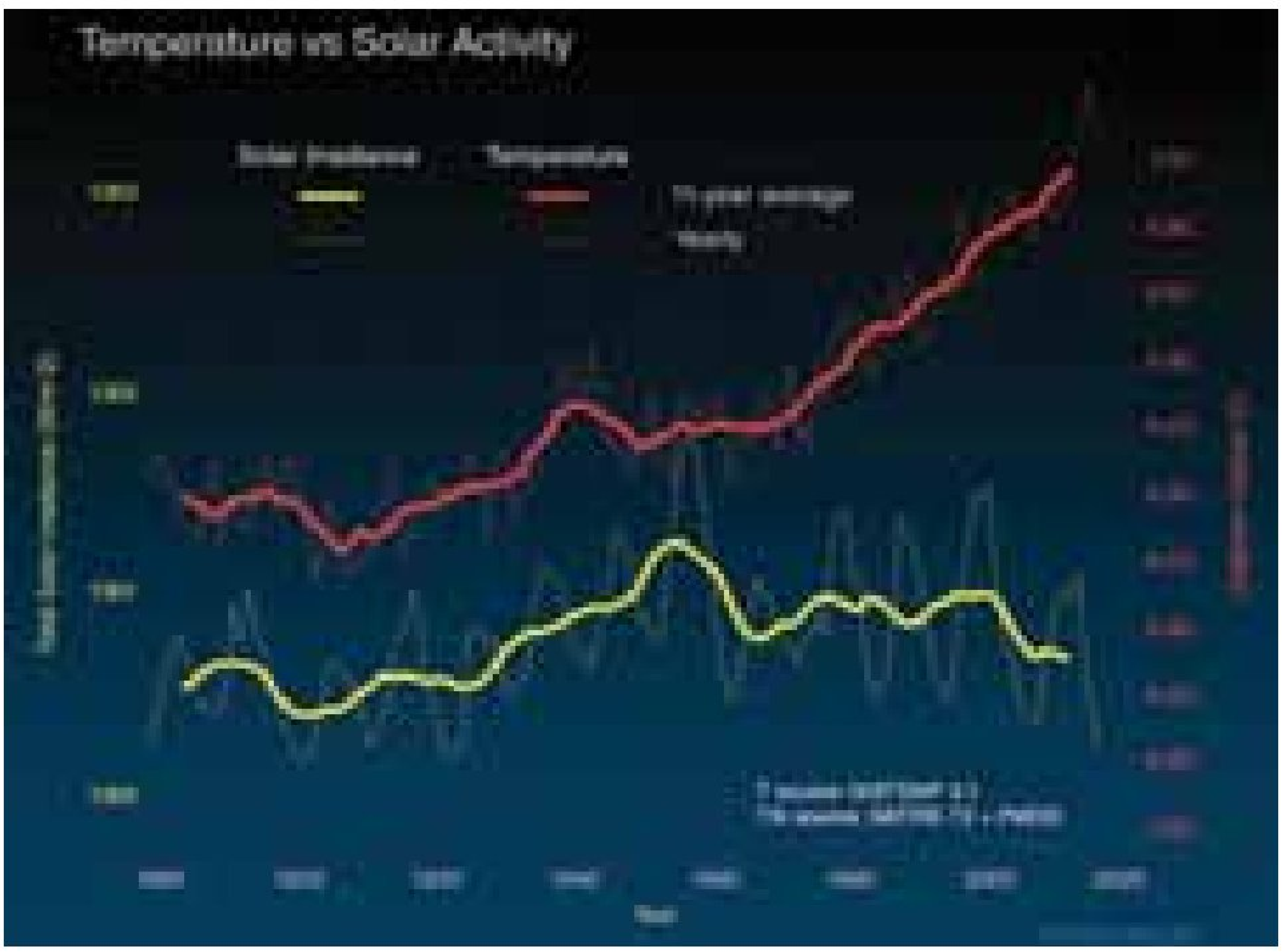
Evidence



- The individual data points would be data, but the line (which shows a relationship) might be considered information.
- The current and 1950s levels alone might be considered data, but the point about how long CO_2 has been below the line would likely be considered knowledge because it implies action.

Causes

- The animation provides a wealth of information – facts which have been developed from data. However, the title leans in the direction of knowledge. Teachers might discuss the impact of the 'greenhouse' metaphor/map on our understanding of the information here.
- This chart is full of both data and information.
- The key and caption on the page identify the data points (yearly data) and the information (11-year averages).

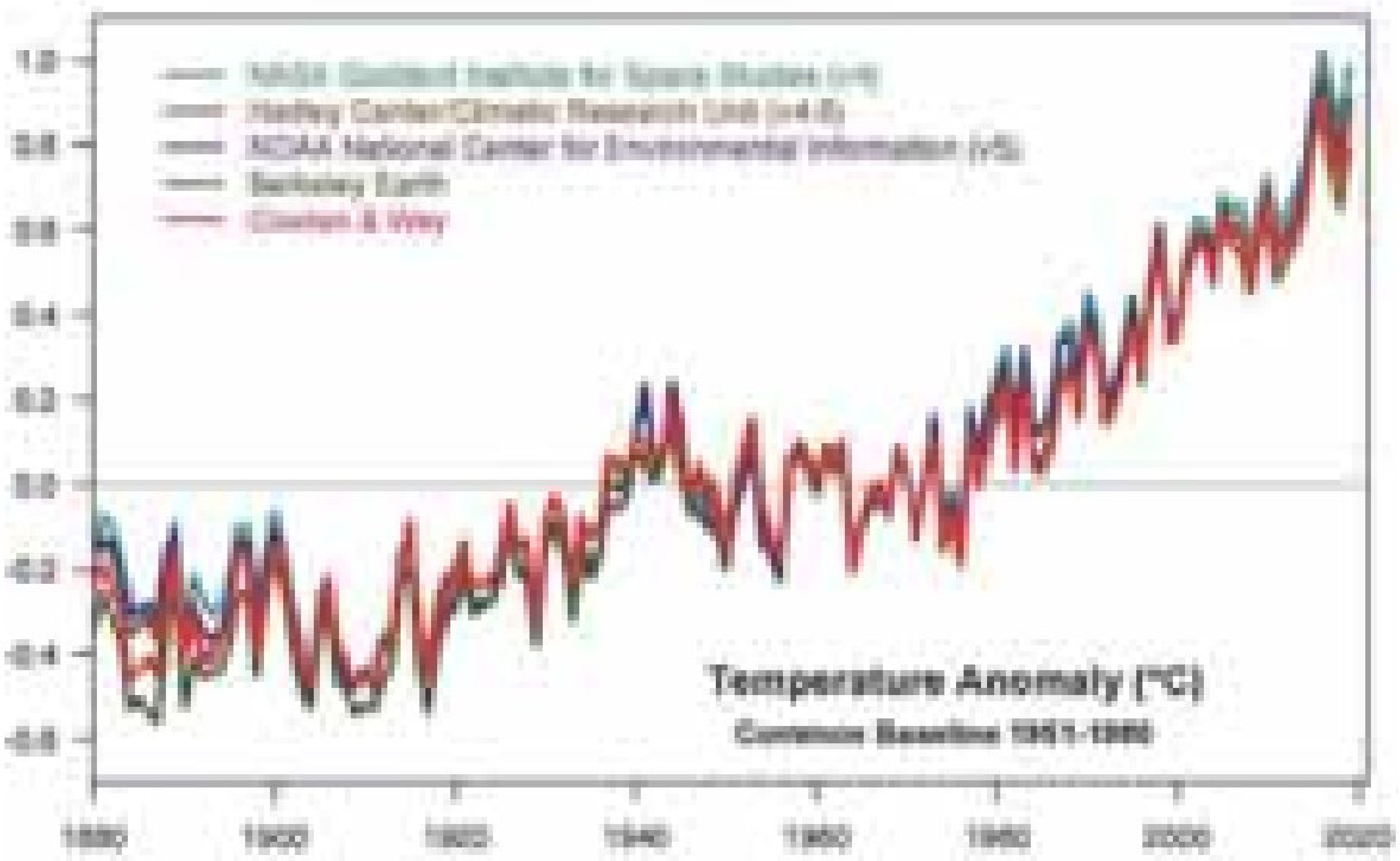


- The information is about two different phenomena (the Earth's average temperatures and the solar activity). The fact that these two sets of information are on the same graph suggests elements of knowledge (but not explicitly), namely that there is no correlation between solar activity and the temperature of the Earth.
- While some might consider this relational claim information, others may claim that this information becomes knowledge when placed within the context of a specific argument, namely that the rise in the average temperature of the Earth is the result of solar activity and not human activity.

Effects

- The NASA website certainly provides knowledge, particularly the quotations presented and the Future Effects section. This represents information that has become actionable. NASA is not simply providing information but is providing reasons to act.

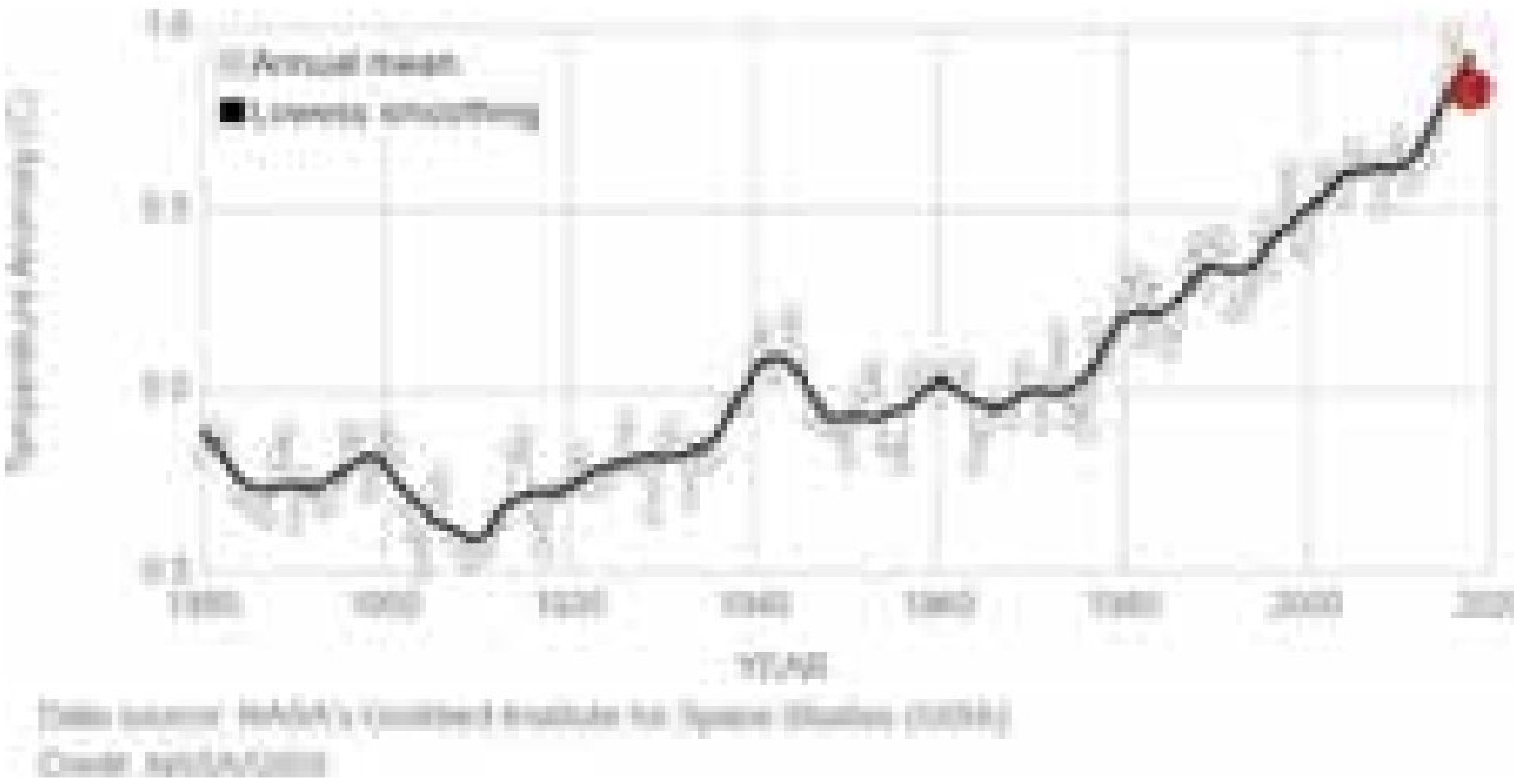
Scientific Consensus: Earth's Climate is Warming



- The heading 'Scientific Consensus' suggests knowledge – content which extends beyond a description of facts.
- The subheading 'Earth's Climate is Warming' is information – a straightforward description resulting from an analysis of data.
- Individually the lines would represent information, but the fact that they are superimposed and relate to the graph's title suggests that this is knowledge. There is an argument being made.

Vital Signs: Global Temperature

- In this graph we seem to have information throughout.
- The points represent the annual mean (which is processed from daily data presumably) and the trend line is relational, so processed and is therefore information as well.
- You might argue that the big red dot is knowledge, because it implies an action or a conclusion (i.e. 'too hot!').



Building on an understanding of the differences between data, information and knowledge, we might now encourage students to use this distinction in the context of an area of knowledge. The Knowledge and Technology theme is not linked to any particular AOK, but as we have mentioned before (in Chapter 2) it is always a good idea to run the ideas from the optional themes through a specified community of knowledge. This will help students develop a deeper understanding of the AOKs, or at least open up discussions which might lead to new understandings of them. Students should consider data, information and knowledge separately with reference to the various elements of the framework, asking, for instance:

- What sort of data does this AOK collect? (Scope)
- How do the methods dictate what sort of data is collected, and how do the processes manage this data? (Methods and tools)
- What worries, ethical concerns or arguments does this AOK engage in and provide information for? (Scope, Perspectives, Ethics)

In addition to attempting to apply the notions of data, information and knowledge to the AOKs, you might encourage students to develop comparisons across AOKs, by asking questions such as:

- What sorts of data do historians seek out or collect that natural scientists might not be concerned with?
- What information does a mathematical analysis provide an economist?
- How can different frameworks provided by different AOKs lead to the same information becoming different knowledge?

There is an activity on page 83 of the student book that prompts students to think about what constitutes data, information and knowledge in the different AOKs.

Artificial intelligence

Under Scope, the TOK subject guide offers two knowledge questions related to the growing field of artificial intelligence, and much of the student book Chapter 4 is devoted to working with this idea. It might be considered slightly niche, but the question, 'Can machines think or know?' is a good way of exploring the intersection between knowledge and technology more generally and will help students apply their understanding of 'knowledge' in a wide variety of ways.

KNOWLEDGE QUESTIONS

Relevant knowledge questions from the TOK subject guide:

- In what sense, if any, can a machine be said to know something?
- Does technology allow knowledge to reside outside of human knowers?

You will need to be very careful in how you manage this discussion. The question of whether computers think is largely a technological concern. There is a TOK question at work in the background to this discussion, however, and this is where you want to keep your focus: what do we mean by 'knowledge' or 'thinking'? The implication of this question, depending on how you answer it, is that it might be possible for machines to 'know' or to 'think'.

There are a number of key distinctions made in the subject guide and the student book that might be relevant here:

- propositional knowledge (knowing that) and ability knowledge (knowing how)
- types of thinking: critical, computational and algorithmic
- data, information and knowledge
- the creation, storage and transfer of knowledge.

The student book spends a fair bit of time unpacking the idea that computers can 'know' something, and how a student carves up these various distinctions will open or close doors to whether or not you think that a technological system (a computer) can know facts or know how to do something.

In order to discuss this question, you might build a conversation around propositional and ability knowledge (applying ideas offered in Chapter 2 of the student book). For example, given a choice between a number of different coloured objects, you likely can identify blue objects among them (unless you are colour blind, in which case you can choose a colour you can identify). One could argue that the reason you are able to do this is because you 'know' what blue is and what it looks like. Now, suppose you wonder whether your friend, Carla, 'knows what blue is' (perhaps she is learning English and you want to test her). You show her a number of coloured dots and if she identifies the blue dot, then you will use that as evidence that she knows what blue is. 'Carla knows what blue is', is justified through her ability to identify blue objects (ability knowledge).

Now suppose that you give the same stimuli to a robot with all of its sophisticated visual equipment and programming. If that computer can identify the blue dot you will have the same justification that you used for Carla to say, 'This computer knows what blue is'. So, in this context, if by 'know' you mean something like 'to be able to …' (ability knowledge), then it seems that you have enough reasons to say that the computer 'knows' what blue is, if you also said Carla that did.

The student book offers other examples of possible reasons why knowledge is the sort of thing that might be attributed to computers. No one is suggesting that computers will know things in the same way as humans, as this would be absurd. Our knowledge depends on brain activity and computers don't have brains. But, they certainly seem to be able to do many of the same things we can – they can solve mathematical equations (often more reliably and more quickly than us), they can tell you the capital cities of all the countries (how many can you manage?) and they can navigate to your favourite doughnut shop with ease.

Remember, the question you should always bring the students back to is, 'What is knowledge and is it the sort of thing that computers can have?' This unpacking of the concept (through some of the distinctions mentioned above) is the important bit.

If you are able to make explicit links to the AOKs, even better. Questions like the following might lead to interesting comparative discussion:

- How important for a mathematician is knowing how to do certain equations if calculators can do the equations instead?
- If a scientist can just 'look up' an important fact, why do they need to learn it?
- If computers run most of the world's stock market trading, can any economist know the current state of the economy?

Perspectives

The perspectives section is focused largely on the internet, and the central tension driving the section is between the internet's promise of the individual being exposed to a wide variety of ideas and perspectives and the ways that, in reality, the diversity of views they are exposed to is actually quite narrow. This is purposeful, as the need for students to consider the 'filter bubbles' that we find ourselves in are becoming increasingly important, socially and politically. The first student book activity is about our access to the internet and how access is one way in which students' experience of the internet might be limited and narrowed by the power structures at work. For the teacher's book, we have shifted this to the ethics section, again pointing out the variety of lenses you might use to discuss similar ideas.

In addition to the notion of a narrowing of perspectives, we have also engaged with the idea that those perspectives, however many of them there are, run the risk of recapitulating the same old biases and prejudices in the technology involved as we find in everyday interactions.

SAMPLE ANSWER TO A KNOWLEDGE QUESTION

Do social networks reinforce our existing perspective rather than boosting our engagement with diverse perspectives?

One of the internet's most exciting features is how it can put us in touch with people from all over the planet (provided they also have internet access). This means that ideas can spread across the world and influence a huge number of people with the click of a button. It seems, moreover, that this ability to connect with so many people will in turn expose individual knowers to a wide variety of knowledge and perspectives. To some extent this is true; we are bombarded with ideas from all sorts of sources – advertisements, the news media, a constant barrage of emails and our own news feeds continually drip feeding us ideas.

However, there is a difference between being exposed to various ideas and acceptance of those ideas. As individual knowers, we know that there are a multitude of opinions and perspectives out there to choose from and we know that much of our education and training has been about learning how to think critically and reflectively about those opinions and perspectives so that we take on or accept the knowledge that is most reliable. But critical reflection is not the only reason why we might accept knowledge: we simply don't have the time or interest to wade through every belief or opinion and commit to the necessary critical processes needed to weed out the less reliable of them. Instead we rely on a whole host of other things and this is where social media's narrowing of our perspectives is most clear.

First, we often tend to accept ideas that we already know our friends or family accept. It is no wonder that we probably share many of the same political, religious and social beliefs that our friends do – it is why we choose to hang out with them. They reflect back to us many of the beliefs that we already have. Our social media is mostly populated with people we know and people we like. If we don't like someone we are not likely to follow them on Instagram so we can see what they are doing right this second throughout the day. So, through the 'follow' choices we have made, we have already narrowed our exposure to mostly people a bit like us. This is not to say that digital or social media is the only arena in which this occurs; we are no more likely going to join a club populated by people we don't know or like.

We also get some of our beliefs from our friends; we share broad musical tastes for instance, so if a friend has heard a new band and really likes them, they might recommend them to us, and we are more likely to listen. If a friend posts something they found interesting onto social media, then we are far more likely to have a look as well. This is perfectly natural, but with the limited time available we might find ourselves relying on the posts or re-posts of our friends to tell us what is important or significant and subsequently we are exposed to a relatively limited amount of the available information. Again, this is not necessarily a digital-only phenomenon.

We also are naturally inclined to give our attention to those ideas that seem to be everywhere. The more often a video or story is fed across our various news feeds the more likely we are to finally take a moment to look at it. The phenomenon of the 'viral story' or the 'video gone viral' illustrates this point. The level to which something has gone viral is a reason to watch it: everyone else is watching it as well! However, the 'virality' of a story has nothing inherently to do with the story's truth. True stories do certainly tend to stand the test of time, meaning that better ideas (including ideas which correspond with reality) tend to last longer, but virality is a fleeting popularity, not one that will survive scrutiny for long. That is the nature of viruses – they do not last long, but they can be very damaging in the meantime.

If we take these points, however, and put them all together we have a scenario in which we have (digitally) surrounded ourselves with people a bit like us, who share the same sorts of beliefs and likes and dislikes and we tend to listen more to them than anyone else. This is certainly not an internet-only phenomenon, but what it means is that the initial benefit of the internet, its ability to put us in touch with anyone anywhere, has largely been negated by our social habits. Yes, we might have 'friends' or 'followers' from all over the world, but they are nevertheless going to be a lot like us. Therefore, using the internet to find and be exposed to new ideas and new knowledge is less wide ranging than we might think. Regardless of what we are exposed to, we are still more likely to accept that which is already a bit like what we have accepted in the past.

The unique element that digital technology plays here, however, is that content providers and social media networks like Facebook and YouTube are perfectly aware of our tendency to give our attention to things we already know and like and to things which we are led to think are 'amazing!' or 'fantastic!' The algorithms (programs) that supply the 'recommended' stories, videos and ads we see online are driven, not by a good faith attempt to help us engage with new and interesting ideas, but by the aim of capturing our attention. Have you ever noticed how one day you suddenly see a whole bunch of stories or ads about, say, hoverboards, but then you realize that a couple of days earlier you searched for hoverboards? This is because your browser is capturing your searches and provides that information to other companies who then create a digital shadow of you and your browsing habits, and then reflect those habits back to you in the 'recommended for you' section of the website or application. YouTube's number one priority is to keep us watching videos, so will suggest videos that the algorithm has already predicted we will like. Facebook knows who our friends are and will populate our news feed with posts that we are already likely to view. Our Instagram, Snapchat and Twitter feeds are already populated with people we know or like, so are designed to give us a 'social' feed we are already likely to view.

Finally, considering how few sites we use to engage with the web (Google, Instagram, Snapchat, YouTube, Facebook, Twitter, Amazon, Microsoft, Apple, Wechat, to name a few (some of which actually own one another!)), this idea that 'the internet broadens our perspective' is damaged even further. This is a very small number of companies (mostly American!) which act as gatekeepers for our access to the internet. Nor do these sites even really care about truth, as seen by Mark Zuckerberg's reluctance to police the political advertisements which find their way onto people's Facebook news feeds, but which are demonstrable lies (Murphy, Sorkin). These are businesses, so they do not have 'freedom and diversity of knowledge' or even 'truth' at the top of their priority list, but instead are more worried about profit, and our attention is directly related to their profit. 'Some people accuse us of allowing speech because they think all we care about is making money, and that's wrong', Zuckerberg said. 'I can assure you that from a business perspective, the controversy this creates [over whether Facebook should allow ads which promote lies] far outweighs the very small percentage of our business that these political ads make up' (Graham). This suggests that Zuckerberg thinks this is not really that big a deal. Whatever it takes to keep us interested and attentive is their goal.

None of this really suggests that we are taking advantage of the variety of perspectives we could be exposed to on the internet. The internet might not be a place of diversity of knowledge at all, but a place driven by diversion, distraction and growing distances between people.

Note: This exploration of the knowledge question is, as always, only one way in which the question might be explored. This response focuses on the various things that narrow the diversity of the internet, particularly in the non-reflective or less purposeful *user. Someone using different examples might approach the question in a different way, perhaps exploring how some people are more proactive in seeking out diversity. The nature of a knowledge question is that it is open ended, and so there is no 'right' answer: there are just well-supported responses or badly supported responses. One critique of this response would be that, while it offers justification for its own argument, alternative perspectives or examples are not developed.*

Bias and technology

Students certainly will come across the notion of bias throughout the TOK course. Bias in technology is discussed in the student book in ways that they may not have thought about before. Whereas they will be familiar with 'bias' in terms of knowledge-creators violating the methods and rules developed by their communities to weed out bad practice, the idea here is that these biases can be 'built into' the technologies and objects we create. The examples used in the student book are of largely non-intentional bias, but here the point is that bias need not be the result of any conscious attempt to manipulate knowledge.

CONNECTION TO: ASSESSMENT

The internal assessment (discussed fully in Chapter 13 of this book) asks students to explore how TOK manifests in the world around us by using objects to illustrate the inner workings of knowledge. The students are expected to offer three objects through which they analyse one IA Prompt from the 35 offered in the subject guide. Knowledge and Technology might be a good context in which to identify objects.

Below are a handful of IA prompts with a description (not a full treatment) of how some of the objects explored in the student book may be used in relation to that prompt.

12 Is bias inevitable in the production of knowledge?

The 'production of knowledge' should not be considered as the production of the object, but rather the knowledge gained from that object. We might, for instance, use a crash-test dummy to point out that car safety standards (the knowledge) which are developed through the use of the dummies must not be limited to only one size and shape of dummy. Women and children are not built like men, so dummies built to their specifications need to be used, otherwise the knowledge produced is biased in favour of what is considered the 'norm', which in this case is the male body.

15 What constraints are there on the pursuit of knowledge?

One constraint might be on who is producing knowledge. Spacesuits, originally designed for men, meant that the knowledge gained on spacewalks, for instance, was only going to be developed, for a while at least, by men.

21 What is the relationship between knowledge and culture?

Here a student might choose to use an internet browser as their object, the vast majority of which are designed and built/programmed in the United States. Students might then research the ways in which the basic assumptions in that culture might find their way into the browser and develop an argument that these assumptions are imposed on the user.

23 How important are material tools in the production or acquisition of knowledge?

Students might research how access to academic journals online is often hidden behind paywalls. The 'object' in this case might be one such database. Students might then explore the ways in which these financial barriers to free access impact the production of new knowledge, possibly by maintaining an economic status-quo in the discipline.

How do biases make their way into our technology?

In the student book, we spend a bit of time pointing out how biases and prejudices can be built into technological objects and products. Here we would like to unpack further how those biased perspectives find their way into the objects of technology.

ACTIVITY

Sources of bias in technology and algorithms

1. Take a moment to consider the problem of bias in computerized technology, or machines that in some sense think or process data (some examples of which can be found in the student book). Can you identify any further examples?
2. Choose one example and break it down into its smaller parts and identify where bias finds its way into the systems. What are its sources? How is it challenged? What is its effect?

Compare your analysis to our analysis below.

Analysis

The important thing to remember is that human beings begin the process. Any new technological development will have been conceived, designed and implemented by human beings with whatever background beliefs and ideas they have. They may not consciously build their bias into the new technology, but their beliefs will be reflected in those products (Hao, 4 Feb. 2019).

We identify three main opportunities for bias to find its way into computer thinking processes (algorithms):

1. *When deciding on the objectives of the product (what it is trying to achieve).* When developing algorithms and programs to solve problems, programmers must first decide what sort of outcome is to be achieved. For example, suppose a principal wants to develop software which will help them make data-driven decisions to promote a 'successful' school environment. If they decide that the ultimate aim of their school is to maximize results, then that objective becomes the constraining factor in the programs developed. A real-life example would be YouTube, which makes advertising viewing a primary objective (it is how it pays its bills), meaning that the recommendations its algorithm makes are aimed at keeping people watching ads (and videos) for as long as possible, regardless of the truth or quality of the videos being watched.
2. *When deciding on what types of data needs collecting, selecting and delivering.* Here, the limits imposed on the system's objectives to maximize results mean that different types of data will be analysed in the process of making the judgments. Programmers developing software for our hypothetical principal have choices to make; they might choose to look only at the final exam grades awarded, or they might consider the rate of students achieving their predicted grades, or they might choose lots of quantifiable day-to-day assessment data. A different type of school with different

values might try to track other factors of success, like mental wellbeing, individualized outcomes or social and community involvement. The choices about what sorts of data to capture and use will be the result of various perspectives and approaches which might not be shared by everyone.

3 *When feeding the developed system more data so it can learn*. Once the programmers have decided what sort of data the system will capture, they must then provide real data to use in the development of the program's abilities. These data used to 'teach' the system, however, might not reflect reality. For instance, imagine a program designed to detect faces (facial recognition): the objective is to recognize faces (decision 1) and the type of data to be collected then are data about facial features (decision 2). In order to improve it, the programmer will now show the system more and more faces and teach it when it is right and when it is wrong. If the programmer, however, only uses one type of face then the program might be biased towards recognizing only those types of faces. This happens when facial recognition software is 'trained' using predominantly white and male faces (Hao, 15 Feb. 2019). The question is, why didn't the programmers think to use other types of faces? That they only thought of using white and male faces suggests that the belief that the 'normal face' is white and male has been unintentionally written into the software. The data might also reflect existing social prejudice, as in the Amazon algorithms which discredited applications from women: more men had been 'successful applicants', so when the algorithm analysed 'successful applications' it was learning from predominantly male applicants, and thus learned that women are less likely to be successful, so deselected them. But, of course, the fact that more men were successful was probably already due to social bias and this bias is simply captured by the software (Weissmann). This issue of a biased collection or selection of data has echoes in the historian's collection of historical data discussed in Chapter 11. In our school environment example, perhaps the notion of a 'successful' school is built on data from schools with students who also happen to be from a certain socio-economic band, or schools from certain parts of the world, or schools who have recruited certain types of teachers, or schools with a highly selective intake. Using schools whose academic success was the result of expensive resources and an already highly selective intake might mean the model only reflects existing inequalities and social biases, making them inappropriate models for other schools not in that context.

These examples illustrate that we cannot assume that the technological processes that surround us, from actual devices through to analytic processes, are themselves as prone to bias (often non-intentional) as the human beings who develop them.

Big data

KNOWLEDGE QUESTION

Relevant knowledge question from the TOK subject guide:

- Is big data creating a new cognitive paradigm?

The student book explores the relatively new phenomenon of 'big data', which is a term referring to the ways that new technologies allow us to capture huge amounts of data from a wide variety of sources and analyse them in real time. The suggestion is that these computerized processes allow us to create a perspective on the world which previously has been impossible. The student book uses the example of how our medical records might be matched to data about where we live and a whole slew of other data about us. This would then allow previously undetectable connections and correlations to be made and new diagnostic and treatment tools to be developed.

Below is an additional case study and activity that students may find interesting, since it relates to their own studies.

In the United Kingdom many schools ask their students to take part in a series of standardized assessments called Alis and CEM IBE in order to identify their strengths and weaknesses, to identify what their outcomes are likely to be in the IB Diploma Programme and to provide better target setting. These tests also allow schools to develop 'value-added' data (Centre for Evaluation and Monitoring).

In some schools, students entering their first year of IB take tests in word fluency and understanding, in mathematical thinking and in non-verbal reasoning. The test then takes this data, along with a handful of sociological information, and gives the students a prediction based on data collected from thousands of other students. The idea is that students can learn what the set of other students with their test profile went on to achieve, and which percentage went on to get each score in the IB. Of course, these scores tell individual students nothing about themselves as individuals, because a percentage of students with the same scores still managed to achieve each of the 24–45 points available in the IBDP. In other words, no matter your score on the standardized test, some number of previous IB students still went on to achieve each IB score. So what use is this information for individual students?

The aggregate does still have some validity. If 70 per cent of the first 10 000 students with a particular standardized test score went on to score over 38 on their IB, then it is highly likely that 70 per cent of the next 10 000 students will do the same. These 'big data' findings, however, have very little predictive power for the individual because scoring 38 points or higher is the result of a whole series of other personal habits and circumstances which have nothing to do with being in a certain test category.

ACTIVITY

If your school runs standardized testing, you might research the test and how it is administered, what it is used for and what effects it has on the students as an example of 'big data' in the real world. Using that information about their own school's context will help students see how TOK works in their own world and further embed the TOK thinking skills we are trying to promote.

Methods and tools

■ Computational, algorithmic and critical thinking

As we discussed in the Scope section earlier, the rise of information technology has opened the door to new ways of framing what we normally think of as knowledge and thinking. As technologies become more central in our lives, the ways that we process data change as well – have our thinking processes become more computerized? Or are computers starting to think like we do? The TOK subject guide raises the question

As we program what we think are 'good thought processes' into our computers, we find that we end up thinking like computers

through offering a knowledge question devoted to three forms of thinking which you might use as an avenue to discuss whether or not our technologies can perform these types of thinking. The student book does not delve into this question – we include it here to help inform your teaching.

One way of unpacking these ideas would be to have an activity similar to that requiring students to identify examples of data, information and knowledge in the AOKs, but with these different forms of thinking. Do some AOKs relate better to one of the types of thinking?

KNOWLEDGE QUESTION

Relevant knowledge question from the TOK subject guide:

- What is the difference between computational, algorithmic and critical thinking?

This three-part distinction is too complicated for a 'possible response' approach. We have therefore outlined the three types of thinking here, to give you the knowledge you need to discuss these ideas with your students. The TOK relevance is to identify and articulate the thinking process that might lead to reliable conclusions. However, the wider context might be related to the relationship between computers and human beings: what sort of thinking might be open to computers?

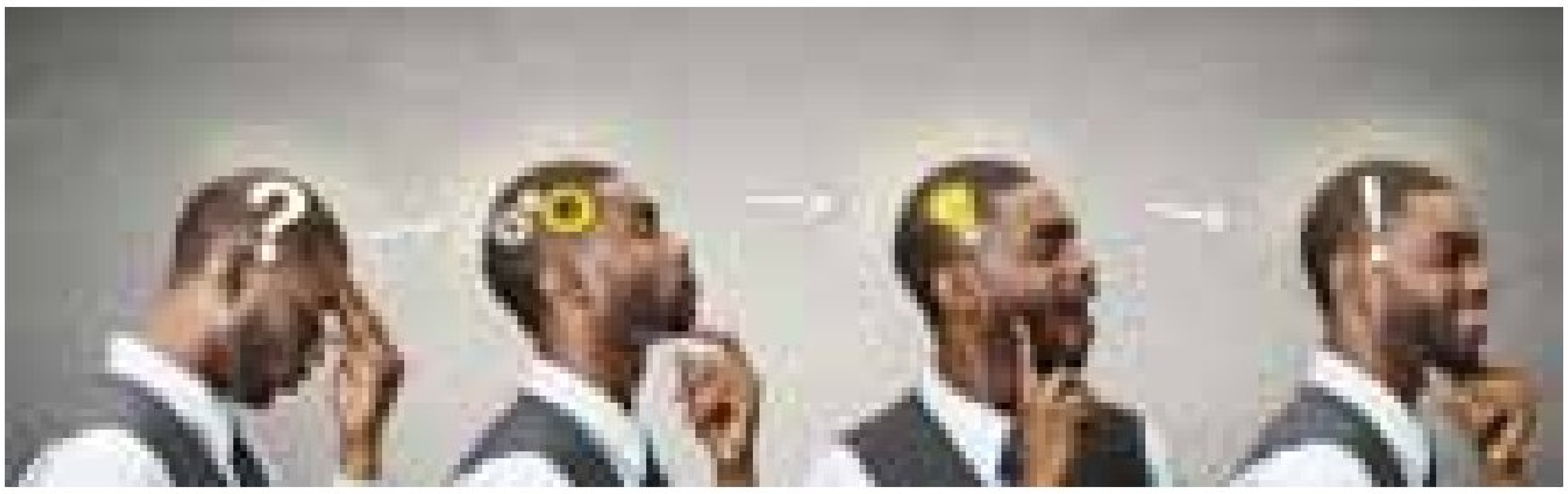
Technology is a wonderful tool, enabling knowers to use the technology to develop new ways of observing the world and understanding data. However, the processes of technology have also provided us with models for how we think. As computer scientists have created processes and programs enabling their ideas to be 'understood' by computers, those thought processes themselves have in turn been used as a model of excellent human thinking. In other words, the types of 'thinking' demonstrated by computers is being held up as a way to describe 'good' human thinking. The process of reason as a way of knowing is a traditional avenue for analysis in TOK, and different forms of 'computer thinking' are examples of this. But what do we mean by 'thinking' and can our technology do it, or do it better than we can?

Critical thinking

Many people consider TOK to be a course in critical thinking. 'Critical thinking' is an incredibly broad term and TOK certainly is one step on the path towards learning how to think critically. However, every subject will provide different tools and strategies to develop a student's ability to think critically. Understanding the methods and the values in an AOK and activating them in the construction of knowledge within that AOK is to think critically in that subject.

Generally, critical thinking is a term to describe a process of thinking which is self-consciously rigorous, guided by a reflective use of evidence and other available knowledge, and accompanied by a willingness to accept the conclusions provided by the process.

Critical thinking is self-conscious and purposeful



Ideally, as students are given opportunities to use critical thinking (through classroom instruction) they will develop certain intellectual habits or natural intellectual traits that mean that they naturally think critically in all aspects of their life.

ACTIVITY

1. Have students review the various definitions of critical thinking on the website linked to by the first QR code in the margin.
2. Ask them to research the discussions of the value of critical thinking by various prominent academics using the second QR code.
3. Ask students in what ways they think their different subjects have been promoting critical thinking? Can they identify the differences in their own learning between mere memorization and genuine critical thinking?

This form of thinking requires a level of self-awareness and self-reflection that technology seems to lack, and should be distinguished from other forms of thinking, such as brainstorming, free association, memorization and recall, all of which we can program computers to do.

The focus of critical thinking is on the self-conscious and disciplined reasoning that comes with an analysis of evidence and is characterized by a logical progression of thinking. This means that the thinker remains self-aware during the process of thinking about a topic and is constantly on the lookout for the effects of prejudice, bias or the manipulating effects of perspective. It is a reflective and purposeful thinking through of a topic, rather than simply thinking about it.

Our definition is also meant to emphasize the expectation that the critical thinking process should show a willingness to accept the conclusions, meaning that critical thinking is not simply interpreting or characterizing data in the terms of a pre-established framework, but rather the discovery of new ideas and conclusions based on a clear-minded exploration of the evidence. In all the AOKs, this willingness to be led by the evidence and by appropriate critical reasoning processes cannot be understated. Being reasonable just means following the logic, wherever it goes.

TOK TRAP

Many students will treat 'reason' as if it is something that tells us the conclusion. 'Being reasonable' or 'using reason' in this view is usually used as if it were synonymous with 'what I think is right'. This often happens in the context of a discussion of emotion, and results in students saying things like, 'The person I agree with used their reason, while the person whose opinion I don't agree with was overcome with emotion'. See Chapter 2 of the student book (pages 69–71) for a general discussion of cognitive tools and processes.

Rather than telling you the outcome of a discussion, reason is a process whereby ideas are linked together. This means that two people may arrive at completely opposite conclusions but still have developed perfectly rational arguments. (See the section 'Certainty' in the student book Chapter 1 (pages 3–7) for a discussion of logical/deductive processes.) It might help to distinguish between three very closely related concepts: 'reason', 'rational' and 'reasonable':

- 'Reason' is a noun referring to a faculty we possess to recognize certain relationships like consistency, entailment or contraction between ideas.
- 'Rational' is a description of an argument or a claim that is the result of some process of acceptable reasoning.
- 'Reasonable' is a way of talking about someone having reasons for their thinking. Because reasoning is a process, it is perfectly appropriate to say that someone has thought through an issue and developed an argument that is entirely reasonable, but whose conclusion I think is simply wrong. I may accept that you have reasons for a claim, and that your argument as a whole is 'rational', but I nevertheless disagree, because I disagree with your premises.

Therefore, do not imply that had someone used reason they would have come to one conclusion over another; that is only part of the picture. If they started from a different perspective, or used different premises, then they might have used reason perfectly well, but you simply do not agree with their starting points.

René Descartes (1596–1650)

Computational thinking

One form of critical thinking is computational thinking. This is a form of thinking that has been around a long time, but whose name conjures up modern computer technology. René Descartes, writing in the sixteenth century, offered something like an early form of computational thinking with his *Method*.

Writing in the *Discourse on Method* (Part 2), Descartes argued that there were four 'steps' for clear thinking:

> The first was never to accept anything as true if I did not have evident knowledge of its truth: that is, carefully to avoid precipitate conclusions and preconceptions, and to include nothing more in my judgments than what presented itself to my mind so clearly and so distinctly that I had no occasion to doubt it.
>
> The second to divide each of the difficulties I examined into as many parts as possible and as may be required in order to resolve them better.
>
> The third, to direct my thoughts in an orderly manner, by beginning with the simplest and most easily known objects in order to ascend little by little, step by step, to knowledge of the most complex and by supposing some order even among objects that have no natural order of precedence.
>
> And the last, throughout to make enumerations so complete and reviews so comprehensive, that I could be sure of leaving nothing out.

ACTIVITY

1. Project the quotation above, or make a handout for the students. A copy can be downloaded using the QR code on the left.
2. Ask students to summarize in their own words the four thinking steps that Descartes is suggesting we follow in order to arrive at reliable knowledge.

Although Descartes' wording is quite complicated, the idea is relatively simple. So simple it certainly doesn't seem groundbreaking, but Descartes was writing at a time when rhetorical debate, loyalty to tradition and application of theories despite the evidence was the norm (perhaps not so different from our own times, actually). Descartes' *Method* represents an attempt to start from the basics and work towards a theory, rather than take a theory and simply interpret the world through it. His *Method* might be summarized as follows:

1. Do not accept any beliefs unless they are certain (and not simply preconceptions for which you have no evidence).
2. Take challenging problems and break them down into their constituent parts.
3. Build larger ideas up by building on the simpler and more certain ideas.
4. Remain vigilant that you are not making logical errors or deviating from what is justified.

Descartes' ideas might be considered an early version of computational thinking. Computational thinking is a general strategy for thinking through challenging ideas, and includes steps which can be seen to relate to Descartes' method, namely:

- decomposition
- abstraction
- pattern recognition
- designing an algorithm. (Sheldon, 'What is computational thinking', Wing).

This form of thinking is something that we can program computers to do. We discussed the new phenomenon of 'big data' earlier. When presented with a massive data set, our programs are 'trained' to do just this sort of thinking in order to identify patterns and correlations that we could not have identified on our own.

CONNECTION TO: ASSESSMENT

To help them understand what these different stages mean, it might be worth asking students to consider how the stages might be applied to something practical like developing their TOK exhibition. The table below describes how this might be done.

Decomposition	**Breaking down a problem into constituent parts** Rather than worrying about the product, think about what steps need doing in order to reach your goal. Whereas thinking too much about the final product may cause stress or worry, thinking about and then tackling each individual element might feel like less of a steep climb. Applied to the internal assessment, these elements would include the following (not necessarily in this order): ■ Choosing one of the IA prompts. ■ Choosing three objects that you think can help you illustrate your thoughts on the prompt. ■ Considering each object and analysing it in a way that brings out an answer to the prompt, then writing up your commentary on the object. Finally: ■ Producing a single electronic document with images of the objects you've chosen, and their write ups, including any necessary citations or references.

Abstraction	**Stripping away elements of the issue that are irrelevant** During your analysis of one of the artefacts, you will need to 'abstract' from some of the specifics of the artefact in a way that provides an opportunity to discuss it in terms of what is most relevant. You might, for instance, choose a microscope from your school's science lab, but when you analyse it the specifics of that microscope are likely going to be irrelevant. You need to consider instead microscopes in general. We will also discuss a similar idea when we look at the notion of selection in developing an historical analysis: an historian must make decisions about what evidence is relevant to their initial inquiry. When asking about the events leading up to Hong Kong becoming a British colony, for instance, the historian might not need to consider genuine historical facts about most individuals living in Hong Kong at the time. Only some of the individuals will be relevant.
Pattern recognition	**Identify patterns within the data or information you are working with** As you work through the three objects that you are using for your exhibition, you might find that a particular theme comes up in each of them, or some similarities in your thinking about the objects appear. Recognizing these patterns is important. It is also important that you manage them properly – you must do something with the patterns. If the pattern is that you say the same thing for each object, then you are not adding anything by choosing each object; you have just said the same thing three times. However, if you recognize a theme across the objects and can articulate that relationship, while still bringing out different nuances in each object, then you are developing a coherent and integrated approach.
Algorithm	**Develop a set of describable and practical rules which you can follow in each instance** Perhaps you have found that each time you begin to analyse the objects, you follow a set series of steps that works for you. Maybe after choosing your object, you develop a brainstorm of relevant TOK-related ideas for it, then you compare those ideas to the prompt and strike out those that do not seem related. Then you take each in turn and try to answer it, reflecting on how well you get on. You again strike out those that you do not think you have answered well or have anything interesting to say about. Soon you are left with a single approach and then you develop that into a full answer

■ Algorithmic thinking

The last of our types of thinking inspired by the growth of technology is algorithmic thinking, and this might be the sort of thinking that is most closely related to computers. Algorithms are a series of rules or steps that are designed to lead to a defined outcome. Algorithmic thinking, then, is a process that follows a very specific set of rules leading to an outcome. This is different from computational thinking, in that computational thinking is the process that develops the rules. Computational thinking is breaking down a large problem, whereas algorithmic thinking relates to the development of rules which one follows when achieving a goal. The algorithm is the rules that have been designed to achieve the goal, whereas computational thinking is the working out of those rules. A student might, for instance, design a robot to 'do their homework'. Computational thinking will help them manage the overall project (deciding on what the robot is made of, whether it will hold a pen or learn to type, whether it will make little errors so the teacher won't know it wasn't the student, or whether it needs to be able to sit at the student's desk or will just be a boxy thing on their desk). Once they have worked out the details of the project using computational thinking, then they will design a program for the robot which meets one of the objectives.

If you have ever added a formula to a spreadsheet, you have created an algorithmic thinking process: you give the program a rule to follow and tell it what to do after that rule is followed. If, for example, you want to find out the sum of a series of numbers in a column you will use the formula (=SUM(A:A)). This tells the spreadsheet to do three things:

1 'Find column A.'
2 'Add up all the numbers in that column.'
3 'Write that number in this cell.'

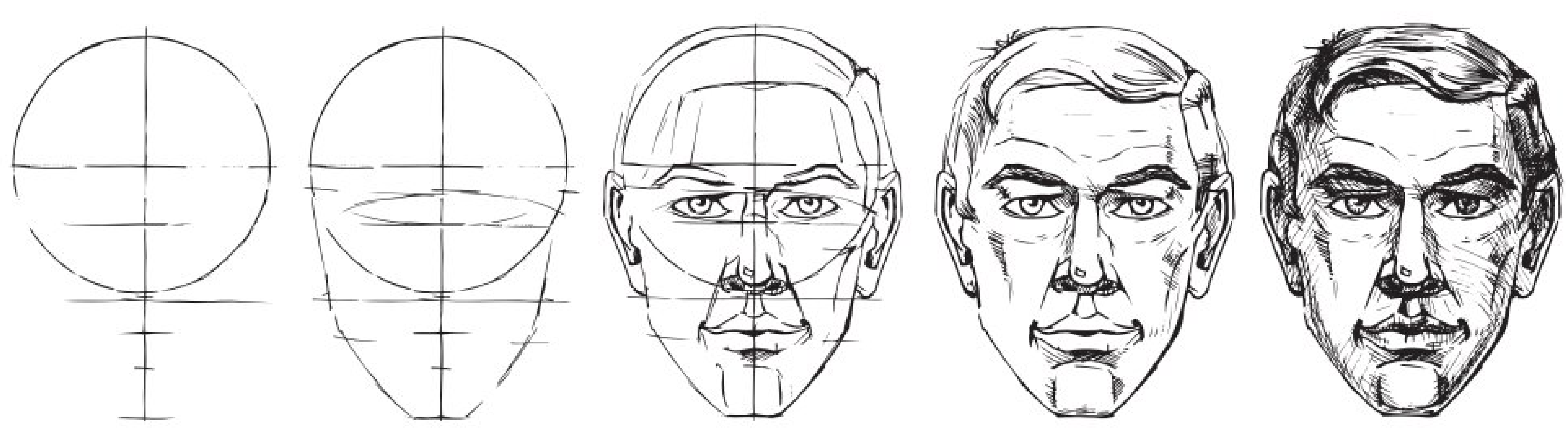
This is an example of algorithmic thinking. If it seems foreign to you, remember that we use algorithmic thinking all the time. Much of what we do in mathematics might be to use this sort of thinking. If we are asked to find the value of x in some equation, we will identify what sort of equation it is, then apply the rules we have learned to solve that sort of equation. A history teacher might have taught students a set of 'rules' to follow when analysing a new historical source. An art teacher might have taught students a set of steps to follow when drawing a face. We provide an algorithm every time we tell someone how to get to our house:

1 Take the 200 bus to Portsdown Road.
2 Walk west for 1.5 km.
3 Ring the bell outside house number 95.

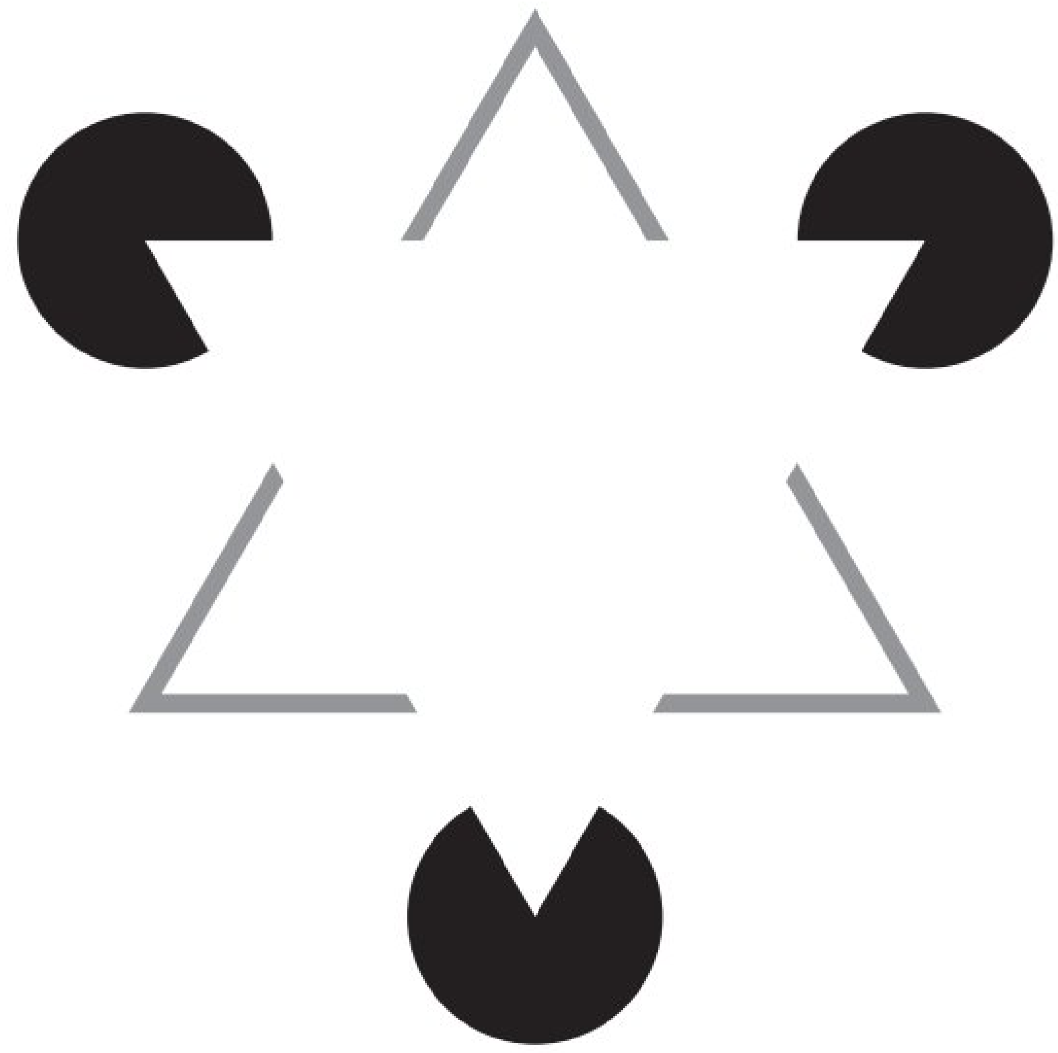
■ RESOURCE

A website containing links to many examples of algorithmic thinking can be accessed by using the QR code in the margin.

Another example of how we use algorithmic thinking is in the case of optical illusions. Our brains are incredibly complex, and the amount of information they process is huge. They filter all the information spilling into us via the senses and then relate that information with everything we have ever learned and all the memories we have ever had. In addition to this, our brain is in charge of the second-by-second maintenance of our bodies, including regulating body temperature, breathing and heart rates, digestion and a whole host of other processes needed to keep us alive. It is no wonder then, that our minds will apply algorithmic thinking to make little short-cuts in our thinking processes to speed things up.



While there is a lot of creativity in drawing, we might be able to follow a few simple steps, or an algorithm, to improve our drawing



The Kanizsa Triangle

The Kanizsa Triangle illusion is an example where the mind fills in the gaps. We expect to see full and complete objects in the world, so when the suggestion of an object is presented, our minds apply rules that are suited to completed objects and we perceive whole objects. In this case, we see a white equilateral triangle imposed on the top of three circles and a line drawing of another triangle. This is an example of an 'illusory contour' illusion and shows that we non-consciously apply 'rules' to our experience in order to help us make sense of the world, but that sometimes, those rules lead us into faulty perceptions.

■ Computer technology and thinking

The types of thinking we have outlined here can be used to explore the broader question of what we mean by thinking or knowing and whether computers can have it.

The question of whether or not computers follow rules is not controversial – they do – we call it their 'programming'. We would also suggest that following rules in our own case (as in following the rules/directions that lead us to a friend's house) is a form of algorithmic thinking. Some might even then say that computers can also demonstrate that sort of thinking – we might give the rules to an autonomous car and let the car 'find its way' to your house. This is like the case we make in the student book that by having been programmed with the rules of chess and programmed to follow those rules, a computer might be said to 'know how' to play chess. It follows the algorithms/rules and beats me every time!

But consider again the autonomous car. It is hard to say that the car is only following a set of rules that we gave it, any more than we only follow the directions when we follow directions to a friend's house. As we travel to the house we are faced with all sorts of obstacles and choices to make – watch out for the bus stop, take care crossing busy roads, avoid other pedestrians or physical obstacles in our path. Doing this is not a matter of following specific rules, but rather employing general strategies that can be applied when needed.

This is far more like computational thinking, where we must remain sensitive to what is happening around us and react accordingly. The autonomous car is doing the same thing, applying general strategies to avoid other cars, to stop at traffic lights, and wait for pedestrians to cross the road. No specific rule can be written for everything that could happen so the car has to be aware of the particular situation and then access and apply the general rules and strategies when needed. In other words, the car must break the current situation down into recognized patterns and events in the world around it and apply the relevant rules to manage the situation. So it seems that (some) computers can think computationally.

What isn't clear (yet) is whether computers can think critically. The critical thinker must remain aware of themselves as a thinker, 'watching' their own thinking processes, perhaps judging their own computational and algorithmic thinking, looking for where their thinking is taking them astray or infusing their thinking with new thoughts. This process might be thought of as more creative, imaginative and genuinely rigorous than the other forms. We say this because there is a far stronger element of choice in critical thinking than we might find in others, and it is this critically thinking through choices and options and evaluating them to see what is the most worthy option (as opposed to simply testing any number of options, like Deep Blue or AlphaGo might do) that we have yet to see in the world of artificial intelligence.

This knowledge question has provided us with an opportunity to distinguish between these different types of thinking in order to better understand just what we think our technologies are able to do and what we are able to do.

The creation, storage and dissemination of knowledge

This section of the student book attempts to break down the ways in which students might wish to discuss the impact of technology. Creating these types of distinctions helps students be more specific and effective in their arguments – a form of computational thinking perhaps?

ACTIVITY

1 For each of the AOKs, ask students to identify specific examples of how technology has impacted the creation, storage and transfer of knowledge.
2 Are some AOKs more affected by technology than others? Has the impact of the technology provided more reliability, or has it created more problems?
3 Students can create and complete a table like the one below.

AOK	Creation	Storage	Transfer of knowledge

Ethics

The ethics section of the student book focuses primarily on the ethical dilemmas posed by autonomous machines, looking at this in two ways:

- Machines which directly enact ethical choices made by their programmers – here we discuss the worries around facial recognition and autonomous war machines, outlining the problems associated with bias.
- Machines which are programmed to make their own decisions but which might need to make 'choices' – here we use autonomous cars as a test case, exploring the worries around which ethical principles get programmed into the cars for when they have to make decisions about courses of action.

LESSON PLAN: AUTONOMOUS CARS

Introduction

The issue being explored here has to do with the ways in which the technologies we develop will have our ethical codes and beliefs programmed into them. We can use this lesson as a way of challenging the notion that autonomous technology is somehow value-free because it is not being directly managed by human beings. The Moral

Machine website (see the QR link in the margin below) offers students a way of uncovering a variety of ethical intuitions by asking them to choose between scenarios having to do with autonomous cars driving through crossings and killing people.

> Philosophers use these 'hypothetical experiments' as a way of uncovering intuitions which then are analysed using the methods of philosophy.

There are three varieties of activity on the website:

- **Classic** – the classic trolley problem – perhaps a nice way of starting the conversation.
- **Judge** – in which you get 13 different scenarios and you choose, then get a break down of where you are in relation to others against a number of benchmarks.
- **Design** – where students get to design their own scenario.

> The trolley problem is a famous and incredibly engaging hypothetical experiment on which you can spend some time. Remember to keep focused on second-order analysis when you do discuss it.

Framework section

Ethics.

Aims

Students will:

- understand how human ethical values are reflected in some of the technologies we develop
- understand and reflect on their own ethical tendencies.

Objectives

Students will be able to:

- reflect on the choices they made
- construct ethical principles based on those choices
- evaluate their own ethical beliefs.

> The development of the principle will be the challenge, 'What principle have you applied in making this decision?'

Knowledge questions from the TOK subject guide

- Do established values change in the face of new knowledge?
- As knowers, do we have a moral duty to examine our own assumptions and biases?
- Should we hold people responsible for the applications of technologies they develop/create?
- In what ways have developments in science challenged long-held ethical values?

Relevant course concepts

Explanation, justification, objectivity.

Prior learning

None required. Some discussions around the values embedded in supposedly value-free technology might help set the context.

Required resources

Students will need individual devices to access the MIT website.

Activities

1. Walk through the classic scenario on the website in a plenary.
2. Students then run the 'Judge' activity on their own.
3. Students should evaluate the data, considering whether they are happy with the general trends that the activity has uncovered.
4. Students might then create their own scenarios to test the general trends that the activity uncovered and see if other students taking their version of the test would result in the same.

> Note that some of the scenarios might be a little insensitive.

The key take-home point from students' discussions about the 'game' is consideration of how ethical principles get 'programmed into' the machines, ie, the cars will have some individual's ethical beliefs programmed into them. Whose beliefs should those be?

Follow up

Students develop responses to the following questions and share with the class:

1. What general rules do you think you were following as you were judging?
2. Were you consistently applying that rule in each of the scenarios, or did you change your rule depending on the scenario?
3. What generalizations can you make about the nature of ethical rule-following based on the exercises?
4. What other problems do you see in terms of technology having to make ethical choices?
5. Do you think that the programmer should be responsible for any ethical choices that they programmed into the car? Why or why not?

Although this next activity is included in the perspectives section of the student book, we have moved it here to the ethics section in this book to highlight the ethical aspect of the issue.

The student book contains an activity prompting students to consider the ways they access the internet (page 91).

KNOWLEDGE QUESTION

Relevant knowledge question from the TOK subject guide:

- How might technology exacerbate or mitigate unequal access, and divide us in our access to knowledge?

The idea behind this exercise is to explore how much or what sort of knowledge is dependent on the students' access to the internet and what that access really depends on. The student book offers one example as a model. Here we offer a few more. Students will undoubtedly come up with others or examples like these. The idea behind the activity is to encourage the students to think about access to the internet as an ethical issue, but one which has ramifications for the type and variety of knowledge available to the individual. If technology provides access to the internet, then access to technology is important.

Possible discussion questions include:

- What new ideas or thoughts about your own individual access has this discussion raised for you?
- Would you say that your access is pretty much guaranteed?
- What would have to change for that access to be limited?
- What knowledge do you think is most dependent on your access to the internet?
- What would be the effects on your knowledge were you to lose your access to the internet?
- How easy would it be for nefarious governments or internet providers to alter the knowledge landscape by limiting access for some?
- Do you think that access to the internet is a fundamental human right? What arguments can you develop for both sides of this question?

Below is a version of the table included in the student book activity, filled in with some possible responses the students might give.

Ways in which you access the internet	Why are you able to take advantage of that access point?	What might limit your access to that access point?
School computers	■ I am enrolled in this school.	■ My school might not be able to afford to buy computers. ■ My family might not be able to afford to send me to school.
Handheld smartphone, iPad or other portable devices	■ I have enough disposable cash to invest in a smartphone. ■ I live in a community where such devices are available.	■ I might use too much data. ■ I might not be able to afford data charges. ■ I might not be able to afford expensive equipment. ■ I might break the device and not be able to pay for repairs.
Personal computer	■ I have enough disposable income to afford such things. ■ My community allows me to find suppliers (stores, internet delivery). ■ The infrastructure around me provides electricity and internet. ■ I have the time to learn how to use such tools.	■ I can't afford the internet/broadband provider (telecommunication companies). ■ Inability to buy expensive equipment.
Public computers (eg, in libraries)	■ I live in a community with a library with enough resources to afford computers. ■ I have a home address with which I can get a library card.	■ Political or social unrest might make libraries unavailable. ■ Social norms in my community might mean that I am reluctant to be seen going to libraries. ■ My financial situation might mean I have to spend my time working, rather than going to a library.
Other general considerations	■ Internet providers do not limit my access (eg, by requiring that I pay more if I want to access a certain amount of data or certain sites). ■ There is enough infrastructure to support internet access of people living in the area. ■ The local government is stable enough for the infrastructure to exist. ■ The local government is liberal enough to allow access (or some access) to the internet. ■ There is no civil unrest (eg, war).	■ Generally there are many financial, social, political and environmental reasons why one's access to the internet might be curtailed.

Conclusion

The role of technology has always been something TOK teachers could explore, if they wanted to. Traditionally it has been managed as part of the discussions surrounding the methodology of the AOKs. With its inclusion now as one of the optional themes, we have the opportunity to devote more thought to how technology influences the construction of knowledge. There are a lot of opportunities here, including what we mean by knowledge, what sorts of things we now can know and what sorts of political and ethical dilemmas our technologies are driving us toward. As technology develops and becomes further embedded in our lives as knowers, we may find it more and more difficult to distinguish between our knowledge and our technological system's knowledge. We have always accepted that we stand on the shoulders of giants when it comes to knowledge. How much farther will we be able to see when we climb up to stand on the top of our servers?

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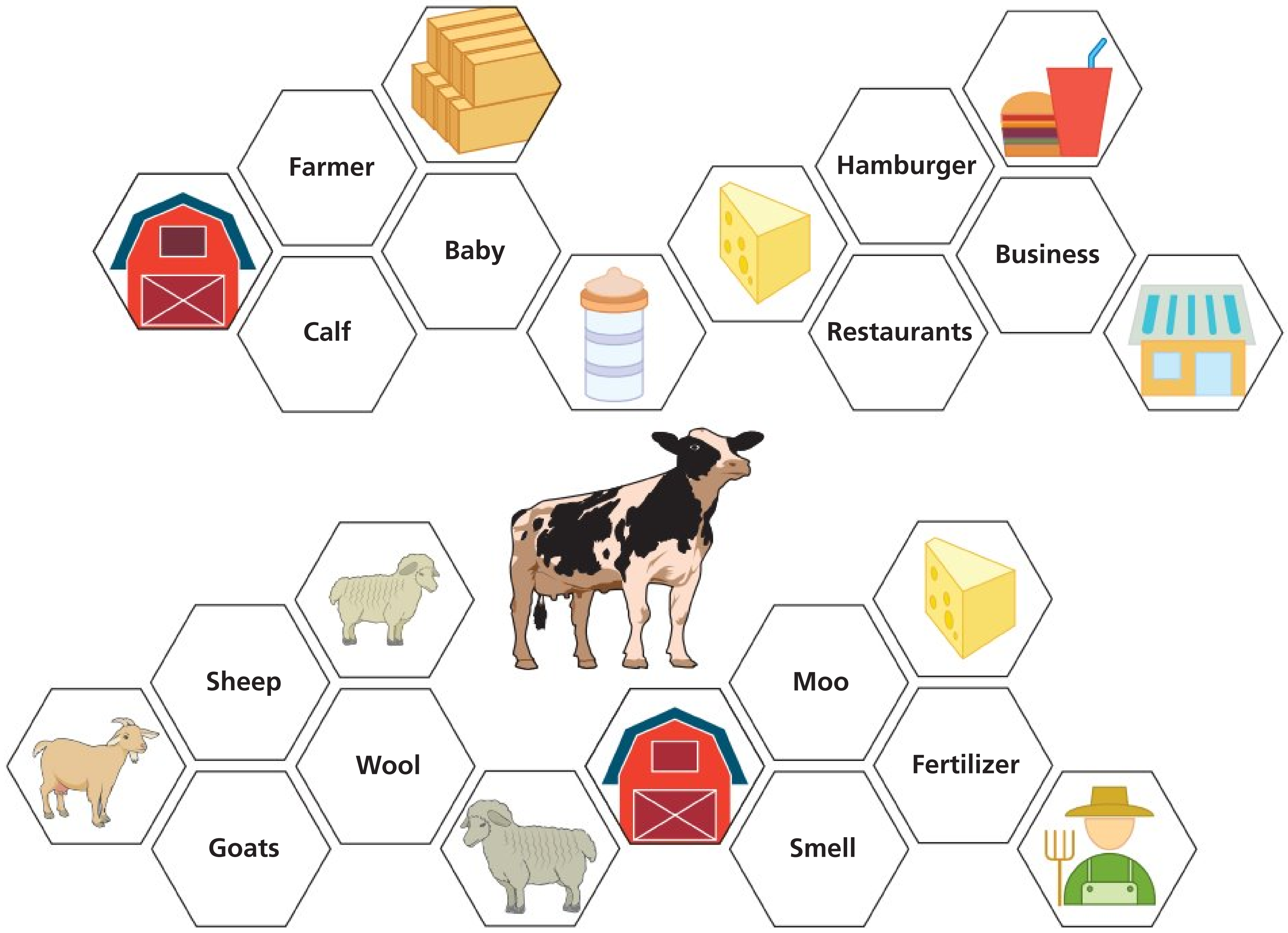
Another interesting activity to help them understand the complex nature of words and our knowledge is to have students pick a single word (nouns work well for this) and then create a mind map showing as many associations as possible with that single word. Here is a partial example of what such a mind map might look like:



An important understanding to be derived from this activity is the degree to which our concepts are intertwined with many other concepts, as well as the understanding of how personal, and how culture-bound, our language is. If all the students in the class were to do a mind map based on the same concept (such as, for example, 'cow'), the mind maps would all be different because they would include different connections. People with a great deal of experience with cows might have a whole series of associations having to do with cow behaviour – when they kick, how they behave when they have calves, what they like to eat, how they react to being milked and so on. Someone who has only seen cows from a relative distance would have different associations. Someone whose grandmother loves cows and has her whole kitchen decorated with cows would have different associations still. Someone from India, where cows are believed to be sacred, would have a set of associations quite different from those of someone who lives in the country near a cattle rancher. The word 'cow' is often used generically for all cattle, despite the fact that it has a specific meaning, so some people will associate 'cow' with steers and calves. 'Cow' is even sometimes used as an insult to describe people one doesn't like. And so on.

Scope

KNOWLEDGE QUESTIONS

Relevant knowledge questions from the TOK subject guide:

- Can all knowledge be expressed in words or symbols?
- Is it possible to think or know without language?

The longest part of the section on the scope of language in the student book is a discussion of what constitutes language. The chapter explains, in some detail, 6 of the 13 features of language described by Charles Hockett in his 1960 article, 'The Origin of Speech', published in *Scientific American*. The chart on the next page summarizes briefly the six features covered in the student text, as well as the seven features which the student text does not include. If you wish to delve more deeply into the definition of language, you can use the QR code on the left to access the original article. The blue items on the chart are those which feature in the student book.

Feature	Description
The first six of these features in particular pertain to the oral transmission of language.	
Vocal-auditory channel	Language is transmitted through physical features which constitute the vocal/auditory system: vocal cords, throat, ears, etc. This eliminates transmissions through systems such as the honeybee dance or body language. This feature is problematic for sign language, however.
Broadcast transmission and directional reception	This feature has to do with the physics of the physical features of language production. Ears can pick up sounds broadcast within range of the ear's capacity to hear.
Rapid fading (transitoriness)	This feature, too, relates to the physics of sound: the waves do not linger in a particular area, so the ear has to pick them up rapidly.
Interchangeability	This feature of language describes the fact that the listener and the hearer can both produce any language which each can understand. This contrasts with some animal species, in which the messages that males are capable of transmitting are different from messages that females are capable of transmitting.
Total feedback	This feature also describes a fact of the physical transmission of language: the speaker can hear everything that he or she transmits. This feature allows for what Hockett calls 'internalization' of language: the ability to think in words.
Specialization	'Specialization' describes the fact that the capacity to spread sound waves serves no biological purpose other than the production of signals.
Semanticity	There is an established and stable relationship between the sound and the meaning.
Arbitrariness	The relationship between sound and meaning is arbitrary; that is, the sound doesn't in some way resemble the thing it represents. (In literature, the term onomatopoeia describes the relatively few exceptions to this general rule.)
Discreteness	The differences between different sounds and their associated meanings are small, but absolute. For example: the words 'three' and 'tree' mean entirely different – and unrelated – things, even though the difference between the initial 'tr' sound and the 'thr' sound is very small.
Displacement	Language can be used to talk about things which are distant from the speakers/writers in time and space.
Productivity	Language can be used to generate an infinite number of utterances (or written sentences), which means that language can be used to express ideas or observations which have never been expressed before.
Traditional transmission	Language is transmitted from generation to generation by teaching, rather than through genetic encoding.
Duality of patterning	A small number of letters or sounds can be used to generate a huge number of words and sentences.

The discussion in the student book tests several different potential 'languages' against the six features in blue above, and determines that of them, only mathematics has a full-blown language. If, however, we were to test those systems against all 13 of Hockett's features, we would find that none of them could be called a language. It is worthwhile noting, then, that Hockett's definition might seem too limited for the purposes of determining how language is used to disseminate knowledge. It is not useful to try to define 'language' as anything which conveys meaning – a slap across the face could certainly convey meaning – so students might discuss which of those features are necessary to call something a language.

CONNECTION TO: THE ARTS

One of the examples of something which might be considered to be a language is a Dutch still-life painting, shown in the student book (page 121). That painting relies on some standard symbols which would have been readily recognized by viewers of the culture in which the paintings were created. Much art uses symbols which have commonly recognized meanings. Thomas C. Forster's book, *How to Read Literature Like a Professor*, details a number of symbols that are recognizable by skilled readers of western literature.

The IB Language A: Language and Literature course includes visual art, such as photographs and paintings, as a non-literary text type. They are included in the course, in other words, under the 'language' part of the course curriculum. An interesting activity, especially if you have students in your TOK class who are taking Language and Literature, is to provide them with some additional visual texts (from genres other than Dutch still life) and ask them to consider how they can be interpreted as language, and what features of language they exhibit.

The following images come from a set of images in the public domain in the United States Library of Congress. All three of these images come from classic Japanese art.

Image 1

Title: Senju no oubashi

Summary: View of the bridge of Senju crossing the Sumida River, with mountains in the background.

Contributor names: Andō Hiroshige (1797–1858), artist

Created/published: 1856

Image 2

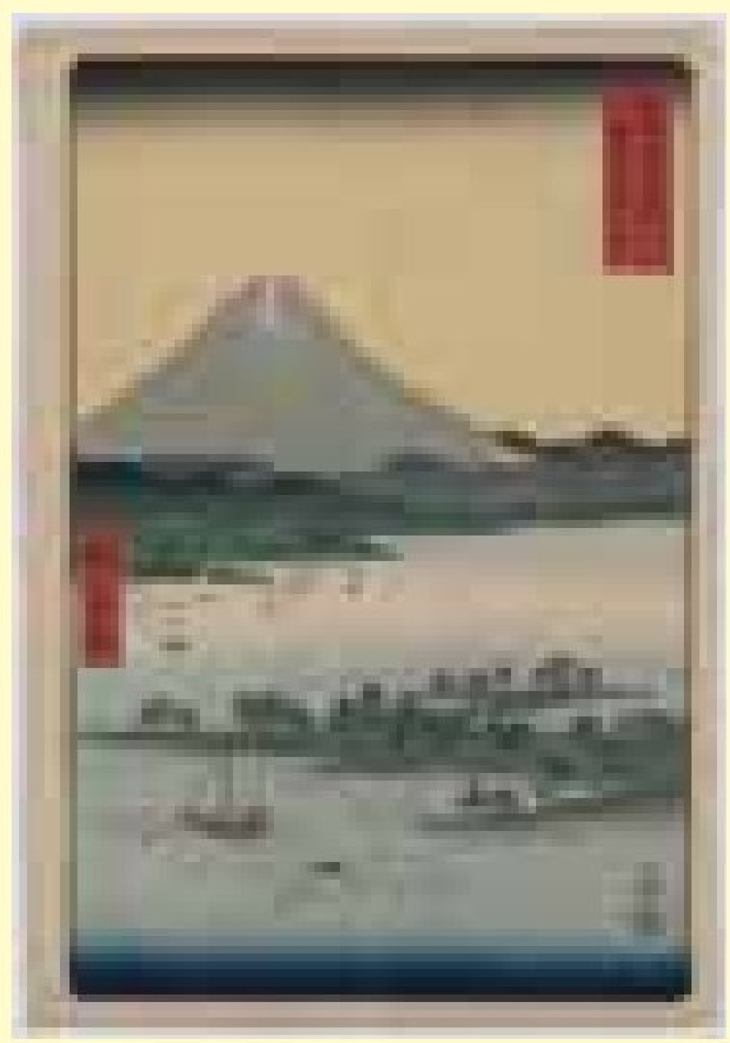
Title: Hanami zuki

Summary: Print shows two women and a child outside a building with cherry trees in blossom.

Contributor names: Torii Kiyonaga (1752–1815), artist

Created/published: Between 1785 and 1789

Image 3



Title: Suruga miho no matsubara/ Hiroshige-ga

Summary: Japanese print shows a view of Mount Fuji with a pine grove on a promontory in the Suruga Bay surrounded by sailboats.

Contributor names: Andō Hiroshige (1797–1858), artist

Created/published: 1858

Some questions that students could consider in aid of determining the 'language' of this artwork might be:

1. What are the features of these images which mark them as the work of Japanese artists?
2. The IB Language and Literature course considers visual art to be eligible for study as part of the 'non-literary' (or language texts). What features of these artworks might be considered to be units of a 'language'?
3. If these images have a language, what message do you think that language is conveying?
4. How many of the (6 or 13 or other, depending on what you assigned students) features of language that we explored earlier in the chapter does the 'language' of these images display?
5. If these images are language, does 'language' mean the same thing in Theory of Knowledge as it does in the Language and Literature curriculum? How do we differentiate between recognizable communicative elements and language?

You can see more public domain photographs on the US Library of Congress website by using the QR code.

This activity could also be done during the part of your course when students are exploring the arts as an area of knowledge.

In the student book, Hockett's definition of language is contrasted with a different idea of how to define language, by offering a viewpoint from evolutionary biology which considers the cognitive skills needed for language to be part of the understanding of what language is.

Beginning on page 114 of the student book, the chapter delves into the question of what we know when we know a language (or languages). One of the main focuses is on vocabulary, and the chapter makes the point that knowledge of a wide-ranging vocabulary enables the speaker (or listener) to communicate in a more nuanced way than can be effectively done with a small vocabulary. It also makes the point that some words which seem similar actually convey quite different meanings if the speaker and listener (or writer and reader) know the words. There is an activity on page 125 of the student book which directs students to look up the precise meanings of some pairs of easily confused words and then to write sentences which display those subtle differences.

You can expand that activity by using a list such as the one linked to by the QR code on the left. A fun variation on the activity is to have students write comedic skits in which the words are misused so that either the speaker OR the listener (but not both) misinterprets what is being said.

TEACHING TIP

Sometimes, when an activity is a lot of fun, it can be easy for students to lose sight of its relevance to the TOK curriculum. In this case, after the skits are presented, it will be important to ensure that the students reflect on what the skits revealed about the relationship between language and knowledge.

Perspectives

The student book approaches the question of perspectives with regard to language and knowledge by considering the ways in which a particular language relates to or shapes a view of the world. That approach entails, primarily, a consideration of the relationship between language and culture.

Language and knowledge of the outside world

KNOWLEDGE QUESTION

Relevant knowledge question from the TOK subject guide:

- To what extent does language allow us to make our private experiences public?

One thing that we know through the use of language is what is in other people's minds. Communication through language is one of our most basic mechanisms for transmitting knowledge from one person to another and one generation to another. The first thing that we learn through language is language itself. We come to understand what others mean by a word such as, for instance, 'table' or 'cat', by hearing people use those words to refer to objects in particular contexts. As we saw in the section on defining language earlier, language is arbitrary. When we learn language, then, we are learning arbitrary connections between written letters and spoken sounds and objects and ideas. The learning of language, in its most basic function, gives us the knowledge of what other people call things.

TEACHING TIP

As students begin to understand the arbitrary nature of language, they sometimes get caught up in the interesting, but ultimately misguided, idea that because the connection between words and ideas or words and objects is arbitrary, the language might not actually accurately represent what is in other people's minds. A favourite example for this argument goes like this:

- I call the sky blue.
- You call the sky blue.
- But just because we both have the same word for that colour does not mean that we both have the same internal mental experience.
- Maybe what I see in my mind when I use the word 'blue' is not the same as what you see. Maybe what you see is what I would call orange, but you call it blue because you were taught to call that colour blue.

While this argument does reveal that the student is beginning to understand the concept of the arbitrariness of language, it also reveals a rather serious misunderstanding of science. Science has long since mapped out the function of the human eye and how it translates light bouncing off objects into internal mental experience. So long as the student's eye is a biologically average instrument, what that student experiences as blue is the same as all other students who have eyes which function in biologically average ways. Someone who is colour-blind will, in fact, experience something different from what most people experience, but the difference, in that case, between that person's internal mental experience and the average person's internal mental experience is explicable in scientific terms.

Language and culture

The opening section on perspectives in the student book begins with a discussion of how many languages there are in the world. Before asking students to read this section, you may wish to ask them to indicate how many languages they think are spoken in the world and in their own country. Probably most students will guess a number quite a bit lower than the actual number of languages in the world. They can then use the QR code provided in the margin and the student book to explore an interactive map of the world to find out how many languages are actually spoken in their country or their family's country of origin.

KNOWLEDGE QUESTIONS

Relevant knowledge questions from the TOK subject guide:

- What knowledge might be lost if the whole world shared one common language?
- If a language dies, does knowledge die with it?

How language reveals culture

There is an activity in the student book (page 129) which asks students to think of an object which is significant in their culture, and to consider all of the knowledge of that culture associated with the object, as well as the cultural values related to the object. You can extend this activity by having students share their objects and their thoughts with each other after they complete the activity individually. This activity should help students to understand how, in their personal experience, the name of something entails a great deal more than the simple identification of that object, and that knowledge of any given word consists of a rich network of understanding. This activity is similar to the one suggested above (and illustrated with the mind map surrounding the cow) but takes the exercise one step further by asking students to focus specifically on the influence of culture on knowledge of language.

KNOWLEDGE QUESTION

Relevant knowledge question from the TOK subject guide:

- Do people from different linguistic or cultural backgrounds live, in some sense, in different worlds?

RESOURCE

An excellent resource for exploring the relationship between language and culture and the power of culture to shape our beliefs, values and attitudes is the commercial game *BaFa' BaFa'*. You can read about it and purchase it using the QR code on the left.

The simulation places students into two (non-existent) cultures, each with its own language and economic practices. The groups work separately to learn their culture's rules, and then visitors from each culture go to engage with the other (but with no knowledge of what the other culture's values and practices are). The visitors report back to their own group. The simulation provides instructions for debriefing the students after the game is over. Typically, you can expect to observe that students will form powerful attachments to their (invented!) culture's way of doing things and will also form stereotypes about the other culture's language and practices. Among many other TOK-related concepts, *BaFa' BaFa'* can help provide students with insights about how language conveys meaning and culture, as well as how we form stereotypes around other people's language.

A final case study in the student book for considering the relationship between language and culture is the discussion of Kuuk Thaayorre, a language of the Pormpuraaw people on Cape York in Northern Australia (see page 130). Before students read that section of the chapter, you may wish to have them answer the questions in the section 'Language mapping the world' on page 129 of the student book, which ask them to discuss where things are, relative to their current position. Most students will likely find the last three questions a good deal harder to answer than the first three. They should then discuss why that is.

Having completed this short activity, students will be well prepared to understand the differences between their own perspective and the perspective of the Pormpuraaw people, in terms of how we orient ourselves in time and space. There is a podcast from *Radiolab* in which this particular feature of language is discussed in some detail, which you can access using the QR code on the left. The relevant segment begins at 11:55.

CONNECTION TO: THE CORE THEME

All of the activities which ask students to consider their own personal experience and knowledge before engaging in an investigation of how other people experience the world are activities which connect to the core theme. One of the vital functions of the core theme in the course is to help students to recognize their own perspective in a variety of situations relative to knowledge and knowledge generation. This is because understanding where they got their own habits of mind should better prepare them to understand that other people with different habits of mind have equally reasonable bases for those perspectives.

Language and the transmission of knowledge

One aspect of different perspectives in language which was not raised in the student book is the question of the role of language in conveying knowledge from one person to another and from one generation to another.

KNOWLEDGE QUESTION

Relevant knowledge question from the TOK subject guide:

- Does the transmission of knowledge from one person or generation to another depend on language?

This question essentially tries to get at the idea that the knowledge that we have alters our perspective on the world. If people from one generation do not have the same knowledge that the people of another generation have or had, then they would naturally have a different worldview. The question is, then, if language plays an important role in conveying that knowledge, does it also, therefore, play a role in sustaining a particular perspective?

ACTIVITY

To help students explore this question, ask them to undertake one or more of the following activities:

1. Make a list of words which have been invented in the last 10 to 20 years. What knowledge reflected in these words do you think you have that your parents don't have? (If students are stuck, you could suggest to them that developing technology is a great place to go looking for new vocabulary. Contemporary slang also likely differentiates the students' vocabulary from their parents'.)
2. Ask students to investigate the most recent list of words added to the Oxford English Dictionary. You can use the QR code on the left to see the list for March 2019. This particular list has some words which are new and some words which are not new, but which had not been included in the OED before. Choose a similar list. Ask students to choose say three or four of each type of word and then, working in groups or with a partner, discuss the reasons for the words being added to the dictionary at this point in time. What change in cultural values, technology, politics or other influence might have led the editors of the OED to feel that the word needs to be given the kind of official status that the OED confers?
3. Ask students to consider the role of the dictionary in 'legitimizing' words. Who decides what words belong in the dictionary? Does inclusion in a dictionary – especially one as established and renowned as the OED – confer some kind of

cultural standing to a word? How does a dictionary such as the OED contrast to a dictionary such as the online Urban Dictionary (use the QR code on the left for a link) in terms of reflecting the culture in which the words have arisen? Do the two dictionaries, with origins in different generations (the Oxford English Dictionary was first published in 1884; the Urban Dictionary in 1999), reflect different worldviews? (This activity can be used in conjunction with or instead of activity 2.)

4 Ask students to consider something that they have been taught recently – a topic from one of their IB Diploma courses would be a good choice for this activity. Students should work out a way to try to teach that same topic to someone else without using any words. Students should pair up with another student and try to teach each other those topics without using any words. When they are done, they should reflect on how well the teaching and learning went, and on how different the knowledge of the second student is for having been taught without the use of words.

Translation

KNOWLEDGE QUESTION

Relevant knowledge question from the TOK subject guide:

- Do professional interpreters and translators have any special ethical obligations?

A final important topic for consideration with regard to perspectives is the effect of translation from one language to another. The student book makes the point that reading something in translation means that the reader does not have access to the knowledge being conveyed in that text exactly as it was originally written and intended. Students can experience this directly by you asking them to translate something from their native language to the Language B they are studying. You could involve the Language B teachers in helping to assess the effectiveness of the translation. Another possibility is to have students read the same text in English and in the language of their Language B class. Here is an example from the 2015 TOK subject guide. The texts are the same paragraph from page 8 in English, French, and Spanish.

English

Knowing about knowing

TOK is a course about critical thinking and inquiring into the process of knowing, rather than about learning a specific body of knowledge. It is a core element which all Diploma Programme students undertake and to which all schools are required to devote at least 100 hours of class time. TOK and the Diploma Programme subjects should support each other in the sense that they reference each other and share some common goals. The TOK course examines how we know what we claim to know. It does this by encouraging students to analyse knowledge claims and explore knowledge questions. A knowledge claim is the assertion that 'I/we know X' or 'I/we know how to Y', or a statement about knowledge. A knowledge question is an open question about knowledge. A distinction between shared knowledge and personal knowledge is made in the TOK subject guide. This distinction is intended as a device to help teachers construct their TOK course and to help students explore the nature of knowledge.

French

La connaissance sur la connaissance

Le cours de TdC demande aux élèves de mener une réflexion critique et de réfléchir sur le processus cognitif plutôt que d'apprendre un ensemble de connaissances spécifiques. Tous les élèves du Programme du diplôme doivent suivre cette composante du tronc commun et tous les établissements doivent lui consacrer au minimum 100 heures de cours. La TdC et les autres matières du Programme du diplôme doivent se soutenir mutuellement, en ce sens qu'elles doivent faire référence les unes aux autres et avoir des objectifs communs. Le cours de TdC amène les élèves à examiner comment nous connaissons ce que nous affirmons connaître. Pour ce faire, il les incite à analyser les assertions et à explorer les questions sur la connaissance. Une assertion est une affirmation telle que « Je connais (nous connaissons) … » ou « Je sais (nous savons) comment … », ou une affirmation sur la connaissance. Une question sur la connaissance est, quant à elle, une question ouverte sur la connaissance. Le présent guide établit une distinction entre les connaissances partagées et les connaissances personnelles. Cette distinction a pour but d'aider les enseignants à concevoir leurs cours de TdC et les élèves à explorer la nature de la connaissance.

Spanish

Conocimiento sobre el conocimiento

TdC es un curso dedicado al pensamiento crítico y a la indagación sobre el proceso de conocer, en lugar de al aprendizaje de un conjunto especifico de conocimientos. Es un elemento del núcleo que todos los alumnos del Programa del Diploma deben cursar, y al que todos los colegios deben dedicar un mínimo de 100 horas de clase. Debe existir un apoyo mutuo entre TdC y las asignaturas del Diploma, es decir, deben hacerse referencias entre ellos y deben compartir objetivos comunes. El curso de TdC examina cómo sabemos lo que afirmamos que sabemos. Con este fin, anima a los alumnos a analizar las afirmaciones de conocimiento y a explorar preguntas de conocimiento. Una afirmación de conocimiento es la aseveración de que "yo sé/ nosotros sabemos X" o "yo sé/ nosotros sabemos cómo hacer Y", o un enunciado sobre el conocimiento. Una pregunta de conocimiento es una pregunta abierta sobre el conocimiento. En la guía de TdC se diferencia entre el conocimiento compartido y el conocimiento personal. Esta distinción tiene por objeto ayudar a los profesores a construir sus cursos de TdC y ayudar a los alumnos a explorar la naturaleza del conocimiento.

Students can compare versions and discuss the ways in which they differ.

Note: at the time of writing this book, the 2022 TOK subject guide had not been translated. You may wish to use that guide instead; you can access the different language versions on the Programme Resource Centre (PRC).

The student book discusses the example of professional interpreters and the kinds of decisions that they have to make as they interpret.

KNOWLEDGE QUESTION

Relevant knowledge question from the TOK subject guide:

- Are there differences in how knowledge itself is conceived of, or presented, in different languages?

RESOURCE

One excellent additional resource for considering how content changes along with language in a translated text is the *New Yorker* article 'Lost in Translation', by Ryan Bloom, which discusses the translation of the first sentence of Albert Camus' *L'Etranger.* Bloom discusses in detail the subtle and important changes to Camus' intentions which result from the different translations of the very first line of the novel. You can access the article using the QR code in the margin.

Methods and tools

Learning language

The section on methods and tools in the student book focuses on two primary topics: the methods by which we go about learning language and the way in which we use language as a tool for acquiring and disseminating other knowledge. In terms of how we learn our native language, the primary method, at least for learning colloquial speech, is immersion and mimicry of those around us. It is worth asking students to consider the fact that while all humans are born with the biological ability to learn a language, people are not born with any biological predisposition to a particular language. We all learn to speak natively the language of the place in which we were born – or at least in which we were raised during our early language-developing years. This fact raises the interesting question of why it tends to be so much more difficult for most people to learn a second language, or any language begun after early childhood.

RESOURCES

Some good resources for exploring the topic of how humans learn language are *The Language Instinct* by Stephen Pinker and *How Language Works* by David Crystal. These books are listed in the Works cited page for this chapter.

Power of language

An important point which is made in the student book about how we learn our own language is that there is a significant difference between learning to speak the language of everyday casual interaction and learning to speak (and write) sophisticated, compelling, persuasive and even profound language.

An activity which can help students to understand the importance of developing enough skill with language to be both clear and accurate is to take ungrammatical or unclear sentences from student papers – one from each paper is a good idea – and put them on slides in a PowerPoint presentation, one sentence per slide (with the names removed). Broadcast the slides and have students discuss what the sentences actually say as opposed to what the writer actually meant. On the next page is an example of the kind of thing that is useful for this activity.

> Both choices held women back from doing what the wanted to do and looked down upon.

This sentence actually refers to the Sylvia Plath poem 'Two Sisters of Persephone', which is discussed starting on page 109. The sentence is reproduced exactly as a student wrote it, including the spelling error. Having students take an objective look at a variety of badly constructed sentences such as this one can be an eye-opening experience about the importance of accuracy and clarity.

Beyond the ability to communicate clearly, the ability to communicate effectively is an important kind of skill to learn. The activity on page 135 in the student book, involving the Sullivan Ballou letter, can be extended for a consideration of the importance of being able to use language in a way that moves others. Ask students to 'translate' the Sullivan Ballou letter into a tweet or a text message. They can then discuss what was lost and what was gained by the dramatic change in the form of the language used to express the sentiments.

The student book makes a connection between this latter kind of language and power – the power we have to convince others to see things our way and the power we have to keep ourselves from being swayed by others who would manipulate our thinking.

■ RESOURCE

An excellent resource for exploring the relationship between social and political power and language is Robin Lakoff's book, *The Language War*. The source is listed on the Works cited page for this chapter.

How is language used to influence us?

KNOWLEDGE QUESTIONS

Relevant knowledge questions from the TOK subject guide:

- In what ways can language be used to influence, persuade or manipulate people's emotions?
- Is ambiguity a shortcoming of language that must be eliminated, or can it also be seen as making a positive contribution to knowledge and knowing?

SAMPLE RESPONSE TO A KNOWLEDGE QUESTION

Is ambiguity a shortcoming of language that must be eliminated, or can it also be seen as making a positive contribution to knowledge and knowing?

There are many ways in which a speaker or writer can fail to be clear, and ambiguity is one of those. Ambiguity occurs when a sentence is constructed in such a way as to allow for two different meanings. Consider, for example, this sentence:

> The owner tried to catch the cat in the hat.

That sentence can be read two ways: either the cat is wearing a hat, and the owner was trying to catch the cat which was wearing a hat, or the owner has a hat in her hands, and she is trying to catch the cat by using the hat as a sort of net. Another example of this sort is this sentence:

> I called the animal control department to ask for tips about the bear. He said he was looking for food.

In the second sentence above, the two occurrences of the pronoun 'he' is ambiguous. The only grammatically identifiable antecedent for the 'he' in the first sentence is 'the bear'. But if we take the bear to be the antecedent, then the second sentence says that 'the bear said that he was looking for food', which of course does not make sense.

Much ambiguous language, such as the two examples above, does function as a shortcoming of language that ought to be eliminated. This kind of ambiguity can result from at least two identifiable sources: either a speaker or writer does not have sufficient command, or did not take sufficient care, to ensure that what is said is unambiguous. The example of the cat in the hat above is an example of this type – confusion has been created accidently because the speaker wasn't careful enough to organize the sentence so that it would be unambiguous. The other situation in which language is ambiguous is the situation in which a speaker or writer is deliberately ambiguous in an effort to obfuscate meaning. Imagine that a boss was asked to write a letter of recommendation for a very unsatisfactory employee, but she (the boss) did not want to be blamed later for causing that employee to fail to get another job. She might include some sentences such as these in her letter:

> When Maxwell left my employment at the end of last year, I was quite satisfied. If you can get him to work for you, you will be lucky.

The first sentence seems to say that Maxwell was a satisfactory employee, but it can also be read to mean that the employer was satisfied that Maxwell was leaving. The second sentence can be read to say that the new prospective employer will be lucky to get Maxwell as an employee, but it can also be read to mean that if Maxwell is hired in the new job, the new employer will have to be lucky to get any work out of him. This type of ambiguity is perhaps a bit morally questionable, as it deliberately avoids telling the truth.

Ambiguity can, however, serve a positive function, especially in the context of the arts. While many writers strive for control over clarity in their writing (journalists, historians, students in school, anyone giving directions), artists, including novelists and poets, use language in much more indirect ways, communicating through figurative structures such as symbols and metaphors or other deliberately indirect uses of language. In her poem 'Two Sisters of Persephone', for example, Sylvia Plath set up an ambiguous phrase in order to encourage the reader to a useful and enlightening misreading of a line.

The poem is about two sisters who live strikingly contrasting lives. One is a mathematician who sits indoors and does a job traditionally undertaken by men. The cost to her is any chance to develop her more womanly attributes as well as the chance to experience a more traditionally womanly life with marriage and children. The other sister takes on the traditional role, marries and has a son, but the cost to her is any chance to develop or use her intellectual capacities and to contribute knowledge to the world in a meaningful way. She becomes, essentially, a body for bearing children in order that her husband's genetic line may continue to the next generation. Here is the poem:

Two Sisters of Persephone

Two girls there are: within the house
One sits; the other, without.
Daylong a duet of shade and light
Plays between these.
In her dark wainscoted room
The first works problems on
A mathematical machine.
Dry ticks mark time
As she calculates each sum.
At this barren enterprise
Rat-shrewd go her squint eyes,
Root-pale her meager frame.
Bronzed as earth, the second lies,
Hearing ticks blown gold
Like pollen on bright air. Lulled
Near a bed of poppies,
She sees how their red silk flare
Of petaled blood
Burns open to the sun's blade.
On that green altar
Freely become sun's bride, the latter
Grows quick with seed.
Grass-couched in her labor's pride,
She bears a king. Turned bitter
And sallow as any lemon,
The other, wry virgin to the last,
Goes graveward with flesh laid waste,
Worm-husbanded, yet no woman.

The enjambment between the sixth and seventh stanzas creates an intentional ambiguity. By putting the phrase 'turned bitter' at the end of line 24, Plath has created in the reader the mental experience of thinking that that phrase refers to the sister who has been pregnant and borne a child. Grammatically, however, the phrase 'turned bitter' is the opening of the next sentence, which runs from the end of line 24 to the end of the poem at line 28, and which is actually about the other sister, the one who worked as a mathematician and never married. Readers of the poem can figure out pretty quickly that the grammatical structure overrides the effect of words appearing in the same line. However, the temporary ambiguity accomplishes the job of making the readers see both sisters as bitter and unhappy. This shared bitterness is part of Plath's point: neither of the two options open to women is likely to make them happy. One must serve as a breeding object for a man; the other is treated as a man and not valued for her womanhood. Writing in the 1950s, Plath was commenting on the narrowness of choices available to women at that time.

The use of ambiguity in this poem can be seen as being both deliberate and as making a positive contribution to knowledge: by recognizing the ambiguity, we better understand Plath's purpose.

An answer to the knowledge question of whether ambiguity must always have negative consequences is no – there are situations in which an ambiguity can actually open up someone's thinking about a particular idea. That use of ambiguity, however, is going to be most effective in the context of the arts, because the arts provide us with an opportunity in which indirect communication is desirable. In situations in which we want to ensure clear understanding and precise communication, ambiguity is to be avoided.

Note: As always, this exploration of the knowledge question provides only one person's response. Other approaches, ideas, and examples are certainly possible, and students should not be encouraged to think that there is ever only one answer to a knowledge question. One of the definitions of a knowledge question, indeed, is that it is open ended. This exemplar response did not take into account such things as whether there are contexts other than in the arts in which ambiguity might be helpful in terms of generating knowledge. Although it mentioned in passing the question of the ethical ramifications of ambiguous language, it did not explore that issue in depth. Another idea which was not explored is the idea that perhaps there might be times when, because it is kinder, ambiguity ought to be used in order to spare someone's suffering. One important thing to notice, however, is that the response to the knowledge question was complex. The writer did not settle for an all-or-nothing kind of answer; they acknowledged that the answer to the question is different in different situations. That complexity is likely to be needed in the response to any knowledge question that your students investigate throughout the year and should be present in their essays and exhibitions.

Learning a second (or other additional) language

If you wish to have students explore the differences between learning one's native language(s) and learning foreign languages later (after early childhood) you can draw on students' experiences with their Language B subject. The activity on page 137 of the student book asks a series of questions that help students to think through that experience.

What we know through language

The first question which is considered in the TOK subject guide has to do with whether there is any kind of knowledge which cannot be conveyed through language.

KNOWLEDGE QUESTIONS

Relevant knowledge questions from the TOK subject guide:

- Is it the case that if we cannot express something, we don't know it?
- To what extent does language allow us to make our private experiences public?

Language and truth by authority

In the Course Concepts chapter of this book, we explored the nature of five truth tests (see pages 34–35). The student book does not mention the concept of truth by authority; however, the discussion here does explore the ramification of the conditions under which a society has given certain people or groups authority to make things so, simply by declaring them to be so. Truth by authority is essentially the result of an act of language – written and/or spoken – and reflects the power of human beings to control certain aspects of reality.

This concept is a particularly important one, because it underlies the need, in the sciences and in history, for findings to be checked by other experts before they are accepted as knowledge. The reason for this is that in those areas of knowledge, the professional practitioners are trying to discover and reveal to the public a reality which is external to our choices. The biology of a species of butterfly is determined by natural process, not by human choice. What actually happened at the Massacre at Sand Creek really did happen; humans cannot now somehow decide to change the facts of history. Professional scientists and historians cannot just individually proclaim something to be true. There has to be a consensus in the field that the facts are accurate and the reasoning about the implications of those facts is sound.

An additional implication of the fact that these areas of knowledge are not subject to truth by authority is that in these fields, knowledge is not absolute (see the discussion of absolute truth in the Course Concepts chapter, page 3), and, therefore, is subject to revision if later facts come to light. The sciences and history have mechanisms built into their methods which allow for the updating of knowledge when necessary.

The making and testing of knowledge in mathematics is slightly different. It does involve peer review for confirmation of findings; however, because the knowledge generated out of a rigorous proof is absolutely certain, there need be no mechanism for updating the knowledge later. The student book includes a case study from mathematics (see pages 279–80).

Connections between language and the areas of knowledge

Each of the areas of knowledge has its own vocabulary related to the construction and testing of knowledge. The chart below shows some of the important terms related to the development of knowledge for each of the five required areas of knowledge. One interesting activity to have students undertake is for them to see if they can generate a similar chart for the core and optional themes that you include in your curriculum.

Mathematics	The natural sciences	The human sciences	History	The arts
Mathematician	Scientist	Human scientist	Historian	Artist
Rigorous proof	Theory		Historiography	Audience
Conjecture	Hypothesis		Artefact	Interpretation
Axiom	Scientific method		Historical fact	Genre
Pure mathematics	Causation vs correlation		Perspectives	Symbolism
Applied mathematics	Controlled experiment		Primary source	Creativity
	Observational experiment	Survey	Secondary source	Plagiarism
Peer review	Peer review		Peer review	

Note: The subject guides for the other IB courses contain course concepts which are also important vocabulary.

ACTIVITY

1 Ask students to work in groups to generate a list of terms related to the development, testing, verification and revising of knowledge – a list of terms relevant to TOK thinking, in other words.

2 Ask them to group the terms into categories of their own choosing, and then to name the categories. What do these important vocabulary words suggest about the nature of TOK as an investigation into knowledge?

Below is a sample list of such terms which was generated by a group of students. The list should not, however, be given to your students: they should generate their own. But you could prompt them with a couple of examples to get them started, or to help the thinking along as they work in their groups and seem to get stuck.

The list is presented in alphabetical order, rather than in any meaningful categories, and, of course, it is not comprehensive. Students may think of other relevant terms, and they may not get all of these. That is perfectly fine.

The language of knowledge

This list is a collection of some abstract terms related to knowledge. The terms might apply in many or all areas of knowledge. The list is not comprehensive.

A posteriori	Bias	Culture
A priori	Causation	Data
Abstract and concrete	Certainty	Datum
Analysis	Claim	Deduction
Analysis and synthesis	Claim and counterclaim	Dialectical relationship
Application	Classification	Dogmatism
Argument	Coherence	Empirical/Empiricism
Assertion	Concept	Evaluation evidence
Assessment	Conclusion	Example (representative) and counterexample
Assumptions	Conjecture	Explanation
Authority	Corollary	Explicit
Axiom	Correlation	Extrapolation
Belief	Correspondence and coherence	Fact

Facts	Objective	Reductionism
Free will and determinism	Observation	Relativism
Generalization	Opinion	Reliability
Givens	Paradigm	Skepticism
Hypothesis	Paternicity (cf. Michael Shermer)	Solipsism
Idea	Perspective	Standards of judgment
Implication	Plausibility	Stereotype
Implicit	Possibility	Subjective (as well as intersubjective)
Induction	Prediction	Synthesis
Inference	Prejudice	Tacit knowledge
Judgment	Premise	Theory
Justification	Primary and secondary source	Truth
Knowledge	Principle	Understanding
Law	Probability	Validity
Limitations	Projection	Wisdom
Memory	Proposition	Worldview
Model	Pseudoscience	
	Realism	

Ethics

The section on ethics in the student book focuses largely on the importance of truth and the damaging effect of lies on the knowledge-making process, in all the themes and areas of knowledge. A series of questions on page 143 of the student book can be used to spark discussion among your students, and the lesson below can provide a basis in the students' personal experience for being able to understand the implications of lies or other failures to identify the truth for society at large.

LESSON PLAN: ETHICS AND LIES

Introduction

This lesson will allow students to investigate through personal experience why lying is an ethical violation of the use of language to make knowledge.

Framework section

Ethics.

Aims

Students will:

- collect data about the frequency and conditions under which people refrain from telling the truth
- consider the motivations people have for choosing not to speak the truth in certain contexts
- understand the potential damage which can arise out of the dissemination of false information.

The aims all have knowledge-related terms: 'data', 'truth', 'contexts' and 'understand'.

Objectives

Students will be able to:

- identify the consequences of the failure to tell the truth
- discuss their personal experience in this activity through the lenses of values, perspectives and justification.

The objectives elucidate ideas beyond just the specific real-life situation.

Knowledge questions from the TOK subject guide

- Does ethical language differ in any significant way from other types of language?
- How can we know if language is intended to deceive or manipulate us?

Students should discuss these questions at the end of the activity.

These are suggestions; other knowledge questions could certainly be relevant here.

Relevant course concepts

Values, perspectives and justification.

Prior learning

- This lesson could work well at the beginning of a unit of study on the optional theme of Knowledge and Language, as it makes a direct connection to the core theme by having students experience the specified language contexts for themselves.
- Students must also have at least a basic understanding of the definition and characteristics of the relevant course concepts.

Required resources

Some mechanism for individual students to take notes over the course of a day.

Activities

1. Assign students the task of keeping track, for 24 hours, the number of times that they personally choose not to tell the truth. 'Not telling the truth' is not the same as 'lying', so they should track times that they kept quiet about something or prevaricated, in addition to any times that they told an outright lie. They should also note down briefly the context in which they decided not to tell the truth and why they decided not to tell the truth.

Activity 1 makes a connection between the core theme and ethical language use.

Note: Students should be exhorted not to change their normal behaviour as they go through the day. The problem of how their knowledge of their participation in their own experience influences their observations is a classic example of the problems that human scientists face in trying to get accurate data, and this activity could also be done during an exploration of the methods of the human sciences.

2. Students should share their experiences with a partner or small group. The sharing does not have to be specific as to what lies or non-truths were told. They should instead make general observations about the kinds of motivations that people have for avoiding the truth.

Ideally, students will identify such motivations as 'trying to avoid conflict', 'wishing to take the easy way out' and 'not wishing to hurt someone's feelings'. There may be many others.

3. Students discuss the ethical ramifications of the choices made based on the motivations that the students identified. They can consider questions such as the following:
   a. What are the likely kinds of consequences of avoiding the truth in each of these kinds of situations?
   b. If you think that there are not any important consequences, from whose perspective is that true? Does the answer change if you consider the problem from other perspectives?
   c. What are the consequences if people find out that the truth was not shared?

Questions b and e ask students to explore the situation through the lens of different course concepts.

You can use the QR code below to view a video which explains Kant's Categorical Imperative in simple terms.

d Consider Kant's Categorical Imperative: could all people be permitted to avoid truth in these ways at all times? What would be the effect on society of that much failure to tell the truth?

e Consider the justifications people might offer for failing to tell the truth in these or similar situations: what values are reflected in those justifications? Are any important values violated by the justifications?

Follow up

The follow-up activity asks students to consider the first activity from a different perspective, and then to move the consideration from the personal to the societal.

As a follow-up activity, students can explore the question of what it feels like to be on the receiving end of the failure to tell the truth. Over another 24-hour period, ask students to attend to things that they are told. Statements made by teachers about content in their courses would be good statements for this activity, although statements made by other people in the students' lives can certainly be used.

Ask students to write down three or four specific things that they were told and then imagine that in fact those statements were not true. They can then discuss with classmates what the implications would be of being taught false information. They should consider the consequences to themselves personally, but also to society, if these practices were to become commonplace.

The end of the ethics section ties up many of the ideas that were discussed throughout the chapter on Knowledge and Language by making connections back to the concept of power. Since language is our primary means of conveying knowledge from one person to another, anyone making knowledge claims has significant power over others. The obligation to believe only what is true, however, does not rest solely with the purveyor of the information: the receiver must also make every effort to verify claims before accepting them and, in turn, passing them along.

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We start with the discussion above then, to provide an opportunity for your students to think about their own culture, its value, its transmission – and its contingency (ie, 'it could have been otherwise'). Our cultures are in a sense protected by the conscious transmission (literally 'sending across') of those cultural beliefs and that cultural knowledge into the institutions, objects and practices with which we surround ourselves. The book you are reading (not just the ideas within it), the institution you bought it or borrowed it from, the building in which you are reading it, the curriculum in which you are using it are all cultural institutions, designed to protect, articulate and transfer the knowledge of a people.

That something as seemingly innocuous as 'going to school' is, at heart, a cultural activity (like attending worship or going to a museum) might be a way into the idea that we are all products of culture. The institutions of formal education are the products of a culture and one of the functions of our schools, surely, is to transmit the core beliefs of that culture to the next generation. The fact that the cultural knowledge being passed on to them might not have been this way might not have occurred to some students.

However, even a 'majority' cultural heritage is vulnerable to collapse: we see the debates around nationalism, the rise of populism and people's worries about immigration in the news every day. These are 'the culture wars' often referred to in the news (and often by people in the dominant 'culture' who are not used to being threatened). What happens then, when another culture, another people arrive on the scene and challenge your culture? What happens when the historical and biological accidents of the time mean that your culture finds itself in a position of weakness? Perhaps you do not have the technological means to resist the advances of the other culture, perhaps you cannot fight off certain diseases, perhaps your culture understands its relationship to the natural world in a way that means you treat it in ways that preserve its natural features rather than 'working' it or transforming it to meet your needs. If other cultures have survival advantages over you because of these things, then your culture will be under threat. Some of us might not have thought of the contingent nature of culture, perhaps because we identify with a dominant culture. But Indigenous cultures cannot help but think about it.

Students engaging in this question of dominant and competing cultures is a useful way of underscoring the tentative nature of 'culture', and opens a door onto their engagement of the notion of Indigenous knowledge systems.

The story of young Hastiin To'Haali is one of the friction points of this competition between cultures, and the field of challenge was school. How might our own schools represent this sort of challenge?

KNOWLEDGE QUESTIONS

Relevant knowledge questions from the TOK subject guide:

- In what ways does the loss of Indigenous languages signify a loss of knowledge and cultural diversity?
- How have government education policies and systems compromised the transmission of Indigenous knowledge?

As a vehicle to respond to the knowledge questions above, have students try the following activity below.

ACTIVITY

After your students have completed the reading and discussion of Hastiin To'Haali's story, ask them to reflect on what they have learned about the nature of their own education.

1 Where are the conflicts of culture in their own experience?
2 What are the effects of the conflict?
3 What do they stand to gain by accepting the cultural knowledge that schools are attempting to transmit? What do they have to *lose*?
4 What did Hastiin To'Haali stand to lose?

CONNECTION TO: ASSESSMENT

One you have established that schools and all the objects that are used and produced there are the products of a particular culture and a particular cultural understanding of the world, students will have a deep repository of objects that might be used in their exhibitions to illustrate how culture might relate to the issues raised in IA prompts.

In addition to the various case studies included in the student book, more are included here, giving teachers a wider repository from which to draw useful narratives to use in the classroom.

Scope

Much time is spent in the Scope section of the student book, unpacking not only the definition of 'Indigenous', but also the issues surrounding the attempt to make such a definition. For those of you keeping track of our use of the elements of the knowledge framework, this question is developing both the *scope* and *perspective* elements of it. It falls under scope because questions about definitions and natures of things, finding what is and what is not covered by a concept, are often questions about the nature or essence of those things. The definition of 'Indigenous' also falls under perspective because making these sorts of definitions and designations in relation to people's identities is an inherently political act.

KNOWLEDGE QUESTIONS

Relevant knowledge questions from the TOK subject guide:

- Does our culture determine what we know?
- In what ways does the loss of Indigenous languages signify a loss of knowledge and cultural diversity?

These two questions are closely related and are themselves related to a number of the issues we explore in this chapter. The central dynamic arises from the relationship between our culture and our understanding of the world around us. Can we know the world in a way that is not influenced by our culture?

We might break this dynamic down step by step, uncovering a number of assumptions. The first assumption here is that a culture and the concepts and ideas (language) that are used in that culture provides a framework through which we both approach and understand the world. As we see in the student chapter, one of the main features common among Indigenous cultures (outlined in Table 6.1, student book page 191) is the inherently dualistic framework applied to the world. Having this framework means that we would approach the world already expecting that the phenomena we encounter will relate to both the secular and the sacred. This approach then will provide a unified understanding of the world, but one which has these two elements in close interplay. The understanding of earthquakes by the Subanen people in the Philippines, for instance, provides a single explanation in which these two components take part.

CONCEPTS CONNECTION: EXPLANATION AND JUSTIFICATION

Being aware of this relationship between the framework we use to understand the world and the claims that we subsequently make about the world, helps us understand why some people simply cannot accept explanations or justifications which do not use the elements provided by the framework. An explanation of the world which did not make use of the animal spirits would, for the Subanen people, be incomplete. From another perspective, one in which those concepts were unavailable, using them would simply be a mistake, a misapplication of the sorts of frameworks available. For an enlightenment scientist to explain earthquakes in terms of the movement of the pigs upon whose back the world rests would be to use concepts and ideas that are not included in the types of explanations acceptable to science.

CONNECTION TO: THE CORE THEME

Here students might reflect on the conditions under which individuals accept knowledge as their own. For knowledge to be transferred from a community to an individual, the individual must already accept to some degree the general framework in which that knowledge is developed and expressed. The student book explores the case of Frank Cushing who lived with the Zuni people of America's southwest in order to understand their culture and their understanding of the world in a way that would have been unavailable to him were he to simply observe from afar. This raises interesting knowledge questions about how to develop knowledge about Indigenous cultures: if we do not live as they live, can we understand the culture? It also raises deeper questions about whether or not people who have lived with these cultures in order to understand them (eg, Cushing) have any hope of transferring that knowledge to others who have not lived with the culture, so will not have developed an understanding of these perspectives.

Another layer of assumption raised by this discussion, one which is discussed in greater detail in the methods and tools section of the student book, is the idea that language itself is encoded with a whole cultural framework. Indigenous languages, the words, concepts and constructions used, are not only how Indigenous people communicate, but are themselves an artefact of that culture and will be preserving a worldview. Recognizing this, 2019 was declared by the UN as The Year of Indigenous Languages, hoping to raise awareness of the danger of losing Indigenous languages and highlight the importance of language in preserving the knowledge of these communities. As explained on the UNESCO website:

> Languages play a crucial role in the daily lives of people, not only as a tool for communication, education, social integration and development, but also as a repository for each person's unique identity, cultural history, traditions and memory.
>
> (UNESCO)

■ TOK TRAP

This quotation illustrates two important TOK points regarding language. First, it makes a couple of obvious points about language is how knowledge is communicated. Many students make the point that if people do not speak the same language then they cannot transfer knowledge between them, or at least cannot do it as easily as they otherwise might. This is not a terribly interesting point.

More interesting is the idea that languages are one way in which individuals engage in their culture (social integration) and a way in which cultural knowledge is stored and preserved. This idea is far more subtle and interesting, and teachers should always be on the lookout for the first approach in order to encourage students into this deeper and more sophisticated awareness of the functions of language.

Earlier we used the common phrase 'in terms of' and this might be a way into thinking about language in the way we mean here. The idea is that the language provides the concepts and ideas in which the learning and knowledge of the community is held. Much of the basic vocabulary, technical language and command terms relevant to the discipline or subject-based knowledge illustrates this. We cannot really be a very good mathematician if we do not understand the concepts 'derive' or 'simplify' or 'root' or 'permutation', nor would we be a very knowledgeable artist were we unaware of concepts like 'composition' or 'form' or 'perspective'. Much of our education is learning those terms, the circumstances in which they need to be used and how best to use them. More deeply, though, they are the knowledge that has been developed. 'Composition' is not just a useful concept, the concept itself has been created as a way of understanding the world from the perspective of the artist. 'Atomic mass' is a concept developed to identify, describe and exploit certain objects in the world from the perspective of chemistry. These concepts are used to make certain features of the world knowable and understandable.

Spoken languages are themselves cultural artefacts, comprised of concepts which that culture has developed to understand the world. The language itself is infused with a perspective. Therefore, when an Indigenous person loses their language it might be said that they lose that perspective about the world along with the attitudes and values that were woven into it. This is the tragedy of Indigenous students being denied access to the language of their culture. Losing an Indigenous language certainly removes diversity in terms of there being fewer languages, but this also represents the loss of a body of knowledge. What is known in the terms of one language might not simply be translatable into the terms of another, anymore than the truths of mathematics can simply be translated into the terms of history. Their concepts create an entirely new picture of the world.

Perspectives

The perspectives section of the this chapter in the student book addresses the contrasting approaches to the natural world typically taken by Indigenous societies and Enlightenment science respectively. In the teacher's book, we have decided to further interrogate the difficulty of defining Indigenous knowledge and the difficulties presented by our outsider status.

In terms of the political and cultural implications of even the attempt to construct such a definition of 'Indigenous societies', we tried to approach the issue in a clear-headed and sensitive way, understanding that there might be no entirely neutral approach. Nevertheless, the important conversations cannot be had if we do not accept some reasonable definition, if only to focus our attention on the issues that are directly relevant to these cultures. This attempt is itself a TOK issue as the following knowledge questions suggest.

SAMPLE RESPONSE TO KNOWLEDGE QUESTIONS

What values and assumptions underpin the use of the term 'Indigenous knowledge'?

Does the term 'Indigenous knowledge' necessarily suggest power divisions between a dominant and non-dominant group?

As an 'outsider', can we know and speak about the knowledge held by a different cultural group?

Given the role of culture in defining people's identity, any discussion of culture runs the risk of being divisive. Add to this the relationship Indigenous cultures have with colonization and the subsequent exploitation of these cultures and it is clear that attempts to find a definition of 'Indigenous' are particularly tricky.

One starting point for such a definition would be to identify examples of such cultures and see if they have any common characteristics. We might start with cultures like the Aboriginals of the continent of Australia, the First Peoples and Native Americans of the North American Continent, the Polynesian people throughout the Pacific Ocean and the native populations of Central and South America. Immediately, however, we are confronted with the historical realization that one thing these groups of people have in common is that they have been subject to European colonization and violent oppression.

The International Baccalaureate, for all its global awareness, is nevertheless the product of a western cultural mindset and is a beneficiary of those European cultures which were themselves colonizers. Yet, it has offered a consideration of Indigenous societies as part of its curriculum. Already then, the fact that Indigenous cultures receive a form of their own might be suspect; the suggestion being that these cultures have been defined as other than whatever the knowledge system is that is underpinning the IB. Simply defining 'Indigenous' then runs the risk of suggesting that it is not the norm. This is fraught with danger, for if the defining individual identifies as a European or with another colonizing culture, then that individual might be imposing the power structures that our cultures have historically had in relation to these examples of Indigenous cultures. One might, for instance, suggest that Indigenous cultures are characterized by their pre-scientific view. This might have been true at one time: one might point out that European colonists arrived in lands where native populations had not yet developed the scientific knowledge that European cultures had; this was a matter of fact. But the emphasis on a culture's relationship to scientific knowledge implies a strong valuing of that form of knowing, which, historically, has its roots in the European Enlightenment.

This approach, often termed 'the great divide', between traditional/modern or primitive/modern cultures highlights how tying an Indigenous culture's relationship to a European body of knowledge creates a judgment on that culture, as even though these Indigenous groups may have accepted the 'modern' scientific view, they are nevertheless still seen as somehow primitive. This definition, then, means that Indigenous people cannot shake off the perception that they are somehow lagging behind, regardless of how modern they are.

The United Nations seems reasonably placed to offer a definition of 'Indigenous' from which we might derive a conception of 'Indigenous knowledge'. It offers general characteristics (discussed in the student book) which can help identify Indigenous cultures, but these underscore the fact that these cultures are surrounded by a more cultural dominant culture. The UN suggests that Indigenous cultures have 'historical and pre-colonial or pre-settler connections to a specific geographical region and having distinct linguistic, social, economic or political systems from the more dominant culture surrounding them'. Another feature is 'the resolve to maintain the traditions and culture of that community in the face of a dominant society which would otherwise easily subsume the community' (United Nations Permanent Forum on Indigenous Issues). As you can see, both characteristics explicitly identify the Indigenous culture in relation to some other, more dominant, culture. This seems to remove the Indigenous cultures from the very discussions they ought to have.

Finally, another assumption which appears to underpin the very search for a definition is that there are, in fact, features common to all these cultures. Why should we think that cultures as varied as the descendants of the Inca in South America or the Sami descendants of Finland, the Aborigines of Australia or the First Peoples of North America or Polynesia, are really alike at all? Even within these groups there is huge variety. In Australia alone, there are over 500 different groups or 'nations', many with separate cultures and languages (Australian Government). Why, then, would we think that globally, the similarities between cultures are enough to ground a common definition?

The historical fact, however, seems to be that these cultures have been dominated by colonizing cultures and so that is a unifying characteristic. The UN might, therefore, be right to use that as a defining characteristic. It is certainly not the only element of the definition, but it seems necessary to apply this as a way of picking out those cultures we want to include when exploring 'Indigenous' knowledge systems.

The next question is how that definition then impacts the analysis we apply to those knowledge systems. One important outcome of this definition is a deep awareness of the damage done to these cultures by dominant cultures, and an awareness of the blind spots in the 'modern' knowledge and assumptions surrounding these cultures. This might impact the development of knowledge across the AOKs. With this awareness, 'post-colonial' historians are encouraged to research and tell the stories of Indigenous people who have been subject to oppression and have neared extinction or who might have been wiped out (Ivison). Scientists are more sensitive to the different 'points of entry' into our knowledge of the world (Nicholas) and take seriously the generations-old knowledge of the local environments held by First Peoples, but who had never been asked or whose knowledge had never been taken seriously. Medics might finally accept that many of the Indigenous treatments, passed down for generations (but not found in any western medical school), actually might be effective for a number of ailments (WHO).

The very attempt to define and analyse Indigenous knowledge systems and cultures leads to a deep awareness of the injustices suffered by these communities, but this awareness might serve to redress these injustices and it might also lead to new approaches and additions to non-Indigenous knowledge systems.

Note: This exploration of the knowledge question is, as always, only one way in which the question might be explored. This is a broad response which touches on each of the three questions shown – we have done this for instructional purposes, but you would want students to be a bit more precise. The nature of a knowledge question is that it is open-ended, and so there is no 'right' answer: there are just well-supported responses or badly supported responses. One critique of the response shown here would be that, while it offers justification for its own argument, alternative perspectives or examples are not developed.

Methods and tools

Much can be said about the different approaches and concepts that are used in the attempt to understand the world around us by the basic 'scientific', or what we have called 'Enlightenment', perspective and other perspectives used by Indigenous societies.

Table 6.1 in the student book (page 191) summarizes these differences along the three broad distinctions:

- Holistic vs reductionist
- Relational vs objective
- Dualistic ('secular and the sacred are unified') vs material ('the natural world is the only world').

As we have seen throughout this book, the basic perspective applied to a situation has practical outcomes in terms of the methods employed. This is the case here too: given the different perspectives applied by Indigenous cultures, they might use methods that don't fit easily into the Enlightenment perspective. The student book identifies and discusses language, ritual, myth and visions in this context.

Students may find that the TOK knowledge framework and its use of methods and tools breaks down here. Generally speaking, we use this element of the framework to discuss how knowledge is constructed, exploring the processes and the required tools in those processes by which individuals and communities of knowers in particular fields move from curiosity and wonder towards established and justified 'knowledge claims'. We are conscious that the nature of this process itself (processes of justification), and even that there must be this sort of process (justification is valuable) might be embedded in an Enlightenment paradigm. Exploring methods and tools in relation to Indigenous knowledge systems, then, might be slightly artificial in that it is not obvious that Indigenous knowledge systems are establishing knowledge in the same way as Enlightenment scientists, even though there are clear methods in the transfer of knowledge from generation to generation. The methods and tools outlined here might be thought of as more of a repository of knowledge. Knowledge is held or preserved in a culture's language, rituals, myths and visions, but not in a way that a book might hold knowledge. Myths, for instance, should not be thought of as a list of claims about the world.

The knowledge held in language, ritual, myth and visions is more of an awareness, or an approach or a relationship to the world, and is illustrated in the main differences between Indigenous and Enlightenment approaches outlined above: holistic, relational and dualistic.

Therefore, seeing the methods and (conceptual) tools we outline below as means by which Indigenous knowledge is constructed or established, in comparison with the methods we discuss in other AOKs, is bound to reflect poorly on Indigenous systems. Rather, it might be worth encouraging students to see these 'methods' more as the means by which a culture's knowledge is held. The feedback loop then would be to encourage students to explore the processes, concepts and tools used in their own classrooms as 'ways in which their culture's knowledge is held and transmitted'.

KNOWLEDGE QUESTIONS

Relevant knowledge questions from the TOK subject guide:

- What is the role of rituals in acquiring and sharing knowledge?
- What methods have Indigenous peoples developed to support the recording, preservation and protection of their traditional knowledge?

Ritual

One of the more interesting methods that we explore in this section of the student book has to do with ritual. It is suggested there that ritual is a method by which knowledge of a shared community is transmitted (as in broadcast) to the individuals within that community. It is argued that the prevalence of ritual in Indigenous cultures points to two ideas:

1. The knowledge binds the community together and is protected by the way it is embedded in the very practices of the culture. This might be done in a way that is non-conscious or pre-reflective (therefore, they might not be easily articulated). Performing or following these rituals are methods by which that knowledge is transmitted to individuals.
2. Some knowledge in these communities is of the sort that the culture could not write down and transfer by simply asking the younger members of that community to learn it. Ritual is needed as a way of transferring that knowledge.

When considering ritual, students often try to use it to describe repetitive behaviours. Our 'morning rituals' for instance might include getting up before the children, having a quiet cup of coffee while catching up on the news, then laying out the breakfast. We might feel that the day hasn't really got off on the right foot unless we have been able to do these things. But we would not normally consider these as the types of rituals that we think of when we think of Indigenous cultures. There is no cultural knowledge being embedded or passed on by that morning ritual, rather, it's just a good way to start the day.

In brief, the defining features of ritual have been described as:

- **formal**: actions which are abstract and divorced from everyday activity
- **repetitive**: they happen again and again, the same way each time without alteration
- **effective**: participating in a ritual creates a change in us, in our status in society and in our status among other people
- **earnest**: participating in ritual is far more than just 'going through the motions'.

CONNECTION TO: THE CORE THEME

We offered a list of four characteristics which might be used to differentiate genuine ritual from daily rituals such as the ones mentioned on the previous page. The key elements of the definition offered in the student book is that the meaning of a ritual is not encoded by the individual and that the ritual is effective. So, the distinctive feature of a ritual is the knowledge that has been encoded or embedded in that ritual. Taking part in it then allies the individual to that culture from which the ritual has come. It is both a way for that community or culture to pass on the knowledge to the individual and for that individual to say, 'This is my community – I accept these beliefs.'

Many of our students will not be familiar with Indigenous cultures directly, so an exploration of the nature of ritual may end up being voyeuristic – it may seem as if they are simply watching it from afar. Therefore, one key objective would be to get them to think about the cultural practices that they or people that they know have participated in or might be familiar with. Having thought about these, then they might be able to use this material to understand their own cultural communities better.

Rituals in which students may have participated or with which they may be familiar include:

- religious ceremonies (confirmation, first communion, baptism, bar mitzvah/mitzvot, circumcision, weddings, funerals)
- membership ceremonies to various organizations (scouts, clubs, sororities, fraternities)
- transition ceremonies like graduations.

These ceremonies might not be as dramatic or 'theatrical' as some of the rituals that we looked at as case studies, but many of them do meet the characteristics broadly interpreted. Very often the effective element is important here, meaning that after the performance (not just the practice), the individual's relationship to that community is genuinely different. For example, weddings create new bonds between individuals and between couples and their community.

Considering whether some practice is genuinely a 'ritual' might be like herding cats, but remember that the point is to explore the cultural knowledge embedded or encoded in that practice, and how individuals' relationships to the community and to themselves are changed through participation in them.

There is an activity in the student book (page 169) that prompts students to think about rituals that they have participated in.

Myth

Again, students who are not part of an Indigenous community might find the discussion of myth somewhat disconnected from their own experience. We therefore purposefully linked the discussion of myths with history in the ethics section of Chapter 11 to provide students the opportunity to explore the 'mythological' elements of the histories our different communities tell ourselves. The national day celebration activities are a helpful way of bringing these out. These historical narratives sometimes work well (but not always!) as examples of mythological narratives because they provide an important function which overlaps with the function of myth, namely to orientate the individual in relation to the cultural norms, expectations and values of the community in which that myth functions. One of the reasons why we have come to equate 'myth' with 'fiction' is because standing outside the culture which provides the myth, we are unable to access the truths available. This further underscores the importance of belonging to a community in order to feel the emotional, intuitive and social power of those myths.

TEACHING TIP

While asking students to reflect on their own religious practice as 'ritual' you might need to take a lot of care if you are going to use religious narratives as examples of 'myth'. The term is generally used to denote a story that is fictional and using students' religious narratives as examples of these implies that they are untrue. One of the outcomes of a discussion of myth is to explore different forms of truth and how they are vehicles for truth in their own way, but this point might be too subtle for some. Nor should you think that we are suggesting that religious narratives are fictional by raising this point here. We only suggest that whereas the student's own participation in religious ritual is an appropriate way to explore ritual, religious narratives might not be an appropriate way to explore myths.

Below is an interesting case study (not included in the student book) that might help illustrate the foundational role that myth plays in a particular Indigenous knowledge system.

One of the most famous features of the Australian Aborigine worldview is the mythology of the **Dreamtime** and the **Dreaming**, which are non-Indigenous terms used broadly to describe the common mythological view of a time before living memory, when spirits moved from dreaming to action, creating the Earth and all her creatures, as well as the celestial bodies. According to the Aboriginal Art and Cultural Centre in Alice Springs, Australia:

> The Dreamtime is the beginning of knowledge, from which came the laws of existence. For survival these laws must be observed.
>
> The Dreaming world was the old time of the Ancestor Beings. They emerged from the Earth at the time of the creation. Time began in the world the moment these supernatural beings were 'born out of their own Eternity'.
>
> The Earth was a flat surface, in darkness. A dead, silent world. Unknown forms of life were asleep, below the surface of the land. Then the supernatural Ancestor Beings broke through the crust of the Earth from below, with tumultuous force.
>
> The sun rose out of the ground. The land received light for the first time. The supernatural Beings, or Totemic Ancestors, resembled creatures or plants, and were half human. They moved across the barren surface of the world. They travelled, hunted and fought, and changed the form of the land. In their journeys, they created the landscape, the mountains, the rivers, the trees, waterholes, plains and sandhills. They made the people themselves, who are descendants of the Dreamtime ancestors. They made the Ant, Grasshopper, Emu, Eagle, Crow, Parrot, Wallaby, Kangaroo, Lizard, Snake, and all food plants. They made the natural elements: Water, Air, Fire. They made all the celestial bodies: the Sun, the Moon and the Stars. Then, wearied from all their activity, the mythical creatures sank back into the earth and returned to their state of sleep.
>
> Sometimes their spirits turned into rocks or trees or a part of the landscape. These became sacred places, to be seen only by initiated men. These sites had special qualities.
>
> ('Dreamtime Meaning')

In this excerpt we can see many of the dynamics we have discussed in this chapter. There is a clear interplay between the ordinary and the mystical world. There are deep connections and relationships between human beings, their environment and the mystical world, and there is a clear holistic vision where both elements are seen as part of the one real world.

KNOWLEDGE QUESTION

Relevant knowledge question from the TOK subject guide:

- Does our culture determine what we know?

One other theme we have explored is that of understanding. Can a non-Aboriginal person understand the meaning and significance of the Dreaming or Dreamtime? Even characterizing it as 'the time before living memory' is misleading because the idea is that the Dreaming is not over, it exists here and now in the present moment.

> The Jukurrpa [The Dreaming] is an all-embracing concept that provides rules for living, a moral code, as well as rules for interacting with the natural environment.
>
> The philosophy behind it is holistic – the Jukurrpa provides for a total, integrated way of life. It is important to understand that, for Warlpiri and other Aboriginal people living in remote Aboriginal settlements, The Dreaming isn't something that has been consigned to the past but is a lived daily reality. We, the Warlpiri people, believe in the Jukurrpa to this day.
>
> (Nicholls)

In the Aboriginal worldview, there are no terms for 'history' or 'past'; instead the world's creation and maintenance are ever-present events, brought forth through ritual and cultural practice. Australian anthropologist (and non-Aboriginal) WEH Stanner, who popularized the term 'Dreaming', recognized the inadequacy of his term, suggesting 'everywhen' as a way of describing the Dreaming's relationship to time; it is ever-present, everywhere, at all times. The innumerable narratives prevalent in the Aboriginal culture and which make up the Dreaming stand as a complete guide for the Aboriginal people; it governs their interactions, whom they marry, the structures of their society and even offers advice as to how to approach water-holes (by tossing in a stone to identify themselves to the water spirits) (Nicholls).

We discussed ritual as a method by which Indigenous cultures communicate knowledge to individuals in the community and we see similar elements of this in the notion of a songline – traces of ancient journeys and paths which traverse the continent, linking the various communities (Roberts). They are called songlines because travellers would sing during their journeys and use the features of the world around them, including a profound understanding of the night sky, as guides for the songs. The role of mythology here is paramount.

> … think of the songlines as the oral archives of Indigenous history that chart the very creation of the land and sea by the Dreaming totems (animals), and the various marks – trees, waterholes, rocky outcrops and creatures – along them. The songlines also hold the stories of the people and the eternal spirits who inhabit them. Because melodic variance is used to describe the land, the songlines – which also manifest in artworks, dance, the yirdaki and clapsticks – transcend language. The songlines or tracks transcend the language groups. If you know the song, you can navigate.
>
> (Daley)

It is crucial when thinking about Aboriginal songlines and other Indigenous knowledge systems to keep in mind that many of these cultures were non-literate, so storytelling or a community's mythological awareness was a deep method by which knowledge was preserved and transferred. One estimate is that there have only been four instances where a system for writing developed independently (Diamond 218). In all Indigenous cultures the ability to effectively pass on knowledge ensured that culture's survival. Until the Europeans arrived in the eighteenth century, the Aborigines had no written language so used art and song to pass on this knowledge. The ritual transmission of this knowledge ensured the culture could survive and, perhaps more importantly, the individual could survive in an incredibly inhospitable environment. With the arrival of the Europeans and their culture's focus on the written word, the value of the spoken word has diminished, jeopardizing an important method of the transference of cultural knowledge.

> Nganyinytja explained: 'We have no books, our history was not written by people with pen and paper. It is in the land, the footprints of our Creation Ancestors are on the rocks. The hills and creek beds they created as they dwelled in this land surround us. We learned from our grandmothers and grandfathers as they showed us these sacred sites, told us the stories, sang and danced with us the Tjukurpa (the Dreaming Law). We remember it all; in our minds, our bodies and feet as we dance the stories. We continually recreate the Tjukurpa …'
>
> (Daley)

KNOWLEDGE QUESTION

Relevant knowledge question from the TOK subject guide:

- What methods have Indigenous peoples developed to support the recording, preservation and protection of their traditional knowledge?

One of the elements of the UN characterization of 'Indigenous' has to do with the culture's 'having historical and pre-colonial or pre-settler connections to a specific geographical region'. The Polynesian Wayfinders provide an interesting example of how this geographical link to the environment provides a deep knowledge of that environment, but one that may be developed and transferred only through living in the culture, or having the right sort of background beliefs and understanding to accept them. Modern methods of classroom and book learning might not apply.

TEACHING TIP

Nearly all the different case studies and real-life examples that we use in TOK can be explored from the perspective of the different elements of the knowledge framework. In the case of the Wayfinders, for example, you might want to look at it from the perspective of the various methods used in applying the knowledge and transferring it to others (touched on here), but you might also want to draw out how the basic assumptions of the Polynesian Wayfinders represent a fundamentally different *perspective* from what we are calling Enlightenment science. Students will want to be flexible and fluid in their application of the elements of the framework. Looking at case studies from different angles opens new discussions on the same material.

Polynesia is an area of the Earth encompassing Hawai'i in the north, New Zealand in the south and Easter Island in the east. This includes over 25 million square miles or nearly 20 per cent of the surface of the world, nearly all of it empty ocean (Davis, 'The Wayfinders of Polynesia'). Despite the great distances of ocean, cultural similarities throughout the region suggest that the Indigenous communities were all related and amounted to a single culture. Ever since European explorers entered the region, beginning with the Spanish in the sixteenth century, the similarities between Indigenous populations divided by the ocean have been considered a mystery. How could such 'primitive' cultures (as was the assumption of the Europeans at the time) have found their way across these vast distances without the contemporary use of navigating equipment like the compass or the shipbuilding technology used by the Europeans? For example, in the eighteenth century, the British Explorer James Cook was astonished by the ability of Tahitian navigators who could, using stones on the beach, map every large island group in Polynesia. One Tahitian (called Tupaia), who accompanied Cook on a 13 000-mile journey across the South Pacific ocean, could point out the precise direction back to Tahiti without any use of 'modern' navigating equipment (Davis 42). The mystery of the Polynesian skills continued into the twentieth century. Unable to believe that Easter Island could have been populated by people coming from the west, Norwegian explorer Thor Heyerdahl made the journey between Peru and Easter Island in the *Kon Tiki*, a ship that he considered would have been like the ships available to the people at the time when Easter Island was first populated. Heyerdahl was successful in his trip (with the help of modern navigating equipment and the Peruvian Navy) (Davis 45). However, the prevailing assumption was still that the Polynesians simply could not have intended that journey and that the more likely explanation for finding these islands were that they were fishermen, blown off course.

To test this hypothesis, that no one from the west could have made this 13 000 mile journey, in 1973, the Polynesia Voyaging Society was founded '… for scientific inquiry into our history and heritage: How did the Polynesians discover and settle small islands in ten million square miles of ocean, geographically the largest 'nation' on Earth? How did they navigate without instruments, guiding themselves across ocean distances of 2500 miles?' (Thompson). The society built a traditional ship called *Hokule'a* and found one of the few living people who had been trained in the Indigenous people's traditional navigating skills, Mau Piailung (1932–2010). Mau taught a Hawaiian by the name of Nainoa Thompson the traditional skills of navigation and together they made a number of incredibly long voyages using no modern navigating equipment, astonishing even modern sea-faring Polynesians who had heard the stories of their ancestors' abilities, but who had not believed them (Moag). A new generation of Polynesian Wayfinders has now shown that, despite being considered 'primitive' by European explorers since the sixteenth century, the ancient knowledge contained in the Wayfinder community is at least as strong as anything the modern world could develop.

So how do the Wayfinders do it? How do they find their way over what looks like thousands of kilometres of featureless ocean? The first thing to keep in mind is that what might look 'featureless' to some, is not featureless at all if you know what to look for.

> You must begin with the fundamental elements of the Polynesian world: wind, waves, clouds, stars, sun, moon, birds, fish and the water itself. Bring to these the raw power of empirical observation, of universal human inquiry. The skills of the traditional navigator are not unlike those of the scientist; one learns through direct experience and the testing of hypotheses, with information drawn from all branches of the natural sciences, astronomy, animal behaviour, meteorology, and oceanography.
>
> (Davis 52)

This quotation brings out the fundamental difference between the Wayfinders and those of us who would be hopelessly lost – the Wayfinders simply know what to look for. From an early age they would memorize the stars in the sky, they would learn which birds flew where, they learned to understand clouds and what information their formations held. 'There is an entire nomenclature to describe the distinct patterns clouds form as they gather over islands or sweep across the open ocean' (Davis 55). The Wayfinders learned to read the behaviour of dolphins, birds and other sea creatures, and basically let the landscape tell them all they needed to know. The memory capacity needed might seem beyond normal ability, but we must remember that these facts are not known in isolation. They are developed over long periods of time (lifetimes, really) and very often are developed in terms of the beings and forces at work in the natural world. Human beings are very good at learning through social interaction and mapping natural facts over social interaction would certainly help an individual learn what they needed to know. A Hawaiian teaching resource illustrates this perspective.

> The 'ohana (family) of old made it possible for the Polynesian voyagers to venture forth to unknown lands. This seafaring 'ohana was able to travel thousands of miles on double-hulled canoes because it was in touch with nature and the gods. The 'ohana felt safe because there were no barriers between the spiritual and cultural world. The Hawaiian was never separated from his makers and ancestors because the gods and demi-gods showed themselves everywhere; in the sky, in the earth, and in the sea. They could move from one realm to another.
>
> 'Every cloud, rainstorm, lightning flash, ti plant, and maile vine was a body form of Kane. Rainclouds, rain, lush ferns, aholehole fish and certain types of seaweed revealed the god Lono. The god Kanaloa was represented by the deep ocean depths by squid, octopus and certain kinds of seashells' (William Pila Kikuchi, 'Heritage of Kaua'i', *The Native Hawaiian*, February 1979, Vol. 111, No. 4, page 4).
>
> (Kapua Lindo)

Like many Indigenous knowledge systems, the knowledge of the natural world was knowledge of the relationships human beings had between the spirits, gods and beings inhabiting the world. The Wayfinder, then, would never be alone.

The Polynesian Voyaging Society continues to pass on the knowledge and skills of the ancient Wayfinders, keeping alive the traditions and knowledge of their Polynesian ancestors and linking them to a community which extends far into the past and across the waters. Their trust in the knowledge of the ancestors and the world around them provides a new model to those who might not appreciate their deep understanding of the world around them. Non-Indigenous cultures would do the Polynesians a great disservice were they to ignore the fact that this knowledge of the Earth's largest ocean is far deeper and more comprehensive than any that could be mustered by 'modern' ship masters.

ACTIVITY

Ask students to read the passage above (see the weblink in the Works cited list at the end of this chapter), to discuss with a partner and identify where they think the tension between a 'modern' scientific or objective perspective on the world might conflict with a holistic or culturally embedded perspective.

Points to consider:

- The background assumptions about what was or was not possible for the Polynesian sailors of antiquity.
- The approaches used to understand the natural environment of the oceans.
- The need for special measures to 'rediscover' and then maintain certain bodies of knowledge.
- The value of such knowledge in a modern world with technological navigational equipment.

Ethics

Many of the ethical implications and choices relevant when discussing Indigenous knowledge systems, revolve around competing frames of references, the facts of history and colonization and the impact of 'dominant' cultures. A deeper concern which permeates the whole chapter is the very notion of 'Indigenous' and whether such designations are themselves perpetuating the colonial thinking which has put Indigenous cultures at such a disadvantage in the first place.

We offer the lesson plan below as an opportunity to explore many of these dynamics in a modern context. The lesson has at its heart a series of interwoven conflicts: the conflict between the methods and opportunities of modern science and Indigenous frameworks of knowledge, the perceived value of western science over traditional cultural practice, the conflicts arising out of the ownership of objects and the knowledge they might provide and the perceived need of Enlightenment science to know ever more in the face of the respect owed to an individual's remains.

LESSON PLAN: THE KENNEWICK MAN

Introduction

This lesson (or series of lessons) is an opportunity for students to discuss a wide variety of issues related to Indigenous knowledge systems, but generally revolves around the intersection of the methods and needs of current knowledge construction in Enlightenment science and the challenges raised by the historical treatment of Indigenous cultures.

If the Kennewick example here is too localized and not relevant to your context, you might research something more appropriate to your location, but still use the broad outlines of this lesson.

The lesson revolves around the discovery of skeletal remains in the United States and the question of just what to do with them. On the one hand, they can be studied and the conclusions used to help understand more about human populations in North America, but on the other, they might belong to a particular Indigenous community who want to treat the remains as those of one of their ancestors, not a scientific specimen. Layered on top of this then is the wider historical context of how the Indigenous peoples have been treated by the US government and how many are trying to rectify those historical wrongs.

The lesson revolves around the chronological progression of the case, a sort of mystery, from when the bones were found, how they were subsequently treated, who had control of them, what different groups thought they were evidence for and finally to the case's resolution.

We suggest two activities related to the material. Teachers will need to use their own judgment (of course!) in deciding how to develop it.

You might use the Wikipedia article as a starting point – click on the QR code to access the link.

Aims

Students will:

- consolidate their learning from the Indigenous knowledge systems unit
- consider and evaluate the different perspectives offered by Enlightenment science and Indigenous culture
- explore the challenge of using human remains belonging to an Indigenous culture in the creation of knowledge
- articulate and explore how historical knowledge and current social values can impact the construction of scientific knowledge.

Objectives

Students will be able to:

- read, analyse, compare and contrast various news articles related to the Kennewick Man
- construct a chronology of events from the discovery of human remains through to their burial over 20 years later
- understand and explore various issues related to Indigenous cultures and the desire to develop further knowledge.

Knowledge question from the TOK subject guide

- What role do objects and artefacts play in the construction and sharing of knowledge? (Methods and tools)

Other knowledge questions related to Indigenous societies and this activity

Don't think of the questions in the subject guide as the only questions you can ask. Practise developing your own!

- Should modern scientific desire to search for knowledge and its methods take priority when dealing with artefacts belonging to Indigenous cultures?
- How should we manage a conflict between the knowledge preserved in the oral traditions of Indigenous communities and the claims made by historians and anthropologists?
- How might prevailing political and social values impact the development of knowledge relating to Indigenous communities?
- What effect do news media outlets have on our understanding of events?
- How and to what extent is it possible to have an objective understanding of human history?
- What effect does belonging to a community have on the study of the origins of that community?

Relevant course concepts

Explanation, certainty, justification, power.

Prior learning

This lesson might be well placed at the end of a unit on Indigenous knowledge so students can consolidate and apply their knowledge to the case outlined here. This might have an effect on the type of activities set. Alternatively, the lesson might be conceived as a research project whereby students identify and articulate issues related to the construction and use of knowledge from the perspective of Enlightenment science and Indigenous communities.

If the lesson is used to identify and articulate (rather than consolidate), then use a chronological approach to create a process of discovering, researching and answering.

Required resources

Use the QR codes to access the following articles:

- 'Two hydroplane racing fans discover the skull of Kennewick Man on the bank of the Columbia River on July 28, 1996', History Link, February 2008.

- 'Tribe Stops Study of Bones That Challenge History', *The New York Times*, September 1996.
- 'The Kennewick Controversies', Constitutional Rights Foundation, Fall 1998.
- 'Anthropology: the great divide', *The Seattle Times*, October 2007.
- 'The Kennewick Man Finally Freed to Share His Secrets', *Smithsonian Magazine*, September 2014.

The later articles will contain and interpret information from earlier articles. This might create interesting discussions about the effect of the different treatments of the material.

- 'It's official: Kennewick Man is Native American', *The Seattle Times*, April 2016.
- 'A Long, Complicated Battle Over 9 000-Year-Old Bones Is Finally Over', NPR, May 2016.
- 'Tribes lay remains of Kennewick Man to rest', *The Spokesman Review*, February 2017.

Activities

We suggest two approaches here.

Socratic circles are a great way to give students responsibility and teach wider discussion and communication skills regardless of the content.

1. Socratic dialogue: This will require a preliminary reading assignment, then at least two lessons.
   - This approach will not require a reading of the articles in chronological order.
   - In addition to the development of the students' understanding of TOK skills, this lesson emphasizes more general skills of communication, collaboration and independence.
   - For an outline of this sort of classroom activity see the websites linked to by the QR codes:
     - Minds in Bloom – 5 Steps to a Successful Socratic Seminar

- Edutopia – Socratic Seminars: Building a Culture of Student-led Discussion
- Teaching Channel – Socratic Seminars: Patience & Practice video

- The students read the material prior to the lesson and use it as the focus of the discussion.
- Students will need to be well practised in keeping to a TOK discussion – using any ethical, political, social or historical debates in the service of TOK analysis. Teachers might need to develop a system whereby they can signal to the students when they need to move the discussion back towards issues relating to knowledge (perhaps a system of yellow or red flags could work).

It is hard for teachers *not* to jump into discussions, so develop and practise strategies to offer non-verbal interventions that do maintain student independence and responsibility.

2 Chronological close read of the material (this might be accomplished over a few lessons):
- In addition to the development of the students' understanding of TOK skills, this lesson emphasizes active reading strategies.
- Students read the articles in succession, raising knowledge questions as they go – identifying questions and issues, then seeing how they are answered or how new questions and issues arise. How are the issues resolved?
- Students (either in small groups or individually) are allocated different knowledge questions and are given the responsibility to articulate their thoughts in relation to the issues related to their questions.

Follow up

Students write up their thoughts about different themes (politics, religion, Indigenous knowledge) or AOKs in relation to the elements of the framework. They answer questions such as, 'What have you learned about the scope of Indigenous knowledge?' or, 'What have you learned about the methods of science?' or, 'What have you learned about the ethics of prioritizing one form of knowledge over another?'

Students might research local museum collections or cultural exhibitions to identify Indigenous artefacts or human remains which 'belong' to a local Indigenous culture. How do the local Indigenous people relate to those artefacts? What have they said about them? What issues need to be resolved in the debate?

Conclusion

The designation of a separate section related to 'ethics' is slightly artificial, given our overall treatment of Indigenous knowledge systems. The nature of TOK is to develop comparisons across themes and AOKs to identify their connections, differences and similarities. In the case of Indigenous societies, this comparative approach will likely immediately raise ethical questions, given the historical treatment of those cultures we have identified as 'Indigenous' and given their current status which is often still characterized by a struggle for survival and respect.

An alternative treatment of Indigenous knowledge might more closely focus on specific knowledge about the world within Indigenous communities, with less focus on the wider political or ethical considerations. Given the broader issues raised when we consider the relationship between the individual and the community students might be analysing, care should be taken to guarantee a credible, reliable and relevant exploration of Indigenous knowledge. If you are not a member of an Indigenous community, you might consider developing links between your school and a local Indigenous community in order to create opportunities for your students to engage directly with that culture and its own approach to knowledge.

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for fear of violating this separation. Students, however, rarely have this constitutional concern in mind and are happy to engage with the ideas. How the TOK teacher manages these discussions can be a challenge, and this is not a concern limited to any one country. Governments and religious organizations all over the world take more or less strict positions on the discussion of religious knowledge systems in an educational context. If you are concerned with how best to approach the discussion of religion, use these books as models on how it might be done in a TOK way, then discuss this approach with your school's curriculum authorities for guidance.

What is clear in all contexts is that the TOK teacher, insofar as they are genuinely involved in TOK, should not engage in a discussion about the truth of religious belief. This approach would be very much a theological discussion rather than a TOK one (and might be in violation of the Establishment Clause). The student book chapter and this teacher's book chapter will hopefully provide a model of how religious knowledge systems can be a fertile opportunity to discuss how human beings construct knowledge in relation to different types of questions, without entering into a discussion of whether the content is or is not 'true'.

The discussion of religious knowledge systems is also sometimes considered 'off-limits' for fear of showing disrespect or intolerance for the religious systems under discussion. Often there will be a dominant religion in the culture in which you teach, and it can be uncomfortable to discuss this dominant faith community in anything like a critical fashion. Similarly, if there are students in your class who are obviously part of a faith community (through dress or other known commitments), it may feel as though a discussion of that faith community is targeting those students or putting them in uncomfortable positions. Do you reflect on the role of authority of the Church when you know there are Roman Catholics in the class? Do you explore the relationship between religious belief and social norms when you know there are conservative Muslims in your class, but you are teaching in a predominantly non-muslim country? Do you explore the role of religious belief impacting ethical principles surrounding abortion, when you know there are pro-life Evangelical Christians in the class? These are no doubt challenging situations to manage and will require much finesse and careful handling by the teacher. These sorts of situations are not unheard of in any subject, however, so are different perhaps in degree but not kind. Here too, you would want to take care to maintain a TOK approach as you describe and analyse the religious systems and their role in the construction of knowledge, rather than evaluate them in terms of whether they are correct or true. An explicit discussion like this in a classroom would be an excellent opportunity to explore religious knowledge systems.

ACTIVITY

The elements in italics are asides for the teacher. The non-italicized text could form part of the activity shown to students on handouts or when projected for them. A version of this activity minus the italicized text is available online using the QR code on the left.

1 A discussion of the challenges surrounding a TOK-oriented discussion of religious knowledge systems can be quite challenging, given certain legal questions and individuals' personal relationships with different religious communities. However, a discussion of why this could be a challenge is a good way of exploring religious knowledge systems.

Start such a discussion by reminding the students of certain ground rules about effective and mature discussions in the context of a classroom. Some of these rules or principles might include:

- *We can respect that others have beliefs with which we do not agree.*
- *We understand that others might disagree with beliefs that we have.*
- *We understand that the TOK classroom is focused on how we construct knowledge, not necessarily only on whether that 'knowledge' is true.*
- *The TOK classroom is about discussing the beliefs held by communities and individuals. It is not about the individuals holding those beliefs.*

2 As a whole group, brainstorm reasons why discussing religion might be uncomfortable in the context of a classroom. Record the ideas of the students on the board.

Teachers should take an active and editorial role in recording the ideas. Do not accept simple claims about religious belief (e.g, 'because it is false', or, 'because it is true and people do not accept it') or judgments of religious people. Ideas like the following might arise:

- *Religion and culture are closely related.*
- *In most cases we try to respect, not critique each other's religious beliefs.*
- *Religious knowledge is incredibly personal, and an examination of the beliefs might feel like an examination of the individuals.*
- *Many people do not know religious belief 'from the inside' of a community, so might not be able to talk about it in an informed fashion, instead drawing on stereotypes.*
- *Many people think that being religious means that you are irrational.*

3 In small groups, discuss what these reasons about why it might be uncomfortable to discuss religion suggest about the nature of religious knowledge systems. Use the elements of the knowledge framework to categorize the group discussions.

a What do these discussions suggest about the scope of religious knowledge systems?
b What questions are answered by religious knowledge systems?
c What types of answers are provided? What concepts are used or are available for these answers?
d How are religious knowledge systems different from other AOKs?
e How are religious knowledge systems similar to other AOKs?

4 What sort of perspective on the world do religious knowledge systems provide? How might your own perspective on religion influence how you reflect on religious systems? Would it be biased in one direction or another? How would you rate your knowledge of religious knowledge systems: do you know enough to reflect on them in a reliable way?

5 What methods and tools do you think religious knowledge systems use to construct knowledge? How are they different from other AOKs? Are there any similarities?

6 How do religious knowledge systems influence ethical beliefs or practice? Do religious knowledge systems provide beliefs other than ethical beliefs?

Feedback to the class.

Here again, teachers should exercise complete editorial control over what gets recorded from this feedback.

TOK TRAP

Many students are drawn to discuss religious knowledge systems in their TOK essays or as part of their internal assessment. This is because religious knowledge systems are rich and fertile ground to explore all sorts of deeply intriguing TOK questions. Many students, however, do not take the time to inform themselves about religious knowledge in general or the religious tradition in particular. Instead, they discuss it from a position informed only by an inadequate understanding or stereotype. You can be more or less informed on religious knowledge systems just as you can be more or less informed about any AOK. If students are interested in exploring religious knowledge, encourage them to take the time to learn about the systems from a position of understanding and charity, rather than imposing what they think they know.

Of course, students should be able to offer their own arguments in relation to the construction of knowledge within any community of knowers, but religion very often results in stereotype. Claiming, for instance, that religious knowledge is based soley on 'faith' is simply mistaken. Likewise, assuming that 'being religious' means an individual must think certain things or that religious knowledge is somehow inherently irrational is equally stereotypical. While there are certainly individuals who are part of religious communities who might agree with these principles, there are many others who would disagree and would still consider themselves members of religious communities. Not recognizing the range of positions and attitudes when it comes to religious knowledge is a weakness in any analysis of religious knowledge system and will limit the discussion. Examiners are hyper-sensitive to this sort of intellectual mistake and references to 'all religious knowledge systems are …' or 'religious people all think that …' will immediately raise red flags for them.

TEACHING TIP

When students choose to write about religious knowledge systems in their assessment, ask about whether they are members of a religious practice community (they may or may not be), or where they have developed their understanding of religious knowledge systems. Whatever the case, ask them to consider why they think they can speak from an informed position. What have they done and what have they learned that will help them develop reliable positions on the issue? They may know very little about religions, in which case their analyses might draw heavily on stereotype. They might be part of a religious community which might lead to a challenge to understand other perspectives.

This is not to pry. Rather it is to encourage them to reflect on the role of their background belief in the formation of their own knowledge, which itself is a perfect TOK question!

The rest of the Scope section of the chapter explores the idea that religious knowledge systems comprise a distinct form of knowing, which is in some ways outside the normal methods of knowledge construction. A central theme in this discussion is whether or not religious knowledge is beyond the reach of critique from the sciences. Many students might struggle with the subtleties needed to develop anything other than a stereotypical view that the sciences are the only legitimate way to describe or explain the world. The best way to engage with this is through a careful consideration of the scope of religious knowledge systems, exploring what questions they seek to answer, what types of things they try to describe or explain. Once you can get some focus on what sorts of things religious knowledge systems are out to describe (or any other AOKs), then you can start exploring the differences between methods. In terms of the question about whether non-religious systems can offer critiques of religious knowledge, one take-home point should be that each considers the nature of the subject and approach of the other. Many of the New Atheists, on this view, would be ignoring the differences in scope between the sciences and the religious knowledge systems, so their critiques often seem to miss the point.

CONNECTION TO: THE CORE THEME

Religious knowledge is deeply personal, but at the same time, in terms of religious dogma, it comprises the perfect example of shared knowledge. There are two avenues of approach, then, when discussing religious knowledge systems in relation to the individual knower. We can explore the power and value of religious knowledge for the individual. The student chapter contains much where this can be highlighted, including especially the Wittgenstein material, the power of faith and revelation and the impact of ethical theories. The other avenue is about the strength of the community's shared knowledge and the transfer of knowledge from these communities to the individual. You could draw on the role of ritual (from the chapter on Indigenous knowledge) or on the role of the rational arguments for the existence of God. You might also use the relationship of the individual to the community to discuss the role of authority in the transfer of knowledge. Making links to other AOKs could be very informative here. Consider your own training – how does the community of experts in your own field influence the knowledge (its content and its transfer)? Are there constraints imposed by the social hierarchy? By financial decision makers? By information gatekeepers?

KNOWLEDGE QUESTION

Relevant knowledge question from the TOK subject guide:

- Is certainty any more or less attainable in religion than it is in the arts or human sciences?

The question above provides us with an interesting approach to religious knowledge by juxtaposing it with knowledge found in the arts and human sciences. The arts and human sciences are arguably more about individuals or humans as individual beings with thoughts and ideas, and so linking religious knowledge to them by way of comparison leads us to think the same of religious knowledge. This is certainly true to some extent – an examination of the scope of religious knowledge would certainly look at the individual's own history and future, their own ethical beliefs and their metaphysical beliefs. In relation to the arts, it would be difficult to establish the grounds for certainty that would be useful in both areas. Given that both areas are so bound up with individuals' perspectives, certainty would very much be a deeply personal feeling. There is no doubt that many religious believers would consider themselves certain. Consider the certainty exhibited in Pascal's *Memorial* (student book, pages 201–2); to suggest that anything was more certain to him after that experience might be a challenge.

Religious knowledge is also, however, about the world around us in ways that deserve comparison with the natural sciences. Religions do make claims about the world, and an analysis of 'certainty' with regards to these sorts of things would require a comparison with other AOKs. When it comes to any of the sciences, there are relatively well-established methods and practices that will be taken into account when it comes to certainty. Here, 'certainty' is tied to those methods; one cannot be certain unless the methods are followed and the conclusions are 'significant'. In religious knowledge, however, certainty might be more about a relationship with the beliefs, not simply a rational assent to some claim. This is the point Wittgenstein is making, as discussed in the perspectives section of the student book: that 'certainty' is about accepting a belief in a particular way, we don't just 'hold' a belief, we hold it before us, let it guide us and let it challenge us. So, depending on how we characterize 'certainty', whether it be rationally holding on to a belief, or allowing a belief to guide our life, certainty is absolutely attainable in religious knowledge systems, though perhaps a different sort of certainty, given the different role the beliefs play in the believer's life.

Perspectives

Legitimate critique and 'properly basic beliefs'

The perspectives section of the student book discusses a number of issues related to the general question of the extent to which a religious perspective constitutes a self-contained block of knowledge immune to pressures from other AOKs. Gould's notion of 'overlapping magisterium' for instance, seems to suggest that scientific claims about the world are of an entirely different nature to religious claims about the world. We also explored the notion of 'language games' from Wittgenstein, who suggested that religious claims and historical claims comprise different games or uses of language. In both the discussions of overlapping magisteria and language games, one of the outcomes seems to be that a non-believer, one for whom the perspective of the religious is not available or not understood 'from the inside', cannot make critiques of the content of religious belief. The truth of these claims, insofar as they are used or understood by the religious believer, depends on the person making the claim being 'inside' that perspective.

This position will be utterly unsatisfactory to the scientist or the historian, especially given the fact that religious believers often make claims which seem to be in direct comparison with scientific claims. Take Wittgenstein's example of 'Jesus was resurrected'. Wittgenstein is probably correct to suggest that the religious believer will hold that belief in their minds and hearts in quite a different way, or will 'make quite a different place for it in their lives'. However, he probably underestimates the fact that the claim is also an historical claim (that it really happened) and that the idea of a person being 'resurrected' directly contradicts everything we know about dead bodies. A similar point can be made in relation to the overlapping magisteria: here is a case where they seem both to overlap and directly contradict.

The question of whether Jesus was resurrected (given that it is a claim about an event which is said to have happened in this world and at a particular time) does, in fact, make it a claim for which empirical or historical evidence might be sought. No matter what role the religious elements of the claim 'Jesus was resurrected' plays in the life of a Christian, it seems legitimate to say that, if it is to be considered an historical claim, it needs to be justified against the methods of the AOKs in which it sits, in this case, science and history.

There are other sorts of religious claims, however, which might still be hugely important in a believer's life, but which might not be the sort of thing which can be criticized in the same way. In Chapter 5 of the student book, we explored the important role that myth plays as part of Indigenous systems of belief. Here it seems that the content of the beliefs does seem to stand outside the ability to be critiqued. Even the religious believer might accept that a belief that is consciously mythical, if it is true, is not true in the same way that science and history are able to criticize. Here we might accept Gould's distinction more favourably.

The case for legitimate critique of religious belief is strengthened as we explore the wealth of knowledge provided by the sciences since the Enlightenment (discussed earlier in the Scope section). As the power of the Roman Catholic Church diminished in European cultures, both in terms of its ability to determine what could count for knowledge (what was consistent with Church teachings) and how that knowledge was constructed (through strict adherence to the authority of the Church), the increase in our understanding of the world grew exponentially. The power of the scientific method to provide reliable, objective and repeatable claims about the world seems to be its own justification. In fairness to the Roman Catholic Church, the basic power of the scientific method and the legitimacy of its outcomes (like the theory of evolution and climate change) are all now perfectly accepted by the Church, and are accepted as consistent with the Catholic Church's fundamental religious beliefs.

In all these cases, we are exploring what amounts to a disagreement over what constitutes the rules of critique. When wondering about whether a claim is 'true' or 'false' should we be using the methods and rules provided by the empirical approaches in science or history, or might 'truth' be found another way?

In the methods section of the student book chapter we examine Blaise Pascal's deeply powerful religious experience, and suggest that for him, to think that the rules of science are more certain than the experience of God that he had, itself is illegitimate. The experience for Pascal will always be more certain than anyone else claiming that 'only through testable empirical experiment can a claim about the world be justified'. This is the power of religious experience, and it seems improper to say that they are illegitimate forms of knowledge – you might never have had such an experience, but this does not mean that they cannot be had.

This dilemma about what foundational methods we should start with when justifying claims leads us into what theologian Alvin Plantinga called 'properly basic beliefs'. His arguments suggest that disciplines like science and history start with fundamental assumptions about how the world is, and that they are right to do so. When accepting these foundational beliefs, no rules about how to create knowledge have been broken, and without these fundamental assumptions, whole subjects would make no sense at all. Science, for instance, depends on the 'basic' (or foundational) belief that there is an external world, one that exists beyond our mind and that our experience of it is not an illusion. It also depends on the belief that the world works in regular ways – it follows patterns which we describe with physical laws. Similarly, mathematics depends on the acceptance of basic *axioms*. Without these 'properly basic beliefs' we simply cannot begin the process of doing science or mathematics, but nothing within these systems can ever be used as evidence for these beliefs. Similarly, with history, we must start with the basic belief that the events of history were genuine events and not figments of our imagination or put into our minds only five minutes ago. Again, without believing in this, we cannot do history. The key is that in both cases, the scientist and the historian are warranted in their beliefs; in other words, they are using their reasoning properly by making this assumption.

Plantinga then asks, why 'God exists' cannot be one of these 'properly basic beliefs'. Why should what makes a claim 'knowledge' or 'known' depend only on the way that science has dictated that those claims be known? We might say that nothing could ever contradict the belief that there is an external world, or that it is older than five minutes, and we could also say that nothing could ever contradict the belief that 'God exists'. Plantinga's point seems to be that religious believers need not let the scientists decide the rules of the game at every turn. He is not advocating making any belief we want into one that is properly basic (there are still basic expectations of consistency and coherence), but a believer need not simply give up the game by choosing to play by another discipline's rules.

TEACHING TIP

A really helpful distinction to make is that between religious knowledge systems and 'religions'. The latter clearly refers to established religious frameworks and their communities. Buddism, Sikhism, Confucianism, Taoism, Shinto, Judaism, Christianity and Islam are all religions – established social communities built around similar sets of beliefs. Getting to a discussion in the TOK classroom about the relative merits of one religion over another might be leaning too far in a direction that is uncomfortable and hard to manage. You might, however, manage a discussion of the different approaches within those 'faith communities'. What are the key concepts in them? How do individuals relate to the divine in them? How does the knowledge of each community guide the everyday actions of the individuals? While we might discuss the relative merits of different perspectives within an AOK (we might consider the merits of the behavioural versus the cognitive approaches in psychology, for instance), even there we are considering their relative merits. We might consider how they each are suited to different questions, without engaging in a question of which is better. That would be for the psychologist to decide.

Similarly, a religious believer might take seriously the question of 'which is the true religion?' A TOK student would rather explore the different approaches and how they might give us a different map to follow.

For this reason, it might be beneficial to maintain a discussion around the general approaches of religious knowledge systems and compare them with non-religious knowledge systems. It will be important to ground the discussion with examples from within religious communities, but as illustrations of general points about how religious systems (as opposed to a religion's view) differ or have similarities with non-religious systems.

A comparative approach

Another avenue for the analysis of various perspectives in religious knowledge systems is to be found in a well-known framework by Ninian Smart for a comparative approach to studying the religions of the world. In the mid-twentieth century, Dr Smart (while at the University of Lancaster in the UK, and other prestigious universities in the UK and the US) pioneered the new academic discipline of 'religious studies' or 'comparative religions', which sought to differentiate itself from 'theology' or 'divinity' by taking an explicitly comparative approach, identifying and articulating similarities and differences in how people think and behave religiously. Smart was not interested in exploring the truth or falsity of religions, but rather in understanding their structure. Smart offers seven 'dimensions' of religion, which provide a way of developing a comparative framework across religions (a bit like how the knowledge framework of the TOK course offers a way to frame comparisons across AOKs). We offer a discussion of it here as a way of helping the TOK teacher navigate through their own approach to the various perspectives offered by different religious knowledge systems.

CONNECTION TO: THE CORE THEME

What is the relationship between the individual knower and the various elements of Smart's seven dimensions? Religious knowledge systems are arguably one of the most important communities of knowledge for the individual. In nearly every case, it is the individual's own 'soul' at stake, so aspects of the individual knower/community of knowers' dynamic, like individual acceptance, articulation and control of the shared message and the transfer of knowledge between individuals, communities and vice versa are important discussion points. We have developed some general points about how each of Smart's dimensions relate to the relationship between the shared knowledge of the religious knowledge system (or community of knowers) and the individual knower in that context. We have not offered or unpacked many specific examples except by way of brief illustrations. Teachers are encouraged to set research activities in order for students to develop their understanding of their own or others' religious knowledge systems, especially if the student is considering writing about religion in their assessments.

A table explaining Smart's seven dimensions and linking each to the TOK course can be accessed using the first QR code shown on the left.

ACTIVITIES

1 Which cognitive tools are highlighted in each of the dimensions?
2 Use the dimensions to develop a research project, presenting various religious belief systems in terms of Smart's dimensions. Use the second QR code on the left to access a source which links a number of major religions to Smart's dimensions.
3 How does each dimension promote *knowledge* within a religious community of knowers?
4 How effective do you think Smart's framework is as a tool in the field of 'comparative religions' or 'religious studies'? Do you think it provides *objective* knowledge? Do you think using a structure such as this turns the study of religion into something like a *human science*? What might the strengths of using this framework to identify and articulate comparisons (both similarities and differences) be? Are there weaknesses?
5 Consider the assumption that the development and use of this, or other comparative frameworks, suggests about religious knowledge systems. Do you think using this framework assumes that they are all on equal footing with regard to the truth or with regard to one another? This framework avoids the issue of whether the religious claims made by a religion are *true*. Would a member of one of the communities you discuss accept this method?

Methods and tools

There is much fertile ground when exploring the methods and tools available to the religious believer in relation to knowers in other AOKs. Some of these elements are outlined in this section of the student book. This section might present genuine challenges to students who are caught in one of the strongest traps: that of thinking that the methods employed by science are really the only methods available in the construction of knowledge. If a student approaches religious belief thinking already that it is fiction, then these methods are never going to seem even remotely plausible. Likewise, for students already devoted to a religious tradition or part of a strong worship community, the credibility of these methods might never have been honestly compared to the methods of other AOKs, or to what an outsider's view of these methods might be. Thinking about these methods might then provide genuine learning for all students.

The trick will be to encourage students to take an 'objective' view of the methods discussed. Here, we have decided to focus on reason, as students often disregard the importance of reason in the creation of religious knowledge.

Reason

One of the most pervasive stereotypes students draw from when they are exploring religious knowledge systems is the thought that they all are 'just based on faith' or that 'there is no reason, it is all faith'. They assume that there is some sort of continuum with faith or emotion at one end and reason at the other. This assumption, however, makes it difficult to develop a nuanced understanding of the interplay between reason and faith when it comes to religious knowledge systems. As emphasized in the student coursebook, all religious traditions have a very long and rich history of religious analysis, debate and argument. Making religious knowledge into a rational system of belief has always been a priority in religious traditions. The four arguments for the existence of God, presented in the student book (pages 203–8), are attempts at providing a rational basis upon which to base a belief in God, whether or not you think the arguments are successful.

There is an activity in the student book that prompts students to develop formal versions of each of the arguments. Here, we have expanded this to show how you might centre an entire lesson around this activity.

LESSON PLAN: FORMAL VERSIONS OF THE ARGUMENTS FOR THE EXISTENCE OF GOD

Introduction

This lesson will allow students to explore the arguments and help them develop their understanding of how reason is used in religious knowledge systems (specifically in arguments for the existence of God).

Framework section

Methods and tools.

Aims

Students will:

- examine the role of reason in religious knowledge systems
- investigate the use of evidence and logic in arguments for the existence of God.

This is an explicit attempt to challenge the stereotype that religious belief is all about *faith* and entirely lacks reason.

Objectives

Students will be able to:

- explain four traditional arguments for the existence of God
- understand the nature of premises and conclusions in an argument
- develop logical skills by extracting the step-by-step arguments from the narrative version presented in the student book.

Knowledge questions from the TOK subject guide

- Are religious beliefs rational?
- Are faith and reason interdependent?
- Is certainty any more or less attainable in religion than it is in the arts or human sciences?

These are suggestions; other knowledge questions could certainly be relevant here.

Relevant course concepts

Evidence, explanation, objectivity, justification.

Prior learning

- Students will likely have explored some elements of religious knowledge systems prior to this, but this could be used independently of those discussions.
- The lesson is focused on the role of *reason* in justifying belief in the existence of God, so builds on or gives students the opportunity to discuss the relative roles of evidence, justification, faith and reason in religious knowledge systems.

Lots of focus here on challenging stereotypes. Remind students of the pitfall of only thinking of *faith* when thinking of religion.

Required resources

Access to Chapter 6 Knowledge and Religion in the student book.

Activities

Here you are looking for general understanding of the concepts in the argument.

1. Break students into small groups and assign each group a single argument for the existence of God.
2. Remind students what the following terms mean (using Chapter 1 of the student book): premise, conclusion, valid, sound.

As students explain, help them articulate a step-by-step series of points, leading toward the conclusion, 'God exists'.

3. Ask students to read and discuss their argument.
4. Ask students to explain their argument to the group. If you have assigned an argument to more than one group, the second group should try to *add* explanations that the first didn't cover.
5. Ask students to go back into their groups and try to recreate the argument in *formal* steps. *(NB: Students may try to cut and paste the words and sentences from the student book's description. However, they should be creating their own articulation, but capturing the same ideas.)* Rules:

Paring down ideas into a single sentence is often a real challenge. Precision is good thinking though!

   - Each premise should be a single, short sentence.
   - The premises should not contain any examples or explanation, just the single idea.
   - Each argument must end with something like, 'Therefore, God Exists'.
6. Each group writes their step-by-step argument on a whiteboard for the class to see and discuss.
7. The class can now discuss each premise and evaluate validity and truth/soundness of the arguments.

Follow up

Students would do well to develop their critiques of the arguments now in relation to specific premises. Ask them to write a critical reflection on the arguments. Critical reflections are not necessarily contrary to the argument; they could develop an analysis pointing out the role of faith or evidence as well.

Activities

1. What empirical evidence from the world around us can be used in support of these arguments?
2. Where do you think *faith* would impact the logic of these arguments?
3. How strong do you think the *logic* of the arguments is (as opposed to whether you *agree* with the arguments)?
4. How might you use what you have learned to engage with the following quotation: 'There is no rational reason to believe in God'?
5. Where you do not accept the truth of a premise, can you develop a counterargument showing that the premise is false?

Use the QR code to access IB Extras where you will find a discussion of the arguments for the existence of God to support your exploration of them in class. Each argument is designed here to be (largely) valid, but students may find it a challenge to evaluate the logic of the arguments distinctly from their own acceptance of them. The challenges to the arguments are generally about whether the premises themselves are true. Teachers should push the idea that *one general critique might be: 'I accept that the logic of the argument "works" but I do not accept the truth of the premises or of this particular premise.'*

A 'formal' version of the argument is one that breaks down the argument step-by-step into its elements (consider this in relation to critical and computational thinking). One of the challenges when trying to articulate the formal steps in an argument is setting aside our agreement with each step and focusing our thinking only on the rational connections within the argument. The process of doing this should underscore the role of reason in theistic arguments.

Religious experience

In the discussion of special revelation in the student book, there is an activity that asks students why people rarely experience religious phenomena from a tradition outside of their own (page 216). The sample response below expands upon this question, in response to a related knowledge question from the TOK subject guide.

SAMPLE RESPONSE TO A KNOWLEDGE QUESTION

Can there be religious knowledge that is independent of the culture that produces it?

The fact that generally people's religious experiences are experienced in the terms and images of the faith system and culture around them is often suggested as a reason to be sceptical of them. One might think that if there is one 'true' religious knowledge system (say Hinduism), then everyone having a 'genuine' or 'real' religious experience would be having experiences of Lord Vishnu or Krishna. The critique suggests that the experiences that people have are really only expressions of their pre-existing cultural beliefs, and we cannot therefore have religious knowledge that is independent of culture.

One thing to keep in mind is that we find ourselves interpreting the world through the beliefs we already hold in all sorts of ways. Throughout the TOK course we have discussed the idea of how we apply 'maps' to situations about which we know very little in order to provide a framework through which we might make sense of new experiences and phenomena. Consider the discussion of the conjoined twins in the student book's Chapter 2 (pages 71–2). There the judges and the parents were faced with a completely unknown 'territory' and could only make sense of it by applying a certain kind of map, or a collection of ideas, which helped them make sense of the experience.

In terms of religious experience, why should this be different? If you are a Hindu and have understood your world in terms of the religious knowledge systems relevant to you, one built up around religious stories about Lord Vishnu or Krishna, is it any wonder that your religious experiences will be constructed of ideas and concepts familiar to you? When thinking about the nature of God or the supernatural world, or our own 'ultimate concern', it would be surprising if we didn't use the concepts and ideas available to us. Consider also the idea that, if there is a divine reality, should it not make sense that that reality is presented to our understanding through the images and metaphors that are part of our own ideas, otherwise we could not make sense of them? For example, if the Lord Vishnu were to appear to a Christian living in America who knew nothing about Hinduism, the Christian would not have any way to make sense of what that experience meant.

This view, however, is a relatively liberal view. The metaphor of knowledge as a map assumes that the knowledge created or the map is not exactly the same as the landscape, that a 'map is not the territory'. The point being made here is that the divine reality is one thing, and human attempts to make sense of it are another. This is not the view taken by many religious believers, who accept their religious system's dogma as being undoubtedly true.

The perspective that the divine reality is one thing and the knowledge we construct about that reality can be called a 'constructivist' approach (notably discussed in the works of Gordon Kaufmann, especially *God the Problem* (1979)). The idea is that many people have experiences of what they might call a 'divine mystery' and struggle to explain or make sense of what was experienced. People then 'construct' an understanding of this mystery using the concepts available to them through their culture. It is no wonder that Buddhism, for instance, has close conceptual connections and shares many ideas with Hinduism, given that Siddharta Gautama was himself a Hindu. Similarly, Jesus Christ was a Jew (as were the people he was preaching to), so spoke of his own mission in terms of the Jewish scriptures. On this 'constructivist' view, the job of the theologian is to pay careful attention to the way the mystery is being discussed to root out any misleading claims. This is essentially a TOK exercise: considering whether the concepts and ideas we use to describe a phenomenon is adequate to the phenomenon or whether the 'map' we are using is leading us into mistakes. Many female theologians, for instance, consider the focus on men as leaders in western religious organizations a worry; they question whether the fact that God is seen as male in the western traditions has led to a view that being female is somehow a disadvantage in the religion, especially considering how in many instances women are not allowed to become ministers, priests or imams (see Elizabeth Johnson's *She Who Is* (2017)). In the 1970s, a movement called 'Black Liberation Theology' questioned whether the image, common in the United States, of Jesus as white led to further racism against the black community (see James Cone's A *Black Theology of Liberation* (2017)).

The fact that people tend to describe the divine in terms that they have inherited from their context and culture then, might not necessarily be a critique against the truth of those claims. It simply suggests that making sense of the world often requires us to use ideas and maps that are already familiar to us and that these help us make sense of ideas and experiences that are very hard to make sense of. It is hard to imagine what an idea completely distinct from any cultural connection would look like.

ACTIVITY

Ask students to research how some religious knowledge system characterizes the divine being or divine beings and think about the following questions:

1 How do you think the way that these beings are characterized might lead people to believe other non-intended elements?
2 If we think of the descriptions as metaphors, how might we differentiate the relevant elements of the metaphor from the irrelevant elements?

Ethics

Ethics vs morality and the relationship to religious knowledge systems

KNOWLEDGE QUESTIONS

Relevant knowledge questions from the TOK subject guide:

- Does religion provide a way to systematize concepts of right and wrong?
- If religion is intimately connected with ethics, should we expect those with religious knowledge to act more ethically than those without religious knowledge?
- Can there be religious knowledge that is independent from the culture that produces it?

As we have seen, there is a close relationship between religious knowledge systems and ethics, but too often students assume that they are in essence the same sort of thing, and underestimate the important differences between them. Here might be a good place to justify a strong distinction between the two, in order to better understand both ethical forms of knowledge (no longer in the TOK subject as a specific area of knowledge but infused throughout the course) and religious knowledge systems.

As a way of comparing the distinct forms of knowing what is ethical knowledge and religious knowledge we can use the distinction made between ethics and morality in the 'Introduction to Teaching Ethical Theory' available at the QR code on the left.

Since morality often refers to specific behaviours (e.g, 'do not drink alcohol') and ethics are general theories of values, how might these relate to religious knowledge systems? We might suggest that the morals of a religious community are heavily influenced by the religious knowledge in place in that culture and are heavily influenced by the authority of the religious institutions (Smart's social dimension) and sometimes revelations accepted by that community. The morals followed then might likely take the form of prohibitions ('Thou shalt not …'). The justification for these morals rests in the acceptance of the authority or the revelation. We discussed the root of the word 'religion' as the Latin for 'binding' (*religare*) and here we can see how this notion of acceptance or faith ('trust') is a different sort of justification than appeal to rational justification. Someone acting in strict accordance with their religious knowledge might be acting morally by following the rules of that community or culture, but this does not mean they are necessarily acting ethically; that is, acting in accordance with some rationally developed and systematic explanation of the concepts of 'right' or 'wrong'. They simply are doing what their cultural rules tell them to do.

CONCEPT CONNECTION: JUSTIFICATION

Justification is a relationship between a claim and the reasons for believing it. In most cases the term conjures up a rational process, whereby some claim or conclusion is said to be justified if reasons or premises for it logically lead to the conclusion. But in religious knowledge systems we might find a different type of justification, through the appeal to authority, either of an institution, a set of doctrines or of a divine revelation. Not accepting this as a valid form of justification probably just means that you are not part of that community.

Ethical theories, however, are not necessarily as closely tied to the religious authority of institutions or revelation, instead developing rational justifications based on shared human experience (like a sense of human flourishing in virtue ethics, or human pleasure in consequentialism). Even the natural law theory favoured by the Roman Catholic

Church is rational in this sense, originating in an understanding of the natural human state, the logic of which is accessible, to some degree, even by atheists. Ethical decision making, then, depends not on belonging to or accepting the doctrines of some religious community, but instead relying on a shared understanding of our humanity and our rational process. In this case, however, the individual is charged with making their own decisions, rather than giving up their choices to the authority of an institution or subsuming their humanity in the face of a divine revelation. Theologians might concern themselves with developing ethical theories based on revelation and authority, but the vast majority of people accept that religious knowledge systems provide very clear guidelines (or morals) on how to behave and place their trust in them to guide them in their behaviour.

Conclusion

The study of religious knowledge from a TOK perspective provides real opportunities for students to take intellectual risks. Some students might find a framework to defend their own religious belief, or at least provide a way of exploring it, as a viable form of knowledge in relation to other forms. Other students might benefit from the application of a framework of understanding to develop their own views on the nature of religious knowledge. As with any TOK discussion, teachers must be on the lookout for debates that don't retain a TOK perspective, and this is a particular pitfall in relation to religion. The students' own emotional commitments will be closer to the surface in these discussions as well, so will need careful handling. Finally, you might need to check with your administration to find out whether any of these discussions are going to touch upon cultural or legal prohibitions. Given these issues, however, we suggest attempting such discussions, as they are excellent ways of building deep understanding of the nature of TOK.

Works cited

Cone, James H. 2017. *A Black Theology of Liberation*. New York. Orbis.

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Kaufman, Gordon D. 1979. *God the Problem*. Cambridge, MA. Harvard University Press.

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- their religious community
- peers
- lessons they have encountered in school
- stories they have read in the press
- social media (there is a section later in the student book chapter that discusses the influence of social media on politics – see pages 244–6)
- personal observations of things that have happened to people around them (for example, the struggle of immigrants they know, a family member who cannot get proper health care, women who are not paid the same as men for the same work – the possibilities are endless).

None of these necessarily mean that students have been influenced to think the same way about politics as their parents, community, peers or other influences do. Often people's political beliefs are formed in reaction to attitudes that they witness in others which they find irrational or troubling.

CONNECTION TO: THE CORE THEME

Chapter 2 of the student book has an exploration of Plato's idea of our 'puppet masters', which is closely related to the ideas being explored here.

The remainder of the introduction to the student book continues the discussion of language by moving from the definitions of the word 'politics' to considering how the idea of something being political can often have a negative connotation.

In exploring the concept of political correctness, you might wish to have students explore the ways in which the divide between people with different viewpoints about what is and what is not politically correct seems to reflect a divide in general in political outlooks. During the 2016 US presidential campaign, we saw open hostility toward the idea that we should make an effort to be inclusive and to ensure equality. In the first Republican presidential debate, the GOP frontrunner and future president, Donald Trump, was asked about controversial comments he had made in the past about women. 'I frankly don't have time for political correctness', he responded. The implication of this statement is that Mr Trump himself has no concern for whether his language is respectful of women (or others), and that he thinks that others who do express such concerns are wasting people's time. If you would like to read an article by Joshua Florence in the *Harvard Political Review* about the historical development of the concept of political correctness since 1793, use the QR code in the margin.

The discussion about political correctness and the attitudes which accompany the use of that term is relevant to a consideration of the following knowledge question from the section on language and knowledge in the guide.

SAMPLE RESPONSE TO A KNOWLEDGE QUESTION

How do our values and assumptions influence the language in which we express our ideas?

Language is the primary means by which we communicate with each other. We can use language very deliberately – as authors do – to communicate certain precise ideas through carefully crafted means. In such a case, while our values inform our choice of language in a conscious way, assumptions are less likely to be an influence, as the deliberate care means that we are consciously trying to eliminate assumptions as much as possible. Think, for example, of President Abraham Lincoln, whose Gettysburg

Address has become one of America's most famous Presidential speeches:

> Fourscore and seven years ago our fathers brought forth, on this continent, a new nation, conceived in liberty, and dedicated to the proposition that all men are created equal. Now we are engaged in a great civil war, testing whether that nation, or any nation so conceived, and so dedicated, can long endure. We are met on a great battle-field of that war. We have come to dedicate a portion of that field, as a final resting-place for those who here gave their lives, that that nation might live. It is altogether fitting and proper that we should do this. But, in a larger sense, we cannot dedicate, we cannot consecrate – we cannot hallow – this ground. The brave men, living and dead, who struggled here, have consecrated it far above our poor power to add or detract. The world will little note, nor long remember what we say here, but it can never forget what they did here. It is for us the living, rather, to be dedicated here to the unfinished work which they who fought here have thus far so nobly advanced. It is rather for us to be here dedicated to the great task remaining before us – that from these honored dead we take increased devotion to that cause for which they here gave the last full measure of devotion – that we here highly resolve that these dead shall not have died in vain – that this nation, under God, shall have a new birth of freedom, and that government of the people, by the people, for the people, shall not perish from the earth.

It is difficult to see where any assumptions inform that speech. Lincoln spells out the values that he wishes to speak about: that the United States was conceived in liberty and that it is dedicated to the belief (the value) that all men are created equal. We might consider whether the use of the word 'men' reveals any assumptions, but in 1863, when the speech was given, 'men' was the group noun that was commonly used to mean people. It is also true that women in those days were not commonly seen as having power, and so the use of the word 'man' might be seen as being literal and reveal the assumption that women were not born equal to men. Nevertheless: as the occasion was a memorial for those men – not women – who died during the battle at Gettysburg, the literal meaning seems likely to apply.

You might wish to look at other such deliberately crafted pieces of writing – King George VI's speech on the occasion of Great Britain's entry into the Second World War, for example, or any poem (poetry being a literary form which relies particularly heavily on very carefully chosen language).

Most of the time, however, we use language much more casually and in situations in which we are speaking extemporaneously, without time to think ahead too far about how we wish to express ourselves. In those situations, our language is more likely to reveal our assumptions. The discussion in the student book about political correctness arises from the fact that language reveals values and assumptions (see pages 222–3). People who advocate for changes in the way we use language are reacting specifically to the fact that some language presumes negative attitudes about some people. The use of the word 'men' to mean 'all people' doesn't work in the twenty-first century, however accepted it might have been in the eighteenth century when the Declaration of Independence (from which the phrase 'all men are created equal' was taken) was written. Calling someone 'black' when that person prefers the term 'African American', reveals that the speaker does not value the right of others to be identified according to their own choice, and it reveals an assumption that 'black' is not offensive – or that the speaker does not care about being respectful. (The student book notes that the distinction between 'black' and 'African American' is a culturally bound one: such a distinction does not exist in British English, for example.)

Use the QR code on the right to access a website which provides a detailed analysis of how one individual's language use (documented over months) reveals her attitudes and assumptions about racial differences. It is an excellent case study in the way in which we reveal our values and beliefs without realizing we are doing it.

Within the field of politics, then, the exploration of this knowledge question – 'How do our values and assumptions influence the language in which we express our ideas?'– reveals that values and assumptions about a number of political issues, including race, gender, religion and nationality are very often entrenched in the language that we use. Politicians generally try to avoid making comments that might reveal them as bigoted, and it is often the slipups that cause scandals. In 2014, for example, the Mayor of Sochi, when speaking about the upcoming Winter Olympics said that homosexuals would be welcome to attend the games, so long as they did not break any laws. He then said, in response to being asked whether gay people had to hide themselves in Sochi: 'No, we just say that it is your business, it's your life. But it's not accepted here in the Caucasus where we live. We do not have them in our city' (BBC News). The claim, which is completely implausible (and which was immediately denounced by one of the mayor's opponents) reveals the mayor's attitude that homosexuality is wrong. His use of the word 'them' is a classic verbal trick for separating oneself from others.

We can make the same observation about the ways in which our values and assumptions influence our language for many other situations beyond politics. When we have a chance to be careful, we mostly try not to use language which reveals values and assumptions which we believe others would find to be inappropriate. When, however, we are speaking without time to think carefully, or if we are not sufficiently self-aware to realize how our language use makes us look, we can quite easily reveal socially unpopular or unacceptable attitudes.

Note: this exploration of the knowledge question is, as always, only one way in which the question might be explored. This response did not, for example, explore the ways in which our more positive and flattering values and assumptions are revealed in the language that we use. Someone using different examples would approach the question in a different way. The nature of a knowledge question is that it is open-ended, and so there is not a 'right' answer: there are just well-supported responses or badly supported responses.

Scope

Because the scope of politics is so broad – the politics of any nation encompasses every person who lives in that nation and influences people of other nations, for example – this section of the student book is rather brief. It merely makes the point that politics reach into many aspects of everyone's life and provides a few examples. The section compares the political structures of various institutions to the political structures of governments. The section closes with the introduction of the idea that political forces inevitably shape what knowledge gets developed and what knowledge gets disseminated and to whom. All of these ideas will be covered in more detail later in the chapter.

One possible activity to help students appreciate the reach of politics would be to have students work together to brainstorm a list of features of their community, country and/or personal experience that is influenced by politics. Such a list might include (but would certainly not be limited to):

- health care
- housing cost
- where certain people can live
- cultural diversity in a community
- quality of education
- job availability
- public services, such as parks, community recreation facilities and sports teams
- infrastructure, including roads, bridges, internet availability and so on.

One approach might be to challenge students to think of something in their lives which is not touched by politics. You will have to be ready, in that case, to ask other students to push back against any such ideas or to offer a counterargument yourself. Some examples are shown in the table below:

Student offering of something not touched by politics	Counterargument
Music	Politics often plays a role in what music gets played on the radio and marketed to consumers. Marketing on the internet is particularly fraught with political manoeuvring. Explicit lyrics are another example of the way in which politics influences the distribution of music to the public.
What they eat for breakfast	Politics governs what food is deemed safe to eat, as well as how that food is grown, transported and priced for market.
Air	Politics is directly involved in regulating our air by setting air quality standards, or rolling them back, if a given administration doesn't think that government oversight is necessary.

It is important for students to notice, as part of this activity, that the discussion is focused on knowledge: it is an investigation of the importance of political knowledge both in terms of what politicians should and must know and in terms of what a citizenry who chooses politicians needs to know in order to make good decisions.

KNOWLEDGE QUESTIONS

Relevant knowledge questions from the TOK subject guide:

- With regards to politics, do we know as much as we think we know?
- Is being knowledgeable an important quality in a political leader?
- How can we know whether we have sufficient knowledge before voting in an election?

CONCEPT CONNECTION: POWER

We did not, at this point in the student book, discuss the significance of power as it pertains to Knowledge and Politics; however, it could certainly be discussed here fruitfully. As students begin to realize how far-reaching the effect of political decisions are, they should begin to understand how much power politicians have over their own lives and the lives of everyone who lives in their community or country. They should also begin to understand that the right to vote is a right which confers on people affected by politics some power over the decisions that get made. Engagement with the political process by campaigning for a particular candidate, writing letters and participating in community forums is another kind of political power that individuals exercise. Knowledge of the community, the politicians, the issues and the avenues open to individuals to participate is of fundamental importance in the political process.

A final case study which can be used in exploring the methods and tools of politics explores the idea that different professional politicians must know about political issues which are specific to the area which they represent.

Case Study: Rising sea levels

In Bangladesh in 2019, approximately one-third of 165 million residents live and pursue their livelihoods in coastal regions. Already by this time during the rainy season, as much as one-fifth of the country could be flooded all at the same time (McDonnell). According to the National Geographic Society:

> Over the last decade, nearly 700 000 Bangladeshis were displaced on average each year by natural disasters, according to the Internal Displacement Monitoring Centre. That number spikes in years with catastrophic cyclones, like 2009's Aila, which displaced millions of people and killed more than 200. But even in relatively calm years, there is a rising drumbeat of displacement as sea-levels rise, erosion, salinity intrusion, crop failures, and repeat inundation make life along the coast untenable.
>
> Overall, the number of Bangladeshis displaced by the varied impacts of climate change could reach 13.3 million by 2050, making it the country's number-one driver of internal migration, according to a March 2018 World Bank report.
>
> (McDonnell)

The same kind of potentially disastrous problems arising from global warming-induced flooding occurs in many places in the world. In Britain, for example, an October 2018 report suggested that many homes along the coast cannot be saved:

> The new report from the Committee on Climate Change (CCC) said existing government plans to 'hold the line' in many places – building defences to keep shores in their current position – were unaffordable for a third of the country's coast. Instead, the CCC said, discussions about the 'hard choices' needed must be started with communities that will have to move inland.
>
> (Carrington)

In order to serve their constituents well, MPs from coastal regions must obviously, then, educate themselves about the dangers of coastal flooding, the current government plans and their viability (or lack thereof) and of potential alternate solutions.

You can view a sea-rise prediction map for coastal cities in Australia by using the QR code on the left. The interactive map allows you to view the currently projected coastline of those cities in a variety of scenarios with different levels of sea rise. Politicians representing those areas must, like those in the UK and in Bangladesh, as well as in any other coastal city around the world, develop knowledge of this problem, which, although a global issue, will have direct local consequences.

Perspectives

Political beliefs and values

The beginning of the section on perspectives in the student book establishes the integral connection between political beliefs and values. Working with this part of the Politics and Knowledge theme provides a good opportunity to review the detailed discussion of the concept of values in Chapter 1 (page 44). It may also be worthwhile to review the concept of evidence, where the relationship between facts, opinions and beliefs is discussed.

The student book follows up the identification of values as an important concept for political knowledge with a discussion of the work by political scientist Jonathan Haidt. He has worked for a number of years on identifying the fundamental values which underly political beliefs and on identifying the reasons for sharply divided political worldviews.

■ **RESOURCE**

An excellent resource for exploring this topic is Haidt's TED talk from 2011 called 'The moral roots of liberals and conservatives', which you can access using the first QR code on the left.

He gave a second TED talk at TEDNYC in November 2016, entitled 'Can a divided America heal?' The talk is specific to the political situation in the United States just a week prior to the election of Donald Trump as president, but the basic principles that Haidt discusses are relevant in many cultures. The kind of political divide he talks about could be seen, for example, in the UK surrounding the Brexit debate. Use the second QR code on the left to access the talk.

TEACHING TIP

Lest students think that political divisiveness is a modern phenomenon, ask them to review and discuss an old political cartoon, such as the one below, from the 1860s, during the American Civil War.

The cartoon shows the Confederacy as being an organization in league with the devil. A letter of marque was a document which gave private persons the right to board ships and confiscate the goods – to engage, essentially, in legal acts of piracy ('Letters of Marque and Reprisal'). The second document in the cartoon is entitled 'The Fundamental Principles of our Government', and lists such things as treason, murder and robbery. The Confederate government, as depicted here, is clearly shown as being wicked and lawless. The serpent over on the right is associated with the fall of Adam and Eve in the Garden of Eden – a succumbing to the devil. Its presence here suggests that the Confederate leaders, too, are succumbing to the devil's temptations. The image in this cartoon, then, constitutes a very strongly expressed opinion, which would certainly have been rejected by proponents of the Confederacy.

'The Southern Confederacy A Fact!!!', representing the Confederacy as a government in league with Satan

Other political cartoons depict deep divides in political values. The QR codes below link to two which relate to the Brexit controversy in the United Kingdom.

The first cartoon depicts the conflict of then Prime Minister Theresa May, whose attempts to get parliament to sign off on the deal she arranged with the European Union were met with considerable opposition and ended, eventually, in her resignation.

The second cartoon was published at the time of Boris Johnson's election to the role of Prime Minister in the wake of Theresa May's departure. It offers the opinion that this event is commensurate with the sinking of the UK as a metaphorical ship.

When using these resources, it will be important to ensure that the discussion moves beyond the simple determination of what the political position of the individual cartoonists are; instead, they must be used to understand more general principles of the knowledge problems that lead to such controversies. Having seen evidence of stark political divides from different nations and different eras, students might be asked to discuss what that widespread variety suggests about the nature of politics and the nature and development of people's political beliefs.

Another avenue of investigation might be to explore the question of how political cartoonists contribute to the process of constructing political knowledge.

What is particularly useful about Haidt's work for the Theory of Knowledge course is that his work is all about identifying the values which form the foundation of our political beliefs.

Haidt's work reveals the close relationship between moral beliefs and values and between values and political judgments. Because of that, his work connects two parts of the TOK framework: perspectives and ethics.

KNOWLEDGE QUESTIONS

Relevant knowledge questions from the TOK subject guide:

- Are political judgments a type of moral judgment?
- Can knowledge be divorced from the values embedded in the process of creating it?
- When exposed to numerous competing ideologies and explanations, what makes an individual settle on a particular framework? Is there ever a neutral position from which to write about politics or from which to judge political opinions?

Haidt's website has a number of surveys which your students could complete. Probably one such survey is sufficient to make the point in class, but students may be interested in completing others in their own time. The surveys can be reached by using the QR code on the left.

We recommend that you preview the surveys yourself before deciding which one, if any, you wish to assign students to complete. You will have to consider what is feasible in your particular teaching situation. However, in teaching TOK, it is also important not to shy away from difficult conversations (unless you could get fired), because uncomfortable conversations are a good way of identifying what we think is significant and important when it comes to the construction of knowledge.

In the methods and tools section that follows, there is a developed activity involving a different survey, called the political compass, which is included in an activity in the student book. You could use one of these Haidt surveys in much the same way, asking the same questions that you will see included in the political compass activity. As a recommendation: an activity involving one or the other of the two surveys (the political compass or the moral foundations survey) would be useful, but both would likely be too redundant in terms of what they reveal about the effort to make political knowledge to be helpful.

The next section of the student book addresses the way that the politics of institutions can also reflect different perspectives. It then offers a detailed discussion of the relationship between culture and political knowledge, showing how different cultures, both in countries and in institutions, generate different beliefs about the way that political decisions ought to be made.

Politics of knowledge and the shaping of perspective

This section in the student book (beginning on page 230) highlights the importance of our ability to know our history accurately, and emphasizes the importance of historical artefacts – documents, photographs, recordings, paintings and so on – in providing historians with a way to establish that past history. In contrast to the natural sciences, where much of the knowledge being developed can be constructed through direct observation of the thing scientists want to know about (discussed in detail in Chapter 9 of the student book), historians cannot observe the events and people about which they want to know. They rely, therefore, on what the events and people left behind, and which can still be observed directly. If someone alters those artefacts, history itself is, in effect, altered. The example of Joseph Stalin's deliberate manipulation of facts and artefacts make the point.

This section of the student book chapter references George Orwell's *Nineteen Eighty-Four*, which demonstrates in a fictional form the power of control over historical knowledge. If students in your school study *Nineteen Eighty-Four* in any of their English classes, you can collaborate with the English teacher to help lay the groundwork for studying politics and history in TOK.

The next section of the chapter raises the issue of how the education that any person can get is profoundly influenced by political factors. Predominantly, of course, that means the allocation of funding, but more subtly it means decision making about what course will be offered in any given school or school system, along with the decisions about what content will be offered in any given course.

ACTIVITY

A possible activity for exploring this idea is to ask students to imagine they are in charge of designing a school programme for students their age. They should decide which subjects will be offered and to whom. Will all subjects be available to all students? They should then choose one subject (it should be one of the TOK areas of knowledge) and try to decide what topics should be covered in that course in one year. They need to track decisions about what is left out, both in terms of courses being offered and in terms of topics being offered and, importantly, why. You may wish to specify history as the subject for investigation, as history offers vast choices of which students will be aware, and so they will necessarily have to make hard choices. After they have worked on trying to design this school curriculum, they must consider the implications for knowledge. Potential questions might include the following:

1 What are the forces which limit the choices of courses?
2 What are the forces which limit the range of topics covered in the course?
3 What are some important gaps in their knowledge that will result from students taking these courses as opposed to a different course which would include different options?
4 What are some consequences for society of the students learning what is in the course and not learning what is not in the course?
5 How does the act of choosing what goes into a curriculum reflect the relationship between knowledge and power? Do the choices that are made about what students will learn help to maintain political, social, ideological or physical power?

There is an activity in the student book (see page 234) which approaches the politics of education from a different perspective: the series of questions relates the problem to students' own personal experience, and so makes a connection to the core theme.

Politics and the dissemination of public information

The final section of the perspectives section deals with the way in which politics, in the shape of both funding decisions and official government policy, shapes what the public can know about a variety of issues. There is a discussion question on page 237 of the student book which asks students:

> Can you think of examples in your country of how political decision-making has resulted in your having access to either more or less knowledge of a particular subject?

You can guide this activity by helping students brainstorm a list of issues about which it would be important for the public to be informed. Then have them do some research to find out what the current policy is and how information might be distorted. An excellent follow-up question would be to ask students how it is possible for them to find out about information which is not being released to the public. In the case of the example of Donald Trump's official position about what government scientists can release to the public about global warming (see page 236 of the student book), one answer to how we can know, despite the effort to withhold certain information, is that the press in the United States can function, sometimes, as an independent observer. Investigative reports seek to function as a check on government policy, releasing information that has not been released directly from the government. The press, in other words, is capable of disseminating a different perspective on various issues from the perspective that the government officially presents. The crucial role of the free press is discussed in Chapter 11 (History), in relation to the concept of government censorship.

Another whole set of laws, another kind of political decision, governs what happens if a member of the press releases information which has been deemed important to the security of the nation. Investigating the ways in which information is or is not released in their own country can help students appreciate the ways in which political decision-making affects them, their knowledge and their ability to function in society.

The intersection between politics and technology

One mechanism related to the ability to include different perspectives in public discourse is the kind of politically motivated decision which controls whose voice is heard. Racism is one problem which keeps some people from having their perspective heard properly. Sexism is another, as are various other bigotries having to do with religion, nationality and sexuality. Often these prejudices are built into institutions in very deep and subtle ways, so that many people are unaware that the barriers exist. The following lesson plan provides you with one example of a way to explore that issue. You may wish, also, to connect this lesson to the discussion in Chapter 3 of the student book about the values and biases that get encoded into other forms of technology (see student book page 94).

LESSON PLAN: POLITICS AND TECHNOLOGY

Introduction

This lesson will allow students to investigate a real-life situation in which political attitudes toward women shaped the way that science was used in order to create technology which, in turn, continues to shape attitudes toward women, particularly women in politics.

Framework section(s)

Perspectives.

Aims

The aims all have knowledge-related terms: 'perspectives', 'understanding' and 'attitudes'.

Students will:

- understand how political perspectives can influence the development of scientific knowledge and technological development
- recognize that technology can influence our personal understanding and attitudes without our realizing it

- consider how the role of women in politics has been influenced by historical attitudes toward women and by technology.

The objectives elucidate ideas beyond just the specific real-life situation.

Objectives

Students will be able to:

- explain how political perspectives can shape the application of scientific knowledge
- discuss the real-life situation through the conceptual lens either of values, culture or power.

Some suggested ideas about answers to these questions appear in the reading notes below.

These are suggestions; other knowledge questions could certainly be relevant here.

Knowledge questions: from the TOK subject guide

- What kinds of knowledge inform our political opinions?
- How might knowledge reflect or perpetuate existing power structures?

Relevant course concepts

Values, culture, power.

Prior learning

- This lesson would work best after students have developed a basic understanding of the scope of politics as a body of knowledge.
- Students must also have at least a basic understanding of the definition and characteristics of the relevant course concepts.
- For the follow-up activity, students must have been introduced to the requirements of the exhibition.

Required resources

Article from The New Yorker, 'A Century of "Shrill": How Bias in Technology has Hurt Women's Voices'. You can use the QR code on the left to access the article.

Activity 1 makes a connection between technology and the particular real-life situation (RLS) and the core theme.

Activities

1. Prior to assigning the article, ask students to discuss their personal experience with the difference between women's voices and men's voices transmitted through electronic media: radio, telephone, loudspeaker and so on. Some potential questions:
   a. Do you notice a difference in sound quality between men's voices and women's?
   b. Do you find women's voices harder to listen to or more unpleasant then men's?
   c. Women are sometimes accused of being 'shrill'. Do you find that to be true?

Students need to understand the facts of the RLS before analysing in terms of knowledge.

2. Ask students to read the article and summarize the main idea of each paragraph in one sentence.
3. Ask for questions about the article before beginning the group discussion.

These questions work in order from those which are more specific to the particular RLS in the article to those which transcend the situation. Facts first, then analysis.

The question about consequences relates to the scope of technological knowledge.

These questions also have knowledge-related words in them: 'bias', 'preconceptions', 'reaffirm beliefs', 'unaware' and 'stereotypes'.

Question f offers an opportunity to discuss mechanisms such as confirmation bias which influence knowledge.

Question g brings the discussion back to a connection to the core theme.

These last two questions fulfill the essential need to ensure that a lesson moves beyond the facts of a real-life situation and incorporates questions about what the implication of this RLS is for knowledge-construction in general.

These prompts are suggestions only – others could certainly be chosen!

4 Discuss the article. This can be a whole group discussion or a small group discussion. Some potential discussion questions include:
   a The author of the article, Tina Tallon, has a particular point to make about bias against women politicians. What is it?
   b What is the author's suggestion about how to solve the problem?
   c What preconceptions about women in the 1920s affected the development of audio technology?
   d How did the developing audio technology help to reaffirm beliefs about women and their speaking voices?
   e What are the consequences for women of the way that audio technology has developed over the years? Consider the nature of the actual technology and the fact that the general public is unaware of the effect of the historical development of technology on women's voices. You may also wish to consider whether the same stereotypes that were present in the early twentieth century are still prevalent today.
   f What does this article reveal about the ways in which preconceptions about the world (whether right or wrong) influence the knowledge which gets made and the attitudes which get disseminated?
   g What have you learned from reading about the relationship between technology and stereotypes? Has the article affected your attitudes or ideas in any way?

5 Assign each group one of the relevant course concepts: values, culture or power. Ask each group to review the article in terms of how the real-life situation reflects the way that the assigned concept relates to the knowledge which is, or is not, made in this situation.

6 Groups share. You can jigsaw them or ask for presentations to the whole class.

Follow up

In order to relate this activity to assessment, you can ask students to think of an object which would illustrate something important about how knowledge was made in this real-life situation. You can assign a choice of the TOK prompts or students can choose one, depending on where in the course and in your work preparing students for the exhibition you are. Another possibility would be to ask students to write a paragraph analysing this real-life situation in the context of a prescribed title. As with the exhibition questions, you could choose the title or allow them a choice.

Some relevant TOK prompts for the exhibition:

7 What are the implications of having, or not having, knowledge?

11 Can new knowledge change established values or beliefs?

12 Is bias inevitable in the production of knowledge?

In this particular case, the concepts involved are not necessarily the course concepts, but the concept of women and their abilities vs the concepts of men and their abilities.

This RLS suggests that technological knowledge has caused and/or perpetuated problems. The intention may have been to solve a problem; however, only for a limited number of people.

21 What is the relationship between knowledge and culture?

35 In what ways do values affect the production of knowledge?

Some relevant prescribed titles from past exam sessions and the exemplars for the 2020 curriculum:

- November 2015: 'The main reason knowledge is produced is to solve problems.' To what extent do you agree with this statement?
- May 2016: To what extent do the concepts that we use shape the conclusions that we reach?

Reading notes for 'A Century of "Shrill": How Bias in Technology has Hurt Women's Voices'

Note: The text in blue relates directly to the knowledge questions and the course concepts referenced in the lesson plan. It identifies ideas that students might bring up in discussion of the three identified concepts and the two knowledge questions.

Point made in article	Significance for knowledge development
In 1924, radio station directors made strong claims about the unsuitability of women to be broadcasters – both in terms of the sound of their voices and in terms of their personalities.	These sweeping generalizations reflect stereotypes and a strong negative bias against the intelligence and stability of women. The acceptance of an 'unscientific' survey further underlined these entrenched attitudes. The attitudes then shaped the way that radio technology was designed. This is an example of how beliefs can determine what knowledge is actually constructed. 'Knowledge' in this case was knowledge about radio technology; the resulting product reflected the knowledge that was considered to be valuable and useful. Power: In that era, station broadcasters were men, and men, therefore, had the power to determine the attitudes and beliefs which would be perpetuated. Values: The fact that men were valued in the role of radio broadcaster and women were not shaped both the power structure and the technological knowledge that arose to serve that power structure.
JC Steinberg, at Bell Labs, made an argument in 1927 that there was a basis in fact (scientific) for the claims that women could not be understood as easily as men.	This claim was made in the context of radio wave frequencies which cut out the higher range of tones that humans can hear – a range in which women's voices form consonants. The physical nature of women's voices – a feature not of their choosing – led to specific choices in designing technological developments which then shaped attitudes. Steinberg, furthermore, blamed the women, not the decision of which frequencies to use in broadcasting. This is an example of an expert applying facts in a way which could be refuted – had anyone been inclined to consider the matter further. Culture: These first two points reflect a way in which culture – in this case, a culture in which women were already presumed to be hard to listen to and hard to hear – shaped knowledge.

In 1933, scientists confirmed that the frequency at which women produce consonants is outside the range of AM radio broadcasts. They demonstrated further that human hearing is more sensitive to higher pitched sounds.	Despite scientific knowledge, no changes were made to broadcast practice. Indeed, despite scientific knowledge, broadcasters used volume to exacerbate the problem. These decisions are political in that the decision makers in the radio industry were deciding that the best way to serve the community was to have male broadcasters. They therefore did not pursue technological solutions to the problem. Politically influential beliefs remained unaffected by scientific facts.
The technological bias against broadcasting women's voices effectively continued through the development of FM radio and on into today's data compression algorithms and Bluetooth technology.	Cultural attitudes have not changed enough to drive change within the culture of broadcasting in various media. Knowledge about the effect of contemporary technology on women's voices has not driven technological change to compensate. Power: Technological knowledge reflects existing power structures and perpetuates them.
Women are being told to lower their voices and not to get emotional.	Knowledge of the widespread attitude toward women generates an understanding that women must adjust in order to try to avoid fitting the stereotype. It is, in other words, politically expedient for women to comply with, rather than defy, the stereotype. The stereotype, a kind of skewed knowledge, drives behaviour and ensures that knowledge is not necessarily progress. Values: Values are in conflict here. One possible value would be a valuing of biological reality over socially accepted beliefs. Another value is the value of doing whatever it takes to get ahead within the existing power structure. Women who wish to work in public positions, be it broadcasting or the political roles mentioned in the article, have to choose between being true to their natural selves and risking being called 'shrill' when speaking on radios or through microphones, or altering their normal speaking voice and risking being perceived as fake.
Many studies have by now shown that it is very easy for the human ear to ascertain when a woman has adjusted her voice. That perception of fakery hurts women's credibility. The article gives the example of Elizabeth Holmes, the world's youngest billionaire, who has been charged with fraud (Hartmans).	More scientific knowledge (from both natural science and human science) accounts for problems that arise from the advice women have been given about how to counteract the negative stereotype. Nevertheless, the technological developments which could solve the problem have not been forthcoming. Culture, values and power: Knowledge from experts has neither had the effect of changing politically expedient opinions, nor has it been used to solve this particular problem. This is a political problem because it clearly benefits some members of society at the expense of others, and it becomes a more salient political issue when it influences who can and cannot win a place in public political office.

The final point the author makes is that this problem is not an insignificant one, because its effect is to silence the voices of a whole segment of society.	This point relates directly to the power of being able to contribute to discussion in any society – an essentially political power – and reveals the importance of our knowing when and how we are excluding people from that discussion. It underscores the importance of using our knowledge to solve problems rather than to perpetuate them or to cause new ones.

Methods and tools

The section in the student book on the methods and tools segment of the course framework covers a variety of situations in which people try to make knowledge about politics, including:

- culture-wide knowledge about a desirable political system
- laws as political knowledge
- politicians developing knowledge about problems needing to be solved
- individuals developing a baseline political stance
- individuals acquiring knowledge about political issues.

Within this part of the chapter, there are several activities and case studies to help you guide students through an exploration of the kinds of methods and tools that people use to develop political knowledge in different situations.

Culture-wide knowledge about a desirable political system

The first part of the discussion focuses on the relationship between values and beliefs and beliefs and political systems, and it includes a case study of the monarchy in Saudi Arabia which has shifted direction under a recent change in the monarch. The methods implied about how a nation knows what sort of political system it needs or wants are tradition, gradual change due to gradual changes in values and consensus of a majority of citizens. The activity gives students the opportunity to explore the connection between values and political systems in their own country's history. As always, students need to take the additional step, beyond ascertaining the facts, of evaluating how the knowledge (as reflected in the established political system) related to the values and beliefs of the people of the time.

Laws as political knowledge

The next part of the discussion focuses on laws and legal systems: the mechanisms for expressing and monitoring the knowledge that people have made over time in a particular nation about what is acceptable for people living in that place to do and what is not acceptable. Laws are inherently political, then, as they are the product of the decision-making process which defines politics. This discussion mentions, but does not develop, connections to several course concepts, including values, culture, power and responsibility. The section affords you, therefore, an opportunity for students to explore those concepts in more detail, should you wish them to do so.

Politicians developing knowledge about problems needing to be solved

The discussion of this section focuses on the wide range of knowledge that a politician (a person in the position of making decisions for a community) must have, if they are going to be able to do an effective job of advocating for constituents. The activity on student's book page 241 affords students the opportunity to find out for themselves how many issues come up before their legislators, so that they (the students) can begin to imagine the immense responsibility for knowing that politicians have.

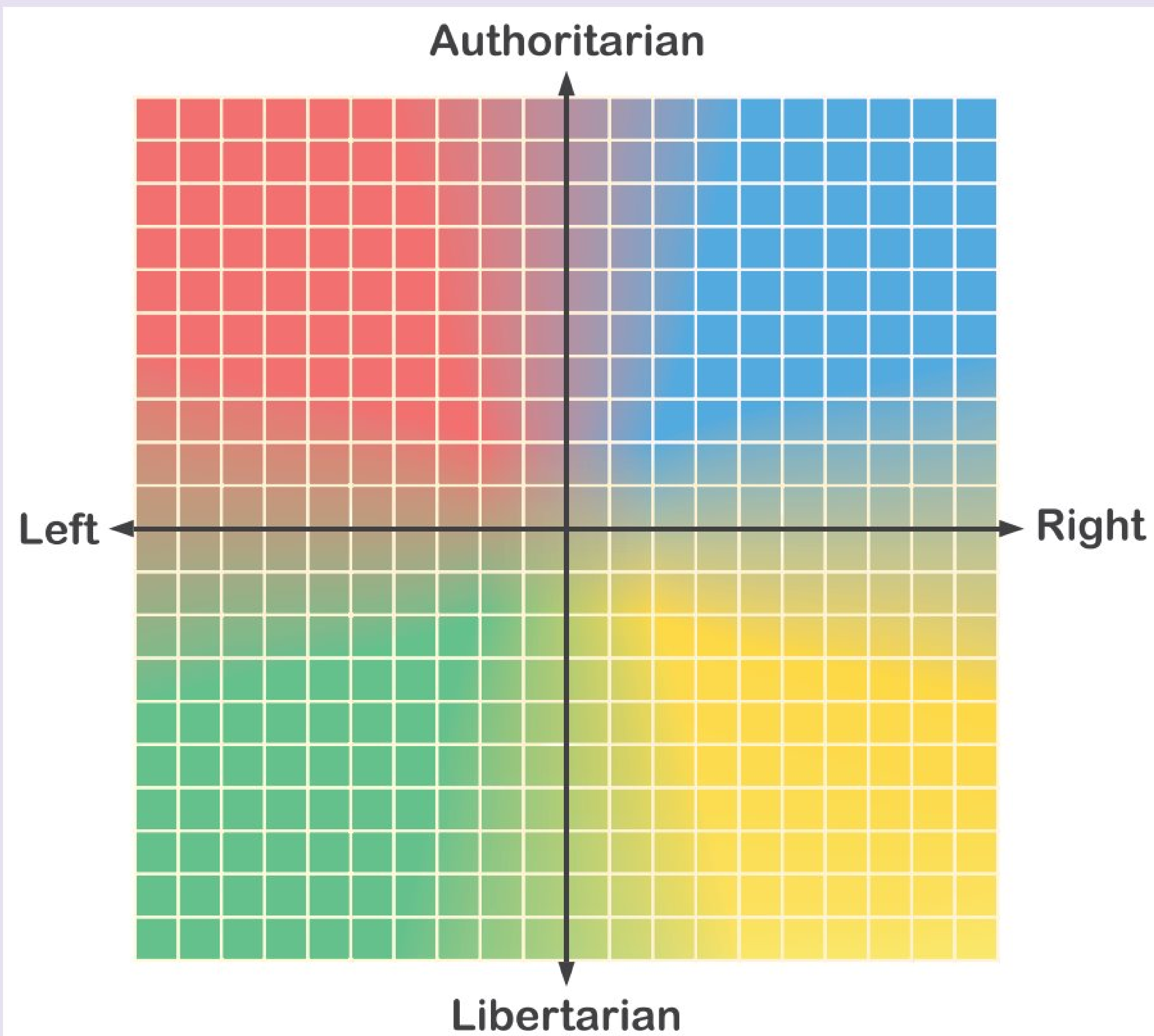
Individuals developing a baseline political stance

The next section of the chapter connects the ways in which politicians make knowledge to the ways that individuals make knowledge. It makes the case that experience with other people and events in the world is the essential force in shaping our political views. This discussion leads to an activity using the political compass website, which was mentioned earlier, during the discussion of Jonathan Haidt's work (see pages 155–7 of this book). The activity in the student book can be expanded considerably, if you wish to do so, as follows:

ACTIVITY

The student book suggests some connections between politics and economics, politics and language and politics and history, but of course other connections are possible. On page 243 of the student book, you will find an activity using the political compass website, linked to by the QR code shown on the left. That activity can be expanded to include the exploration of some useful connections to the human sciences and language:

1 The activity suggests that students go to the website and take the survey. You can have them do this all at once in class. Draw a four-square grid on the board, and label the boxes as shown below:



2 Students can then plot their result by estimating the correct spot. They can do it anonymously or using their initials. Once the whole class has plotted their results, you can discuss the class result: is there anything surprising? What influences might account for similarities or for striking differences (if any) among students in the same class at the same school and who, therefore, share a certain amount of cultural experience? Notice that the focus here is on how different people formed their beliefs differently, rather than on what those beliefs are or how strongly students hold them. The discussion should not at any time veer off into an argument about whose beliefs are 'right'.

3 Another direction the lesson can go is into a consideration of the methods of human sciences. (Some of the challenges of producing high-quality questionnaires to gather reliable data are explored in Chapter 10 of the student book.) The content of the survey is political beliefs, but the construction and administration of the survey is the job of human scientists. Some questions to be explored here are:
   a Does the result you got seem to you to accurately describe your personal political outlook? If not, where would you put yourself?

This could lead to additional discussion about the reliability of human science studies. This highlights the problem that human scientists face in trying to elicit truth from participants, and it raises the question of whether it is possible for human scientists to determine something about people which is ultimately more accurate than people's opinions of themselves. People are, after all, sometimes biased or even deluded.

   b Consider the language of the survey instrument:
      - Were there any questions which you found to be difficult to answer or for which you had to give an answer which did not represent your actual beliefs?
      - Were there questions you did not understand? Why were they difficult?
      - Do you think that the construction of the survey is likely to elicit accurate results? Why or why not?

Some issues which are likely to come up here are vocabulary words that are unfamiliar. The survey forces participants to answer all the questions, whether the participants can understand those questions or not. Another issue that may come up is the emotionally slanted nature of some questions which seem to direct participants to particular answers. The survey is an excellent example of the problems of surveys in the human sciences in general.

4 How did the website come up with your result? What methods were used to convert your answers into a political values profile?

The methods are not public; they are proprietary. The only way we have of determining whether the methodology is sound is by the result. If we feel that the results were pretty accurate, then we can deduce that the methods were good, but we cannot, from this activity, check them for soundness. We could not re-run the study with other participants in order to replicate the findings, either, as the *methods are private. We have no way of knowing, then, whether this study has been validated by other scientists. In accordance with scientific method, therefore, we should not consider the results to be 'knowledge'. They are hypothetical only.*

5 What does this survey reveal about the nature of the methods and tools in the human sciences in general? What obstacles are there to getting accurate knowledge? Are there ways to compensate for the problems?

This last question is a very important one: this is where you will ensure that the lesson achieves the aim of TOK in helping students focus on knowledge-making processes.

KNOWLEDGE QUESTION

Relevant knowledge question from the TOK subject guide:

- To what extent can polls provide reliable knowledge and accurate predictions?

Individuals acquiring knowledge about political issues

The final topic covered in this section in politics focuses on how individual citizens develop their knowledge of political issues. This part of the chapter provides a connection to the core theme, as it focuses on individuals rather than on professionals and experts in politics. One of the most important methods that individuals rely on is the word of authority figures. We listen to people whose opinion we respect. Because we respect them, we tend to believe what they tell us and (at least at first) to adopt their positions. Experience, as we go on through life, will either confirm or undermine those ideas.

Can we ever know what a politician is really like?

Among the many sources of information that we may or may not trust are the wide-ranging varieties of media, including social media, which has, in the twenty-first century, come to play a very significant role in conveying political information – accurate or not! – to many people, and especially to young people. A lot of this information is conveyed directly, in declarative statements, but a lot of political information is conveyed more subtly, through metaphor or symbolism. One kind of activity you can do with students is to ask them to interpret some of the visual media that is available in your country. The political cartoon on the previous page, for example, requires some interpretation.

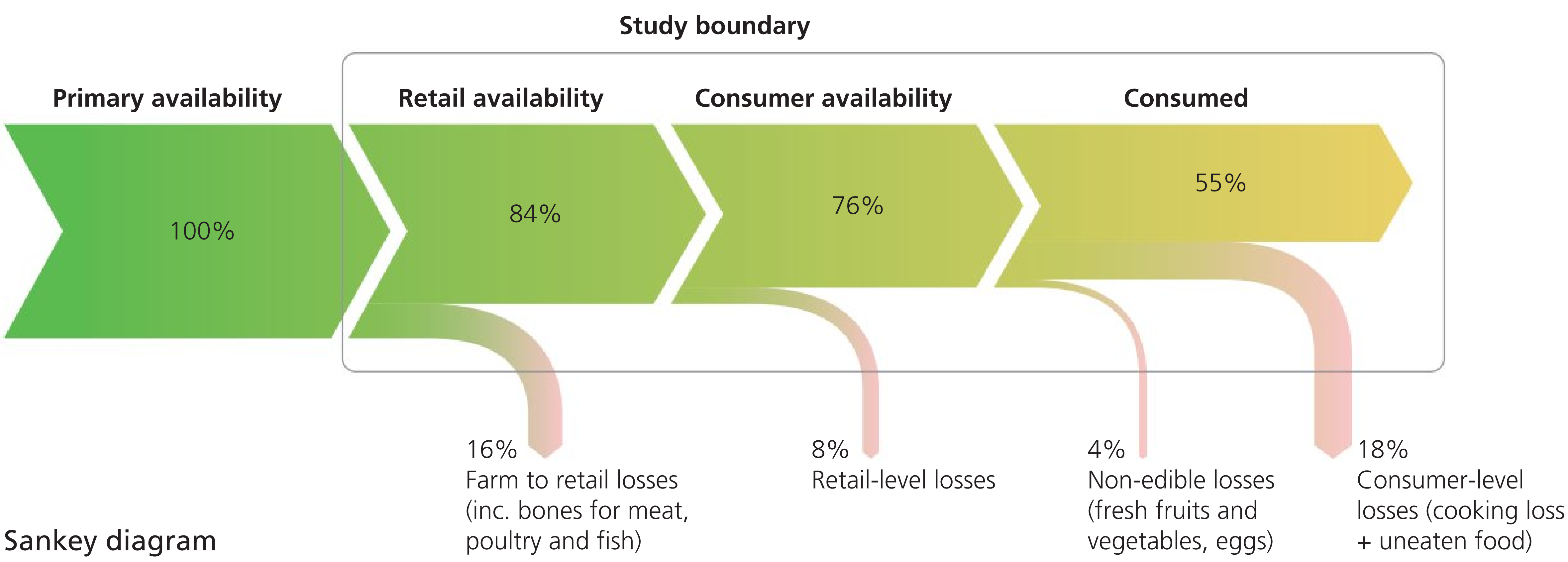
The politician standing behind the podium has no actual face, only a mask. This suggests that the artist wishes to convey the idea that we never know what a politician is really like – he (in this case, the politician is a man) only shows us a face that he wants us to see. The symbolism is more interesting than that, however: this politician has not one but six faces, all different. The cartoon suggests that the politician is ready with a number of different personas (points of view) that he can put on as needed, depending on the audience reaction to whatever it is that he has to say. The comment the artist seems to be making is that we cannot know, direct from a politician, what he is thinking, and we cannot trust him to have a consistent political value system, because he changes it at will, according to situation. The connotation is quite negative, and the individual viewers of the cartoon will have to first interpret it, before they can shape their ideas in response.

Another type of visual medium that is used to convey political ideas is the Sankey diagram. A Sankey diagram is one which depicts any kind of process which has direction and quantity in such a way as to reflect relative quantities by the thickness of the bars in the diagram. The diagram below is a Sankey diagram which tracks the waste of food that occurs in the supply line from the farm, or other first source of food products, to the table of the consumer.

This diagram reveals facts that virtually no average consumer knows. Students could look at this diagram and identify political issues reflected in this information. Some of the issues they might identify are:

- cost to the consumer to compensate the supplier for the loss of food
- the environmental and financial problems which result from the really high amount of waste
- the global impact of the use of resources in a system which wastes this much food.

Another important question for students to consider here is that of the impact of the fact that so few people actually know about the waste of food in the supply chain.



Sankey diagram

KNOWLEDGE QUESTIONS

Relevant knowledge questions from the TOK subject guide:

- With regards to politics, do we know as much as we think we know?
- Why do facts sometimes not change our minds?

Students can work together to interpret another Sankey diagram which can be found using the QR code on the left. The diagram depicts the targets of the tweets that Donald Trump made attacking people or institutions between January 2017 and early October 2017. In order to understand the chart thoroughly, consumers need to know how to interpret information to which they have access. The diagram implies a particular point of view, though it is not necessarily immediately obvious.

The table below contains some interpretive notes about the diagram.

Feature of the diagram	Possible interpretation
Purple colour chosen to represent media.	Purple is an amalgamation of red and blue, the traditional colours of the Republican and Democratic parties in the US. The colour suggests that this artist sees the media as consisting of both Democratic and Republican perspectives.
The purple line is the thickest one.	This contrast shows that Trump attacked the media more than any individual persons.
The phone is held in his left hand while his Twitter finger, on his right hand, is poised for another 'attack'.	This suggests an attack by the right, where Mr Trump's politics lie, against the left, where the politics of the Democrats lie.
There are 16 different pathways depicted in the diagram.	This variety reveals a wide range of people and institutions to whom Trump has objected in the first eight-and-a-half months of his administration. So many targets may suggest a president who sees himself as having many enemies.
The overall effect of the combined elements of the diagram implies criticism of Mr Trump. He appears to spend a lot of time attacking people, and he has a particular objection to the media. (As we saw above, one role of the media is to provide a check on government information and actions.) He seems, from this illustration, to be overly sensitive and somewhat confrontational. The use, in the description, of the word 'attack', also conveys the artist's attitude toward his subject. Instead of just conveying facts, this diagram includes, by implication, an interpretation of the significance of those facts.	

The last topic in the section on methods and tools investigates the problems that individual knowers face (often without knowing that they face them) in trying to gain accurate knowledge of politics and political issues. Many of the problems discussed are related to the unreliability of information which is widely disseminated, particularly through social media. The activity on page 245 of the student book asks students to evaluate their own use of social media and whether they just accept what they read, or whether they take steps to check the validity of claims. This activity relates to the first four course aims as presented in the TOK subject guide:

- to encourage students to reflect on the central question, 'How do we know that?', and to recognize the value of asking that question
- to expose students to ambiguity, uncertainty and questions with multiple plausible answers
- to equip students to effectively navigate and make sense of the world, and help prepare them to encounter novel and complex situations
- to encourage students to be more aware of their own perspectives and to reflect critically on their own beliefs and assumptions

KNOWLEDGE QUESTION

A relevant knowledge question from the TOK subject guide:

- What impact has social media had on how we acquire and share political knowledge?

Ethics

This section of the chapter in the student book ties together several main points which have been made throughout the chapter: the relationship between values and beliefs, between beliefs and political viewpoint, and the relationship between the scope of politics and the responsibility of both politicians and individuals in a representative society to make accurate knowledge. Much of the discussion refers students back to the online chapter on ethics, so if students have not read that chapter before getting to content about politics and ethics, they should definitely do so.

KNOWLEDGE QUESTIONS

Relevant knowledge questions from the TOK subject guide:

- Are political judgments a type of moral judgment?
- Can knowledge be divorced from the values embedded in the process of creating it?
- Do political leaders and officials have different ethical obligations and responsibilities compared to members of the general public?

RESOURCE

An excellent resource to which the student book does not direct students is the set of videos by Michael Sandel, professor at Harvard University. Sandel teaches a course in political justice, and a number of the classes have been filmed and made available without charge on the internet. You can access the course using the QR code in the margin. There are a number of videos which are quite useful to a Theory of Knowledge course, including one on justice and one on democracy, both of which are relevant to the Knowledge and Politics theme, and there is another one on ethics and technology, which is relevant to the Knowledge and Technology theme.

The last section of the chapter deals with the ethical problem of politicians – or others – who tell deliberate lies, or who prevaricate, when speaking of issues of real significance to people's lives. If you did not do the activity on truth and lies in Chapter 4 (Knowledge and Language), it would work very effectively here, as well.

The chapter closes with a connection to the concept of responsibility. Responsibility for accurate knowledge of politics is a concept which applies equally to professional politicians, political scientists, and to members of a community.

Conclusion

The inclusion of knowledge and politics in the course offers an opportunity for students to explore a highly engaging topic. Ideally, it also offers the opportunity for students to begin to discover how critical the relationship between knowledge and politics is. It is easy to think of politics as just something that happens and which is dramatic but not very consequential in our day-to-day lives, but a TOK approach to the topic should help students develop a deep appreciation for just how consequential it really is. Through investigating knowledge and politics, students can develop a clear understanding of the roles that power and responsibility play in our construction and consumption of knowledge.

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CHAPTER 8

Mathematics

OBJECTIVES

After reading this chapter of the student book, students will:

- understand the wide and varied scope and applications of mathematics
- recognize the differences between students of maths, pure mathematicians and applied mathematicians
- appreciate the different perspectives of those who believe that mathematics is invented and those who believe it is discovered
- understand the importance of the rigorous proof as a method for making mathematical knowledge
- recognize how some of the fundamental methods of mathematics are changing due to developing technologies
- appreciate the varied ways in which ethical values shape knowledge-making in mathematics.

Introduction

The introduction to mathematics in the student book introduces two very significant characteristics of mathematics: its symbolic nature and its arbitrariness. The concept of arbitrariness is the same here as it was in the language chapter, because mathematical statements are part of a language. The opening problem in the chapter (student book page 258) guides students through thinking about both the symbolism and the arbitrariness. The specific arbitrary feature of the problem is the order of operations, which functions, essentially, like a rule of grammar does in a verbal language. You can use the first QR code on the left to watch a video which shows a few more problems like the one with the cats and mice and fish, as well as providing a step-by-step solution for one of them.

The discussion of the order of operations picks up later in the chapter, in the section on ethics, because it pertains to the ability to know with absolute certainty how to interpret mathematical statements. This ability is important in all mathematics, but particularly in applied mathematics. The Chapter 8 Works cited page in the student book provides several excellent sources of detailed discussion of the order of operations.

RESOURCE

The second QR code on the left here will take you to a TED talk about how X came to be used as the symbol for an unknown quantity in a mathematical equation. This topic is directly relevant to the discussion of the symbolic nature of mathematics in this section of the student book. The talk is quite short, but it is particularly interesting for TOK because, first, it demonstrates the historical roots of mathematics by the Persians, Arabs and Turks. Second, the explanation about how X came to stand for the unknown involves the differences between Arabic and Spanish, and so pertains directly to the translation discussion in Chapter 4 (see student book pages 132–3).

KNOWLEDGE QUESTION

Relevant knowledge question from the TOK subject guide:

- Should mathematics be defined as a language?

Scope

The introduction mentions, just in passing, the question of whether mathematics is invented or discovered. This is an interesting question which gets at a significant idea about the fundamental nature of mathematics, as well as the question of what the scope of mathematics entails: does it involve the exploration of a mathematical system which has been created by humans? Or does mathematics involve the exploration of the natural world?

Invention vs discovery

The student book treats mathematics from the former perspective, considering mathematics as a constructed system which can be, and is, used in order to describe real-world phenomena. The discussion is ongoing among professional mathematicians, nevertheless. Roger Penrose, a mathematical physicist and philosopher at Oxford University, ascribes to the belief that mathematics exists in a kind of reality which is not real in the same way that tables or trees or animals are real. He believes that mathematics are out there waiting for us to discover them, in a way similar to the way that explorers might discover previously unknown islands. He calls this kind of reality 'Platonic realism'. Platonic realism is named after Plato, who first described it. He believed that there is a kind of reality of universal abstract things which exist outside of space and time and which we cannot discover using our sensory apparatus (Mastin). Other people, however, disagree. Linguist George Lakoff subscribes to the idea that mathematics is not 'in the world' in some sort of Platonic reality. He discusses the development of mathematics as being a function of our extrapolating from the innate sense of quantity and relationships that humans are born with. You can use one of the resources below to listen to interviews with Penrose and George Lakoff discussing their different views.

One important point to consider in the discussion of whether mathematics is invented or discovered, is that even if one ascribes to the general idea that mathematics is man-made, discovery is part of the process. As we discuss in the student book, pure mathematics consists of the process of using deduction to develop the inevitable consequences of the mathematics we have already documented. That process is, in an essential way, a process of discovery. So, while humans invented the number system, for example, and humans create rigorous proofs, the invention led to our then working on discovering the implications of those creations.

RESOURCES

✔ You can use the first QR code shown here to access a series of videos in which mathematicians are interviewed about their beliefs with regard to the question of invention vs discovery. You will find that they are not all in agreement. In addition to the interview series, the Closer to Truth site has a 27-minute television programme on the subject of whether mathematics is invented or discovered, and they have another interview series on the question of whether mathematics is eternal. Both of those resources can be accessed via the second QR code shown on the left.

✔ These are excellent resources focused squarely on knowledge questions about mathematics. If you use these resources, you will recognize, in the views of Frank Wilczek, a Nobel Laureate in Physics, the approach that we have taken for TOK.

The discussion of whether mathematics is invented or discovered is raised in more detail in the student book in the section on Perspectives (see page 277). However, one engaging way to begin an exploration of mathematics as an area of knowledge is to ask students to investigate this question of whether mathematics is invented or discovered. The following lesson plan suggests a way to do this.

LESSON PLAN: MATHEMATICS – INVENTED OR DISCOVERED?

Introduction

This lesson will allow students to investigate for themselves the question of whether mathematics is invented or discovered.

Framework sections

Scope and Perspectives.

The aims all have knowledge-related terms: 'evidence', 'investigate', 'sensory data' and 'understand'.

Aims

Students will:

- examine the real world for evidence of mathematics existing in nature
- investigate the nature of the human capacity for organizing sensory data into meaningful experience
- understand that anything that they can directly observe in the real world in the nature of mathematics was invented by humans.

These objectives relate specifically to understanding the nature of mathematics. The question of whether a subject is invented or discovered can also be applied to other areas of knowledge.

Objectives

Students will be able to:

- explain why everything they were able to observe, including geometric shapes, was invented by humans
- articulate the argument for maths being discovered, rather than invented (requires follow-up activity).

Knowledge questions from the TOK subject guide

Students should discuss these questions at the end of the activity.

These are suggestions; other knowledge questions could certainly be relevant here.

- Does mathematics only yield knowledge about the real world when it is combined with other areas of knowledge?
- Is mathematical knowledge embedded in particular cultures or traditions?
- Does personal experience play any role in the formation of claims in mathematics?

Relevant course concepts

Evidence, explanation, objectivity.

Prior learning

This lesson could work well at the beginning of a unit of study on the required area of knowledge mathematics, as it makes a direct connection to the core theme by having students experience the specified mathematical observations for themselves. Students must also have at least a basic understanding of the definition and characteristics of the relevant course concepts.

Students will need to have some understanding of the science and psychology of how the brain turns sensory data into mental experience.

You may have covered the topic of how sense perception and imagination work if you have done some or all of the core theme by this point in the course. If not, those mechanisms for knowing can be introduced now. The two important concepts for students to understand prior to this activity are that what we experience in our minds is a representation of what is in the world outside of us, and that we are capable of imagining things that do not exist.

Students will also need a basic conceptual understanding of the difference between an ideal (perfect) object which can only exist in imagination and an actual object created by humans.

Required resources

- Access to an area outdoors with some natural objects such as trees and rocks. A courtyard at the school would be fine; a more ambitious field trip to a park would also work.
- Pen or pencil and paper for students to take notes while they are outside making observations.

Activities

1 Tell students that they are about to take a short field trip in order to find as much mathematics in the world outside as they can. Tell them that they will have 20 minutes to look around and make a list of all the mathematics that they can find.

Activity 1 makes a connection between the core theme and mathematics.

2 When you return to the classroom, tell students that they must now cross off their lists anything that was invented by humans.

This step in activity 2 will require students to cross off anything such as numbers on classroom doors, license plate numbers, numbers on signs and so on. This should eliminate most of the items on students' lists.

3 Ask students to volunteer to share items that they still have left on their lists.

At this point, you should expect to hear about things like a triangle. You should press the student for an explanation of where the triangle was, and then provide the student with a challenge which demonstrates that the triangle was manmade. If it was a picture on a sign, then that one is easy. Humans made the sign and drew the triangle.

More difficult for students to grasp will be the fact that if they claim to have found a triangle with rocks or trees or other natural objects forming the points of the triangle, that triangle is still made by a human being – in fact, the student themselves. The triangle is not actually there, in nature. The human mind saw three objects and constructed the idea of a relationship among those three objects. If students struggle with this idea, it can be helpful to ask them why they are only considering those three trees. Nature gave us many more than three trees. Why does the natural form not consist of all the trees in the courtyard, or all the trees on campus, or all the trees in the world? The fact is that the student chose the three trees in order to make a triangle. If the student argues that the three trees were obviously planted in a triangle, then it becomes clear that the triangle of trees was a deliberate human construction.

If a student sees a sunflower and tries to claim that he or she found the Fibonacci sequence in the ordering of the sunflower seeds, then the response is similar to the response about the triangle: the Fibonacci sequence is a mathematical explanation for that relationship which is found in nature. Humans identified the pattern and named it. The sunflower has seeds in a pattern, not a mathematical explanation. You can use the first QR code shown on the right-hand side of the page to watch a TED talk about the Fibonacci sequence.

4 Once all of the items on the students' lists have been eliminated, they can discuss the difference between explanations invented by humans and objects that exist in the natural world. They should include a consideration of the way our minds work to categorize and account for our observations and our ability to imagine things which do not actually exist.

Follow up

As a follow-up activity, students view the programme on closertotruth.com (use the second QR code on the right-hand side of this page for link) about whether mathematics is invented or discovered.

(Note: In order to view this programme, you will need to register for a free account with closertotruth.com. Add the programme to your watch list, and you will be able to launch the whole programme, rather than just the preview, from there.)

You may also wish to show students one or more of the interviews mentioned above. Once they watch the programme, they should develop an explanation of the argument in favour of the idea that mathematics is discovered. They can also discuss whether they find the argument compelling or whether they are more inclined to consider that mathematics is entirely invented.

It is important for students to understand at this point that the question of whether mathematics is invented or discovered is an open one among professional mathematicians.

The argument for the idea that mathematics exists in the universe and that we are discovering it depends on an assumption either that a designer created mathematics or that mathematics somehow arose as part of the physical development of the universe. We have no evidence for the process of any designing of mathematics, nor of the arising of mathematics as a result of physics. In fact, since the argument that mathematics exists in some sort of Platonic reality depends on the idea that it exists outside of time and space and cannot be discerned using human sensory apparatus, we cannot get any such evidence. We can only see reflections of it in nature, and we are creating the language to describe these reflections.

At this point, students should be able to explain why everything they were able to observe as mathematics in the world was invented by humans.

One final important idea relative to the question of whether mathematics is invented or discovered is the point that the activity focuses on: the question of whether the whole concept of mathematics is invented or discovered. A different way to consider the question is to look at which aspects of mathematics are invented, and which are discovered. If we consider mathematics to have begun with the human invention of a system for counting, and then we realize that during all the ensuing centuries mathematicians have been exploring the ramifications of that invention, we realize that a great deal of mathematical knowledge is discovered, even without a Platonic view of the question.

Pure vs applied mathematics

The activity in the lesson plan is a good way to begin an investigation into mathematics as an area of knowledge because it involves students directly in one of the important questions of mathematics. In more practical terms, the section of the student book on scope considers two important aspects of mathematics: the difference between pure mathematics and applied mathematics. Pure mathematics is the study and development of existing mathematics, while applied mathematics is the use of mathematics to describe real-world processes and to solve real-world problems.

TEACHING TIP

In the student book, we discussed this difference principally in the perspectives section. However, we include it here under the section on Scope to highlight the overlap between the sections on the framework. We do not want to treat the four sections on the knowledge framework as compartmentalized elements of knowledge-making. In all themes and areas of knowledge it is a good idea to help students see the complex interactions among the four parts.

The student book provides a description of the axiomatic nature of mathematics and suggests the use of the metaphor of a game to help explain what axioms are and how they shape mathematical knowledge. You can use a specific game as an example for exploring that point. Here, for example, we have chosen to illustrate it using curling.

Curling involves sliding stones down a sheet of ice to try to hit the centre of a target (called the house) at the other end of the ice. One of the important rules, or axioms, requires that teams alternate throws, so, let's say, the team with the red stones goes first. The first player will throw their first stone, then the first player on the other team will throw the first yellow stone. Then red, then yellow, and so on until all 16 stones have been thrown. The throwing of 16 stones is called an end. (This is an over-simplification, of course, as all curling fans will know, but it will serve our purposes.)

Another important rule or axiom is that at the end of each end, only the team with the stone closest to the centre of the house (a circle called the button) scores. This rule has a natural consequence, which is that the team who throws the last stone of any given end has a distinct advantage, because the person who throws the last stone has the last chance to knock a stone from the opposing team out of the way and to get closest to the button. Because of the alternating stone rule, however, that team only gets one chance to get closer to the button, and if the person cannot make the shot, the other team will win. You can use the QR code in the margin to watch a video of a spectacular example of someone winning on the final stone.

You will see how the team with the red stones, having the last shot at the end (and, in this particular case, the last shot of the game), was able to knock out the yellow stones which had been closer to the button. In doing that, they were left with three red stones closer to the button than any yellow stone, so they scored three points and won the game. Had they missed that shot, though, they would have no more chances and the yellow team would have won.

The inevitable advantage that goes to the last player to throw a stone in an end is like a theorem in mathematics: given the axioms of the system, there are inevitable theorems. This is what Feynman described as: 'if such and such is so, what then?' Here, if it is so that we must alternate stones, then the last stone has the advantage.

If we were to try to change the rule (which is like an axiom), then the inevitable implication (which is like a theorem) would also necessarily change. We can imagine how that would work by imagining that we do decide to change the axiom. We invented it so we can change it. So now let's imagine that under the new rules of curling, whichever team has yellow stones will always throw all their stones first, and the team with red stones will always throw all their stones when yellow is finished. You can immediately see that this new axiom changes everything. We have a new theorem-like outcome, which is that red will always have a terrific advantage, because red will get eight straight chances to get a stone closest to the button and yellow will have no chance to defend against them. It is hard to imagine, even, what motivation yellow would have for playing, as the possibility that they could win is reduced almost to zero. This change of rule does not just alter the game, it changes the system so much that it does not really seem reasonable to call it curling any more – we'll have to call it Domination of the Red Stones.

The discussion of pure mathematics also provides a review of the history of early mathematics and the development of symbolic systems to represent quantities as a means of demonstrating how the basis for pure mathematical study was established. You can use the QR code on the left to access a more detailed discussion of the history of mathematics.

KNOWLEDGE QUESTIONS

Relevant knowledge questions from the TOK subject guide:

- Why is mathematics so important in other areas of knowledge, particularly the natural sciences?
- Does mathematics only yield knowledge about the real world when it is combined with other areas of knowledge?

The chapter provides a number of examples of the ways in which mathematics is used to solve real-world problems. The use of mathematics to solve real-world problems illustrates one way in which mathematics can be seen as a type of explanation of the way the world works. We are not, in TOK, interested in what the solutions to the problems are, but rather we care about how the mathematics serves as explanation. On page 267 of the student book, there is a discussion question which asks students to try to think of any aspect of society which does not require some sort of mathematical understanding or mathematical application. Note that the question does not ask for students to think of areas of their lives or activities which require them to do mathematics; rather, they should be thinking about how mathematics might have been used by someone in creating or monitoring or repairing processes in their culture. This is a good discussion to have to help students understand how deeply embedded mathematics is in their daily lives without their realizing it, and, therefore, how broad and deep the scope of mathematics is.

Mathematical thinking skills

The scope of mathematics also includes a whole set of cognitive skills which are not directly related to calculating and problem solving with numbers. These thinking skills help people to function better in their everyday lives, even if they do not ever become mathematicians or take on jobs which require them to do things that we normally recognize as working with mathematics. There are activities on page 268 of the student book which guide students through exploring some of the thinking skills on which mathematics relies and which the study of mathematics helps develop. A useful follow-up to these activities would be to ask students to identify real-life situations in which they personally have to use those skills, but also situations in which others in the community – local and national – need to be able to use those skills well. The effective use of these thinking skills leads to better reliability in the resulting knowledge.

RESOURCE

Use the QR code on the left to watch a further TED talk that is useful in terms of exploring the way that mathematical thinking can – or should – be applied in the real world. This talk is by Eugenia Cheng, a mathematician who is the Scientist in Residence at the Art Institute of Chicago. She was formerly a tenured professor at the University of Sheffield in the UK. Dr Cheng works through a process of showing how an understanding of a set of relationships among numbers and an ability to identify features which categorize objects – or, in her example, people – can help us to understand better some commonly misunderstood sources of resentment in modern society.

Perspectives

The perspectives section of the student book explores the concept of differing perspectives in mathematics in several ways:

- How different goals for mathematical knowledge result in different kinds of knowledge, considering students of maths, pure mathematicians and applied mathematicians.
- How different branches of mathematics represent different perspectives on mathematical knowledge.
- An in-depth consideration of the differences in perspective on the question of whether mathematics is invented or discovered.

One aspect of perspectives which is not covered in the student book is the role of individual mathematicians in making contributions to mathematics. There are several advantages to exploring the work of some individual mathematicians:

- Helps to generate an understanding of the kind of personal skills and knowledge which contribute to the greater world of mathematical knowledge.
- Helps to reveal the universality of mathematics: important work has been contributed from all around the world (and for centuries). This work is established and used by mathematicians from all cultures.
- Provides examples of real-life work that students might be able to use in their essays.
- Can offer a chance to explore the possibility of non-neutrality in mathematics. In Chapter 10 of this book, on the human sciences, you will encounter a similar discussion about bias creeping into our study of even objective phenomena. The QR code here will lead you to an article on the subject of non-neutrality in mathematics.

Mathematics arose in the centuries before the Common Era in Ancient Mesopotamia. The student book discusses the rise of mathematics in the form of bones used for records keeping, a system which was needed when nomadic people settled and formed cities (Mastin). Over the next centuries, mathematics spread to Egypt and Greece. The Egyptians are believed to have developed the earliest base-10 numeral system, at least by 2700 BCE (Mastin) – possibly much earlier. Students will be familiar with the name of Pythagoras, the Greek mathematician who proved what we now call the Pythagorean Theorem. In the second millennium BCE, the Chinese developed a decimal system very similar to what we use today. The Chinese had it 1000 years before anyone in the West did (Mastin).

KNOWLEDGE QUESTIONS

Relevant knowledge questions from the TOK subject guide:

- What is it about mathematics that enables mathematical results to remain unchanged over time?
- How significant have notable individuals been in shaping the nature and development of mathematics as an area of knowledge?
- Is mathematical knowledge embedded in particular cultures or traditions?

Here are a few notable mathematicians from around the world. The QR codes shown on the next page will take you to sources with more information about each.

Muhammad Al-Khwarizmi

Muhammad Al-Khwarizmi

Muhammad Al-Khwarizmi was a Persian mathematician from the ninth century who wrote the first known text on algebra (Gangolli). The word 'algebra' comes from an Arabic word in the title of the book: Hisab **al-jabr** wa-al-muqabala. The word in bold is the one which has come down to us as 'algebra'. All that remains of this work is the Latin translation from the original Arabic.

Brahmagupta

Brahmagupta was an Indian mathematician from the seventh century who developed the first rules for working with zero as a number, as well as for working with negative numbers (Mastin). He also established a number of rules for working with square and cube roots and a number of types of fractions.

Sophie Germain

An eighteenth- and nineteenth-century French mathematician, Sophie Germain began teaching herself mathematics when she was 13 and confined to the house during the French Revolution. Her interest was considered inappropriate for a woman, and she was discouraged by her parents; nevertheless, she persisted. Germain eventually managed to make acquaintance with some male mathematicians (by using a pseudonym) and proved herself a good enough mathematician to win their approval and mentorship (Swift). She is known for what is now called the Germain Theorem, which was one instrumental part of Andrew Wiles' eventual proof – 200 years later – of Fermat's last theorem. She later won an prize for work on elasticity, and became respected in her own time as an important mathematician.

John Nash

A mathematician at Princeton University, John Nash won a Nobel Prize in Economics in 1994 for his work on game theory. Nash also won the Abel Prize for mathematics in 2015 for his work on differential equations. The Abel Prize is the equivalent to the Nobel (there is no Nobel prize for mathematics). Nash's life was portrayed in a reasonably accurate movie in 2008 called *A Beautiful Mind*. He is known for his long struggle with mental illness, but that did not keep him from doing work which has led his colleagues to describe him as having 'profound originality … tenacity, courage, and fearlessness' (Kelley). Nash is remembered not only for his highly original contributions to mathematics, but also for being an inspiration to students and other mathematicians.

Andrew Wiles

Andrew Wiles was a professor at Princeton University for 30 years, and since his retirement in 2012, he has been a Royal Society Professor at Oxford University. Wiles is renowned for proving Fermat's last theorem. While the proof of Fermat's last theorem might seem to be an impractical effort, in fact, it drew on centuries' worth of mathematics and opened up a great many new avenues of mathematical exploration ('Andrew John Wiles'). Like his colleague John Nash, Wiles won the Abel Prize – in fact he did so the year after Nash's award. Discussion of Wiles and his work appears in the student book in Chapter 4 and in Chapter 8.

■ RESOURCES

PBS made an episode of their programme *Nova* called 'The Proof'. It is an outstanding depiction both of what Wiles is like as a person and as a mathematician. It shows what qualities he brought to the solving of the world's most famous mathematical problem and of the accepted process of producing mathematical work which is ultimately accepted as knowledge by the mathematical community. The video could be used to explore both an individual perspective on mathematics and the methods and tools for making mathematical knowledge. The programme itself is unfortunately no longer available on the website, but if you can locate a copy, it is an outstanding resource for Theory of Knowledge.

✔ The first QR code will take you to the PBS website for the programme.

✔ The second QR code will take you to a transcript of the video.

✔ A link to Wiles' Abel Prize interview is available online using the third QR code.

✔ The fourth QR code will take you to the Mathematical Sciences Research Institute (MSRI), which has another programme with their version of the Andrew Wiles story.

✔ The final QR code will take you to a BBC programme on Andrew Wiles.

One interesting observation that we can make from the more detailed information we have about these last three examples of mathematicians is that all three are people whose work in mathematics was powered by their own internal commitment and initiative. They were also able to see problems in ways that others had previously been unable to do. All three were dedicated and persistent, despite obstacles which might have kept someone less determined from achieving what they did.

The perspectives section of the student book provides the case study of Alan Turing and the breaking of the Enigma Code during the Second World War as an example of the application of mathematics. You can use the following activity to help students explore the nature of codes and ciphers.

ACTIVITY

An example of a very simple code is the book substitution code. If we want to use that code, we take our original message and we find all the words on different pages of a book. Then we provide the page number, line number and letter number in order. The person on the other end must have the same book (and the same edition of the book) that we have in order to be able to break the code. In the example below, we have created the code from words on all one page just in the interest of space. In real life, no one would do that as it would be too simple. The person encoding the message would use words from throughout the book.

This text has been taken from the internet site Project Gutenberg, and the novel, *Pride and Prejudice*, is in the public domain. For the purpose of constructing a code, we will pretend that this text came from page 145 of the actual book.

'My dear Jane!' exclaimed Elizabeth, 'you are too good. Your sweetness and disinterestedness are really angelic; I do not know what to say to you. I feel as if I had never done you justice, or loved you as you deserve.'

Miss Bennet eagerly disclaimed all extraordinary merit, and threw back the praise on her sister's warm affection.

'Nay,' said Elizabeth, 'this is not fair. You wish to think all the world respectable, and are hurt if I speak ill of anybody. I only want to think you perfect, and you set yourself against it. Do not be afraid of my running into any excess, of my encroaching on your privilege of universal good-will. You need not. There are few people whom I really love, and still fewer of whom I think well. The more I see of the world, the more am I dissatisfied with it; and every day confirms my belief of the inconsistency of all human characters, and of the little dependence that can be placed on the appearance of merit or sense. I have met with two instances lately, one I will not mention; the other is Charlotte's marriage. It is unaccountable! In every view it is unaccountable!'

'My dear Lizzy, do not give way to such feelings as these. They will ruin your happiness. You do not make allowance enough for difference of situation and temper. Consider Mr Collins' respectability, and Charlotte's steady, prudent character. Remember that she is one of a large family; that as to fortune, it is a most eligible match; and be ready to believe, for everybody's sake, that she may feel something like regard and esteem for our cousin.'

'To oblige you, I would try to believe almost anything, but no one else could be benefited by such a belief as this; for were I persuaded that Charlotte had any regard for him, I should only think worse of her understanding than I now do of her heart. My dear Jane, Mr Collins is a conceited, pompous, narrow-minded, silly man; you know he is, as well as I do; and you must feel, as well as I do, that the woman who married him cannot have a proper way of thinking. You shall not defend her, though it is Charlotte Lucas. You shall not, for the sake of one individual, change the meaning of principle and integrity, nor endeavour to persuade yourself or me, that selfishness is prudence, and insensibility of danger security for happiness.'

Now that you have the code book, try to decode this message:

145 2 10

145 10 10

145 14 8

145 23 1

145 2 12

145 17 14

145 13 11

145 4 6

An example of a very simple cipher is the Caesar Cipher, in which you just shift the alphabet by some pre-determined number. The chart below demonstrates a shift of 6, so that instead of A being the first letter of the alphabet, F is the first letter of the alphabet:

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E

Once you have applied the shift, you just write your message using the letter in blue in place of the letter in pink.

See if you can translate this message:

BJQHTRJ YT YMJ BTWQI TK HNUMJWX

Answer key: The coded message (using the *Pride and Prejudice* book code) says 'What I have to say will be extraordinary'. The ciphered message (using the Caesar Cipher) says 'Welcome to the world of ciphers'. Remember that in TOK, the actual translated message is not important; we want to understand how the application of mathematics to the real world helps us solve problems. Students can discuss these questions:

- Are the 'answers' to the decoded messages absolutely certain? Why or why not?
- What is it about the nature of mathematics as an area of knowledge that makes the use of these codes and ciphers possible?

Methods and tools

Methods of pure mathematics

The student chapter opens with a careful walkthrough of one way to prove the Pythagorean Theorem. The purpose of that section is to demonstrate the fact that a rigorous proof must account for every possible instance of a problem or object rather than only particular instances – in this case, right-angle triangles. An important concept for students to understand is the idea of infinity, which is not as easy to understand as it might seem.

Infinity

The human mind cannot readily comprehend in an effective way very large numbers or very large spaces. Imagine the widow whose husband dies and leaves her \$3 million. She is herself 90 years old, but she frets about the amount of rent at her retirement home, because \$4000 a month sounds to her like an enormously large amount of money – and, of course, that is quite a lot of rent. She cannot truly conceive in her own mind what \$3 million looks like. We try to make such a number more comprehensible by changing it into other forms. If the rent is \$4000 a month, for example, we can pay that rent for 750 months (or more than 62 years). Our widow friend can afford her rent until she is more than 150 years old. Converting the large sum of money into a number of years makes the number easier to comprehend.

When it comes to infinity, which is not exactly a number, the concept is even more difficult to understand. Humans are finite creatures with finite minds and trying to visualize infinity is an extremely difficult proposition. Below are some practical ways to try to help students imagine what infinity is and what it means for making knowledge in mathematics.

1 Ask students to write down the integers starting with zero. When they get to about 12, ask them how many more there are. When would they get to the last one? The answer is 'never'. No matter how high the number gets, they could always add one more. Ask how close they would be to the 'end' if they wrote integers for the rest of their lives. Then if someone else picked up the task and continued it for the rest of his or her life. And then someone else. And so on. It wouldn't matter if new people took a shift every time the current counting person died until the last human on Earth passed away; there would still be more numbers. An infinite quantity more. If we have written down three numbers, there are an infinite amount left. If we have written down three million numbers, there are an infinite amount left. If we have written down 1 000 000 000 000 000 000 000 000 000 000 numbers, there are an infinite quantity left.

2 Students draw a right-angle triangle with sides of 3 cm, 4 cm and 5 cm. Then ask them how many more right-angle triangles they would have to draw in order to prove that the Pythagorean Theorem worked for all right triangles. The answer is that they could not possibly demonstrate the Pythagorean Theorem that way (by induction – see the student book Course Concepts chapter pages 3–4), because there is an infinite quantity of right triangles.

3 Ask students to come up with as many aspects of mathematics which are infinite as they can. Some examples are the set of all integers; the set of all real numbers; the set of all fractions; the set of all fractions between any two integers; the size of a geometric plane; the length of a line.

Understanding the nature of infinity should help students understand that theorems in mathematics cannot be derived, in fact, from induction, because mathematics is infinite. Hence the need for rigorous proof based in deduction.

■ RESOURCES

TED has several videos which explore aspects of the nature of infinity:

- ✔ 'Infinite Hotel' – this TED-Ed video explores the fact that infinity is such a large quantity that it is extremely difficult for the human mind to understand.
- ✔ 'How big is infinity?' TED-Ed video that explores different kinds of infinity and the fact that some infinities are larger than others (a mind-boggling concept!).
- ✔ 'Infinity in the real world' – this TEDx video explores some real-world phenomena which are infinite.

■ The nature of the rigorous proof

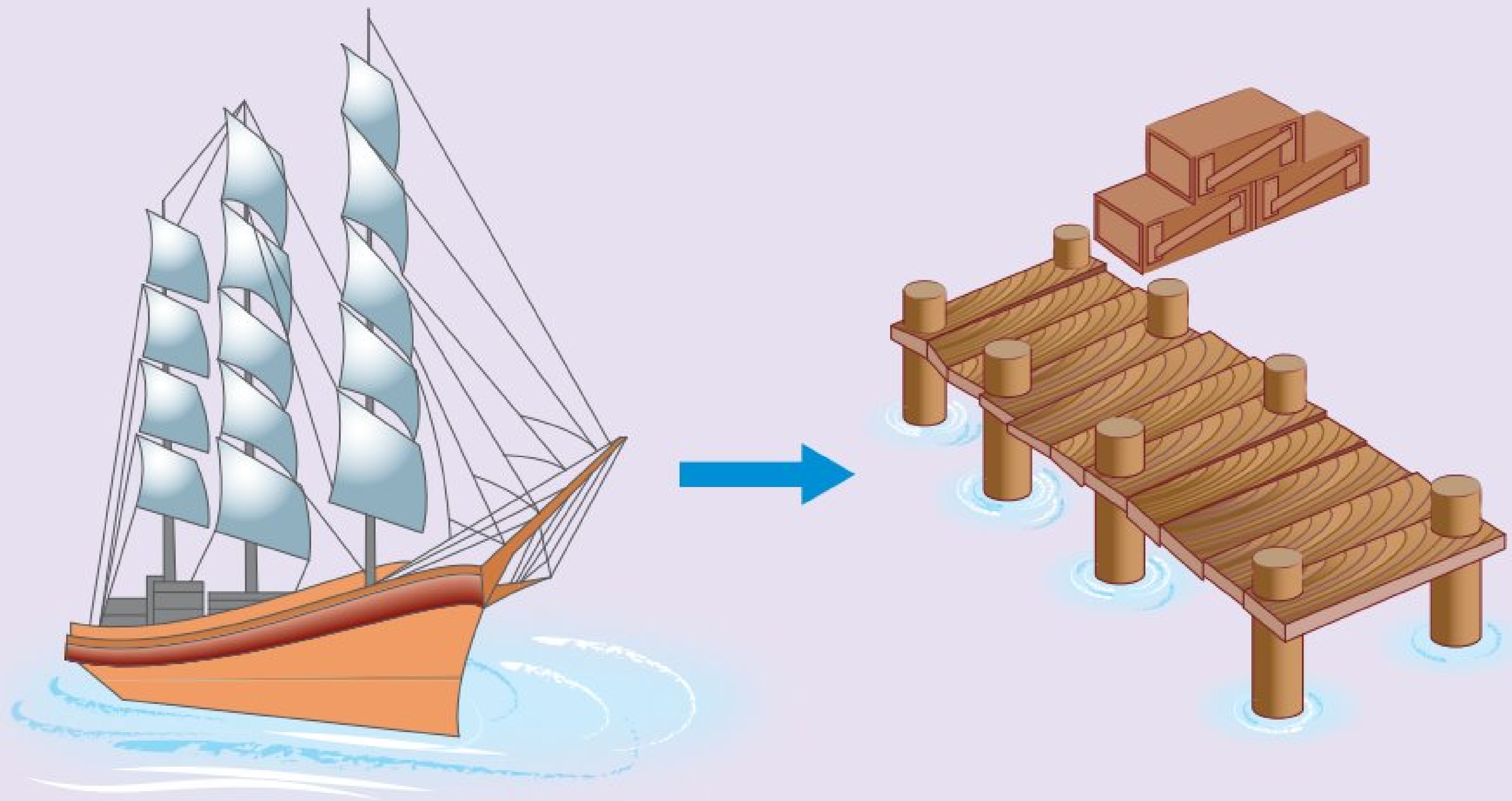
KNOWLEDGE QUESTION

Relevant knowledge question from the TOK subject guide:

- What is meant by the term 'proof' in mathematics, and how is this different, similar to, or different from, what is meant by this term in other areas of knowledge?

The following simple activity, introduced to us by IB Theory of Knowledge Senior Examiner Ric Sims, demonstrates the nature of the rigorous proof. The activity has been slightly adapted from the original version.

ACTIVITY



1 Assign students to groups of two or three.
2 Tell them that they must begin with the word 'ship' and end with the word 'dock'. The rules for transforming the words are as follows:
   a You can only change one letter at a time.
   b Each change must result in an actual English word. The list below shows one example of a viable process (this is by no means the only possible set of words – or even the most efficient way to work from ship to dock!).

SHIP
WHIP
WHIT
WRIT
BRIT
BRAT
BOAT
BOLT
BOLE
SOLE
SALE
BALE
BASE
BASK
MASK
MUSK
DUSK
DUCK
DOCK

3 Assign each of the groups a different letter which they must change first: some groups must change the 's' first, some must change the 'h', some must change the 'i' and some must change the 'p'. This ensures that all the groups cannot come up with identical lists!

4 Once each group has managed to convert 'ship' to 'dock', ask them to put their lists up on the board (next to each other, so that they can be compared with each other).

5 Ask students to peruse the lists and to point out any patterns they see. Keep asking until someone notices that there is at least one word on each list which has two vowels. That will be our conjecture:

> In order to change 'ship' to 'dock' changing only one letter at a time and ensuring that each change results in a real English word, we must have at least one word with two vowels.

6 Ask students to think about whether there is a way to substantiate that conjecture or not. Guide them as needed to work out that because the vowel in 'ship' is in the third position and the vowel in 'dock' is in the second position, there is no way to make the transformation without using at least one word with two vowels, because every English word has at least one vowel.

This process models the process of the mathematical proof. Our proof looks like this:

Conjecture: *In order to change 'ship' to 'dock' changing only one letter at a time and ensuring that each change results in a real English word, we must have at least one word with two vowels.*
Fact 1: We are only allowed to change one letter at a time.
Fact 2: The 'i' in 'ship' is in the third position.
Fact 3: The 'o' in 'dock' is in the second position.
Fact 4: Every change must result in an English word.
Fact 5: All English words have at least one vowel in them.
Reasoning: Since we cannot change more than one letter at a time, we cannot change the letters in the second and third positions at the same time.
Reasoning: In order, therefore, to move a vowel from the third position to the second position, we must have at least one word with two vowels at the same time.
We have essentially made a proof that for any two words in which the vowels are in different positions, to change one word to the other using the rules we set for this task, we must have at least one word with two vowels in it.

This process models the process of the rigorous proof in mathematics, although we were not 'doing' mathematics. It shows how we can demonstrate some truth about a whole set of possibilities without having to work through each, one at a time.

This activity is also an excellent example of the nature of a TOK exploration: you do not have to know mathematics; you just have to know how mathematics works as an area of knowledge.

Methods of applied mathematics

The student book contrasts the methods of applied mathematics to the methods of pure mathematics. The goal of the applied mathematician is to solve a real-world problem; they do not have to worry about whether or not the solution they develop works for every instance of a similar problem. Very often, the real-world problem is known and the mathematician sets to work to find or develop the mathematics necessary for solving it.

The student book provides the case study of a mathematician who solved what is known as the three-body problem for the Apollo 11 mission to land a man on the Moon. The mathematician, Richard Arenstorf, did solve the problem but only for that one particular case. The test of the accuracy of his work was the mission itself. Apollo 11 succeeded in getting to the Moon and back, so we know, with absolute certainty, that Arenstorf's mathematics were correct.

Students can be set the task of doing some research to find other instances in which mathematics were used to solve real-world problems (as opposed to problems within the world of mathematics). They can use these examples in their exhibitions or essays.

CONNECTION TO: THE CORE THEME

On pages 281–2 of the student book, there is a discussion of the role of imagination and intuition in making knowledge in mathematics. Intuition is an unconscious process of rapid thinking, based on a person's amassed experience. If people have a lot of experience with something, then their intuitions are much more likely to be reliable than if they do not have a lot of experience in that area. In the student book, we talk about how professional mathematicians' intuitions about how to approach a problem are much more likely to be reliable than, say, a high school student's intuition, because the professional mathematicians have many more years' experience with mathematics.

Sometimes, however, mathematical results are counter-intuitive enough to flummox even professional mathematicians. A famous example of this is the Monty Hall problem. In 1990, a mathematician, Marilyn vos Savant, wrote about this problem in her magazine column, and she was subsequently inundated with angry letters (some from professional mathematicians) telling her that she was wrong and, sometimes, calling her many ugly names (Cetina). Vos Savant was, however, correct in her explanation.

KNOWLEDGE QUESTION

Relevant knowledge question from the TOK subject guide:

- How do mathematicians reconcile the fact that some conclusions seem to conflict with our intuitions?

Here's how the problem works:

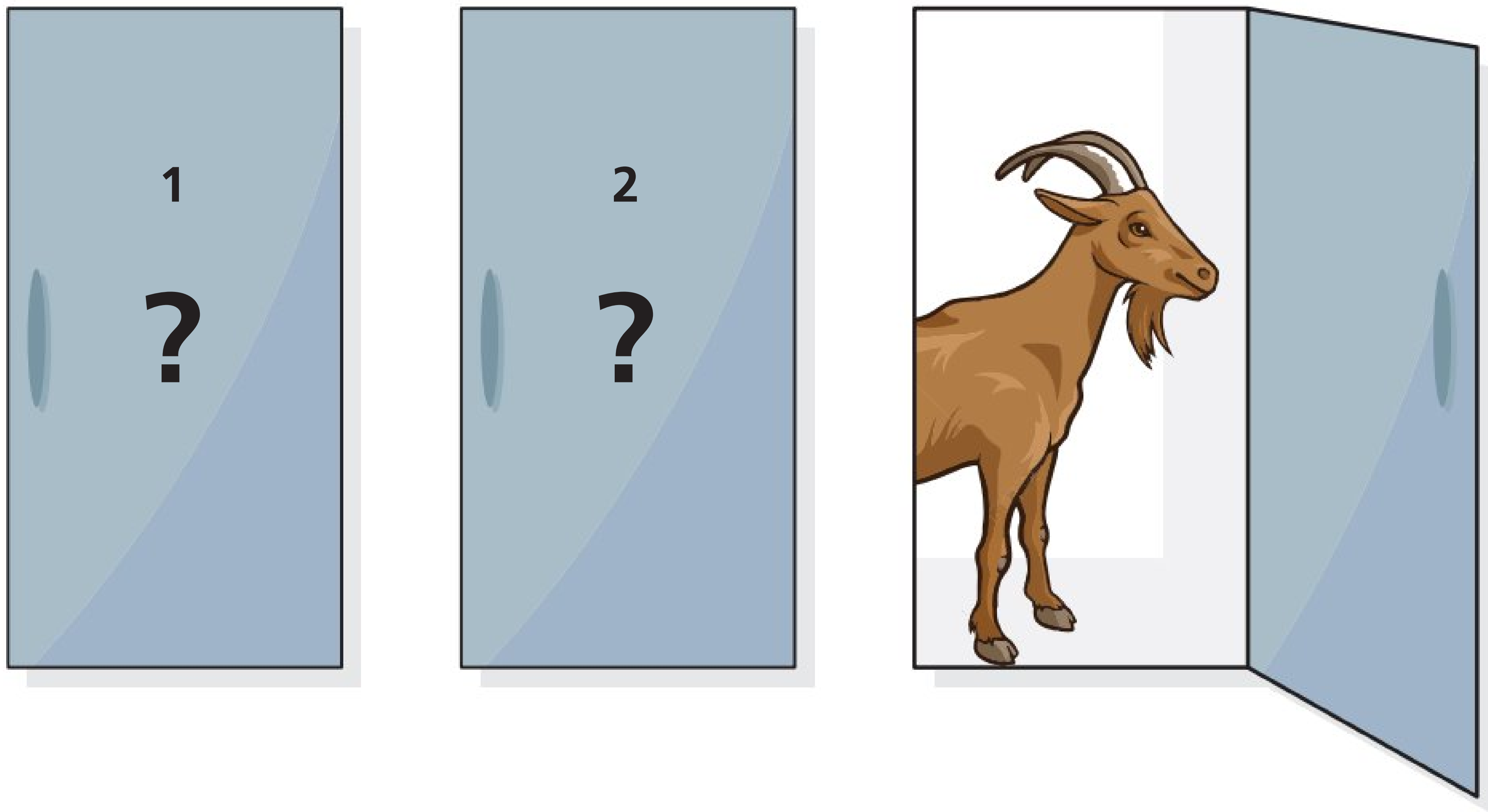
The problem is called the Monty Hall problem because it is an adaptation of the climactic game on a game show called *Let's Make a Deal*, for which Monty Hall was the host. For this problem, imagine that there are three closed doors. Behind one of the doors is a valuable treasure and behind the other two doors there are dud prizes, such as live goats. The problem goes like this:

1 You choose one of the three doors.

2 Monty Hall opens one of the other two doors and reveals a goat. (He, of course, knows where the treasure is, and he will never open that door!)

3 Monty Hall offers you a chance to keep your door OR to switch your choice to the other closed door.

What should you do?



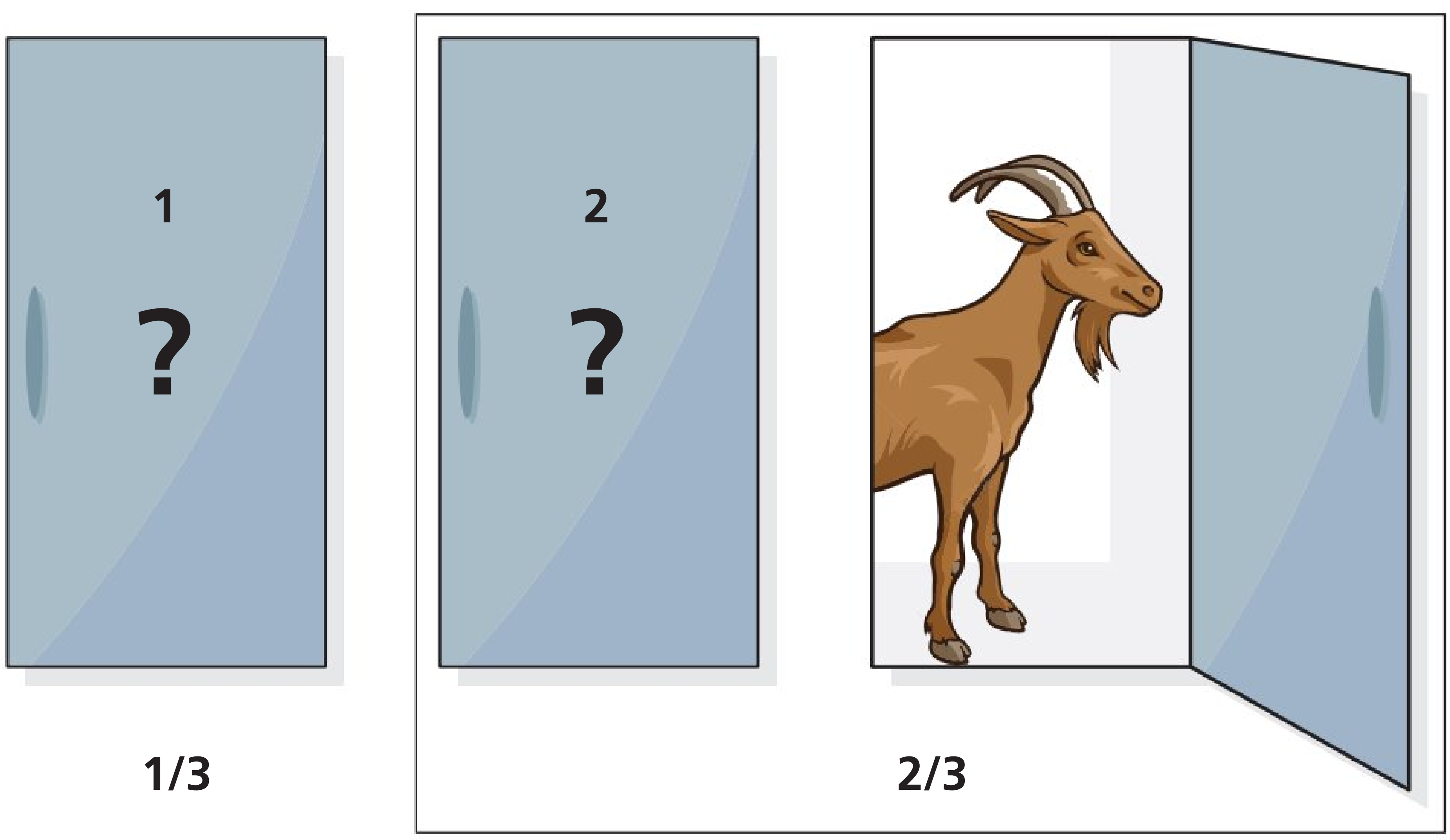
You can set your students this task and then collect the data about who would choose to keep the door that they initially chose and who would choose to switch. Probably most, if not all, will say that they will keep the door they chose initially.

In fact, they should switch. Switching doors doubles their chances of winning the treasure.

That fact perplexes many people. Most people do not really understand probability in a sophisticated way, and so they have an intuition that once one of the goats has been revealed, there is a 50/50 chance of the treasure being behind the remaining doors, and so changing does not increase their odds. That intuition is incorrect, however.

Most people do understand that when they made their initial choice, they had a 1 in 3 chance of winning the treasure. What they fail to appreciate clearly is that that means that the other two doors form a block which represents a 2 in 3 chance of winning the treasure. Opening one of those two doors does not change the odds. The chooser of a door still has a 1 in 3 chance of winning the treasure, and the block of remaining doors still has a 2 in 3 chance of containing the treasure. Since we now know where the goat is, we know that those two thirds reside in the remaining closed doors.

Imagine that we chose door number 1. Our odds of winning the treasure look like this:



It might be easier for students to understand if you ask them to think of the problem this way: imagine that Monty Hall did not open any doors, but instead, after you chose door 1, he offered you a chance of swapping your door for the other two. Everyone would understand that such an offer increases the chances of winning from 1 in 3 to 2 in 3. In the original version, Monty Hall's opening of one of the two doors in the 2 in 3 block is a distractor which helps to confuse the participants.

For students who are still not convinced, you can ask them to make a chart showing all of the possibilities. They will discover that out of the nine possible scenarios, they will lose six times if they keep the original door and win only three times. If they switch doors, they will win six times out of nine and lose only three. The following two charts show what all the possible scenarios look like.

If you keep the door you originally chose …

What's behind the doors?	Goat #1	Goat #2	Million dollar prize
You chose (and kept):	Door #1	Door #2	Door #3
Door #1:	You chose GOAT #1	Goat revealed (because Monty Hall never reveals the treasure!)	You LOSE
Door #2:	Goat revealed (because Monty Hall never reveals the treasure!)	You chose GOAT #2	You LOSE
Door #3:	Goat revealed (because Monty Hall never reveals the treasure!)	**OR** Goat revealed (because Monty Hall never reveals the treasure!)	You originally chose the MONEY behind door #3, so YOU WIN!

Conclusion: You will lose two times out of three. Notice that keeping your door does NOT guarantee that you will lose; it just makes it twice as likely as winning.

If you switch to the other door …

What's behind the doors?	Goat #1	Goat #2	Million dollar prize
You initially choose (but then switch):	Door #1	Door #2	Door #3
Door #1:	You chose GOAT #1	Goat revealed (because Monty Hall never reveals the treasure!)	You WIN!
Door #2:	Goat revealed (because Monty Hall never reveals the treasure!)	You chose GOAT #2	You WIN!
Door #3:	Goat revealed (because Monty Hall never reveals the treasure!)	**OR** Goat revealed (because Monty Hall never reveals the treasure!)	You originally chose the MONEY behind door #3, so YOU LOSE!

Conclusion: You will win two times out of three. Notice that switching does NOT guarantee that you will win! It just doubles your odds of winning.

Here are two final ideas about why so many people feel strongly that they should not change from their initial choice. First, they make their initial choice based on some intuition, and they believe their intuitions more than logic. The other possible contributing factor is imagined disappointment. The prospect of finding out that one originally chose the correct door and then gave it away is so awful that people would rather lose than suffer the disappointment of the feeling of having had the treasure, in some sense, in their hands and then lost it. It is emotionally easier never to have had it at all.

RESOURCES

There are many resources available on the internet to help investigate this problem.

- ✔ Use this QR code to access a simulation from the University of California at San Diego which students can use to test the game as many times as they like.
- ✔ Use this QR code to watch a simulation with many repetitions.
- ✔ This last video provides a succinct visual explanation of the problem.

TEACHING TIP

The Monty Hall problem is a highly engaging exercise, and students will very often get caught up in trying to understand the mathematics directly. However, this is Theory of Knowledge, so we have to move the discussion beyond the real-world situation and investigate the relevance to knowledge. The knowledge question from the guide about why mathematics is sometimes counter-intuitive is a great way to ensure that the discussion moves to knowledge issues. The fact that intuition and reason can often be at odds is explored in the sample response below.

SAMPLE RESPONSE TO A KNOWLEDGE QUESTION

How do mathematicians reconcile the fact that some conclusions seem to conflict with our intuitions?

Our intuitions are not exclusively rational. The intuitive process involves reason, of course, but also imagination and emotion. When we are trying to make some sort of decision – such as what the right thing to do is in a particular situation – we are relying in part on how we feel about the choices.

Imagine that someone is trying to decide whether or not to marry a particular person. We do not expect people to sit down and make a list of pros and cons and to doggedly consider every potential thing that could go wrong in the future and weigh those (currently imaginary) possibilities against the list of (currently imaginary) things that could go right and ending by making a cost–benefit judgment. Instead, we expect people to act on their intuition that living with this person for many years would be a positive experience which would provide them with happiness. Many people make the wrong decision, of course, in such a situation. Their intuitions are either based on too little experience with potential marriage partners or they are distorted by any one of many other factors: a desire to be married, fear of not being able to support oneself financially, loneliness following the loss of parents, and so on. Intuitions can be reliable, but they can also be notoriously unreliable. (We should note that this example reflects only the practice of deciding on a marriage partner in cultures where people choose their own life partners. In cultures where arranged marriages are the normal practice, the approach to choosing a marriage partner is, of course, quite different!)

Mathematics, on the other hand, is quintessentially rational. Mathematics – whether pure or applied – aims for a high degree of precision, to the level of absolute certainty, whenever possible. Emotions do not give us that kind of precision. Mathematicians may rely on an intuition about how to approach a problem, but if the approach turns out to be unsuccessful, they will abandon it and try something else. A 'mathematician' who tried to claim that they had solved a problem by intuition would not be believed. The work would still have to be subjected to stringent peer review, which would require the mathematician to justify the finding with a meticulous step-by-step explanation of how the answer was developed. Any refusal to provide that demonstration would result in the work being rejected, and any errors discovered in the process which was detailed would also require the mathematician to go back to the project and try again.

This is not to say that mathematicians are not passionate about their work and capable of strong feelings about the beauty of the maths or the frustration of not being able to find the way through a problem or the excitement of making a break-through discovery. If you were able to see the video of the story of Andrew Wiles solving Fermat's Last Theorem, you saw a scene which shocks many students: when he talks about the moment in which he realized that, after nine years of working on this problem, it was finally and actually solved, Wiles gets very emotional and cries. Students cannot always understand why someone would 'cry over mathematics'. They have to be led through a discussion about the kind of dedication it takes to work on something for nine years, the pressure that Wiles was under for the last two of those, when the whole world was watching and waiting for his solution, and what it is like to fulfil a dream that he had had since he was 10 years old. The emotion he felt was powerful, but it was not emotion that contributed in any way to the solution to the maths problem. It was emotion in reaction to a once-in-a-lifetime accomplishment. The mathematical work was relentlessly logical.

Mathematicians in general, then, do not reconcile a difference between intuitive knowledge and mathematical knowledge. Instead, they reject the intuition in favour of the mathematics. Because they have such a high degree of certainty when a mathematical finding has been developed and certified, mathematicians will trust it over intuitions. The failure of some mathematicians to do just that in the case of the Monty Hall problem can be put down to several potential problems. Some people attacked Marilyn vos Savant for being a woman who had no business doing mathematics. Their bias blinded them to the facts of the problem. Some were too proud to admit that they could be wrong. In all these cases, what we saw were mathematicians who failed to adhere to the discipline of their subject.

Many times, the conflict between intuition and mathematics is not among mathematicians themselves, but rather occurs in laypeople who do not really understand the nature of mathematics or the level of precision with which mathematics provides answers to problems. The Monty Hall problem is one example of this; another is the mathematics of the self-driving car (the example of the self-driving car is discussed in some detail both in the Scope section and the Ethics section of the mathematics chapter in the student book – see pages 265 and 287–8). The intuitions of drivers in many places (especially in the UK and the US) make those drivers fear the self-driving car and trust their own driving more. The mathematics, however, show that a car driven by a computer is dramatically safer than a car driven by a human (Shashua and Shalev-Schwartz). In these cases, the people whose intuitions lead them not to trust the mathematics occur because of a lack of sufficient understanding and appreciation for what mathematics tells us about the world.

The fact that mathematics does sometimes conflict with our intuitions reveals the difference between reasoning which is rapid and lacks rigour and reasoning which is thoroughly and deliberately rigorous.
The failing is in our innate capacity to understand probabilities in a realistic way. Michael Shermer, writing for Scientific American, explains it this way: '… our brains never evolved a probability network, and thus our folk intuitions are ill equipped to deal with many aspects of the modern world.' Mathematics done right depicts things as they are, not as we perceive them or wish them to be. Mathematics are the result of an assiduously careful process; intuition is the decision of a moment. Intuitive conclusions are inductive and are based on a whole collection of random experiences that we have had during our lives – experiences which may or may not be either sufficient or relevant to the problem at hand. Mathematical conclusions are deductive and are the result of conscious and deliberate processes aimed at solving particular problems.

Note: As always, this sample answer is not the only possible answer to this knowledge question. This answer took the approach of contrasting the rigorous reasoning that mathematics requires with the kind of unjustified thinking that intuition so often involves. An answer could take an entirely different tack and focus on situations in which mathematicians do actually take on incorrect intuitive responses by using mathematics to show why those intuitions are wrong. (In fact, this is what both Marilyn vos Savant and Michael Shermer did in their published articles responding to people who did not understand the mathematics of probability which were reflected in the Monty Hall problem. The Shermer article and an article by Daniel Cetina talking about the backlash against vos Savant are listed in the Works cited list for this chapter.)

Note also that this particular knowledge question is a good one for a number of themes and areas of knowledge. Any time we are trying to develop knowledge about the world outside of ourselves and outside of human control, we cannot rely on our intuitions, emotions or imaginations for an answer. The universe is as it is, not as we would wish it to be or hope it to be or imagine it to be. Truly ethical work in developing knowledge honours that fact, and the methods employed in the generation of knowledge claims are designed to eliminate as much as is possible the biases and limitations of our human ability to perceive and understand.

Tools for making knowledge in mathematics

An example of a quipu from the Museo Machu Picchu

The final segment of the methods and tools section of the student book raises the question of the role of technology – tools – in helping mathematicians to develop mathematical problems. A good activity to engage with in considering this question is an historical review of the tools that mathematicians have developed over the centuries. Some of those tools which are mentioned in the student chapter are:

- the Lembobo Bone
- the Ishanga Bone
- the Roman numeral system
- the Arabic number system.

Other technological developments for the study of mathematics have included the:

- abacus
- mathematical compass
- protractor
- quipu – an advanced system of counting using knots used by the Inca. Use the QR code in the margin to access a National Geographic video explaining this technology.
- electronic calculator
- computer.

Ethics

The ethical standard of clarity

CONNECTION TO: OTHER THEMES AND AOKS

At the beginning of the section on ethics in the student book, there is a discussion about the need for mathematical claims to be made in unambiguous terms. This discussion provides a good opportunity to raise similar questions about other areas of the course. Students can consider whether the same ethical obligation exists in such areas as history, the natural sciences and the human sciences, and they can consider the ethical obligations of the purveyor of claims in all these areas to use language skilfully. This consideration can be tied directly to the students' efforts in their other DP courses, in which their teachers are no doubt trying to help them learn to express themselves more clearly in both their written and oral work. It can be quite useful for students to understand that the need for clarity arises not out of some arbitrary standard set by some unknown people somewhere, but rather out of an ethical obligation to convey the truth to the highest degree that is humanly possible, in whatever field of endeavour we undertake.

■ The ethical standard of absolute certainty and the checking of proofs

KNOWLEDGE QUESTION

Relevant knowledge question from the TOK subject guide:

- Who judges the validity of a proof?

The student book refers to a proof by Thomas Hales which has not been able to be verified by human reviewers, even with a team of 12 reviewers trying for 5 years (see student book page 287). The article which is the source of that example can be reached using the QR code on the left.

Towards the end of the article, the author quotes a mathematician, Keith Devlin, of Stanford University, as saying that the fact that it is becoming more and more difficult for humans to verify proofs might be a good thing because, 'It makes it more human' (Khamsi). This observation is an interesting one for discussion in TOK. Here are some questions for considering the implications of such a claim:

1 How might the fact that humans can no longer verify some mathematical proofs be seen as making mathematics more human?

2 If by 'more human' we mean that mathematics which can no longer be seen as providing absolute certainty will reflect more truly a human capacity for understanding the world, would that be a desirable state of affairs?

3 What do we lose in terms of knowledge if we lose the capacity to determine that certain claims in mathematics are absolutely true?

4 How do the ethics of mathematical methods have to change if we can no longer determine whether 'proofs' are true or not?

5 Do we need to change the vocabulary of mathematics to include a different term for what we now call proofs? What might a more accurate term be?

■ Ethics of applied mathematics

The final aspect of ethics in this section of the student book focuses on how the application of mathematics to solve real-world problems entails certain ethical obligations for method. The obligation in the case of applied mathematics is essentially the same as the obligation for pure mathematics: mathematical claims must be unambiguous and accurate, even if absolute certainty is not possible in real-world situations in the same way that it is possible in the conceptual realm of pure mathematics. Several examples are given to demonstrate the consequences of a failure of mathematics to be right, including a discussion of the self-driving car, as noted earlier.

One idea which is not explored in the student book is that sometimes societal ethical standards have an impact on what knowledge can be made in a given area of knowledge. In the discussion of the knowledge question about the conflict between intuition and mathematical reasoning in the previous section, the sample response implies an ethical standard for rigorous reasoning. One of the knowledge questions from the TOK subject guide suggests a different way to consider the ethics of knowledge-making in mathematics:

KNOWLEDGE QUESTION

Relevant knowledge question from the TOK subject guide:

- To what extent do you agree with the mathematician Paul Ernest's claim that mathematics 'serves as a training that shapes thinking in an ethics-free and amoral way'?

The source for the Ernest quotation is on the Works cited list for this chapter, shown below (the quotation is on page 188 of his book). The context in which he makes the claim is a discussion about the idea that mathematical knowledge itself is not (or should not be) constrained by moral considerations, as the quest for scientific knowledge sometimes is. Ernest brings up the application of mathematical knowledge in the context of war as an example of how the ethical concerns about weaponry and the right or wrong of killing people in wartime were not at issue when the mathematical knowledge was being pursued. The article which we referenced earlier on page 179 via the QR code, by Jose Vilson (also listed in the Works cited page for this chapter – below), can be helpful for a contrary position. His point is that the social context involved in the development of mathematics and the transfer of mathematical knowledge are heavy with bias and prejudice. The mathematical method seems safe, but context can distort findings.

Conclusion

The conclusion of the student book chapter is an important one to ensure that students understand, because it highlights the interconnectedness of all four elements of any area of knowledge: the scope is related to the methods, the perspectives are related to scope and methods and the ethical principles arise from the endeavour as a whole. It is important that students understand that the ethical standards in any area are not arbitrary, but instead are related directly to the effort to ensure that knowledge claims that are made are, to the degree possible, true.

Works cited

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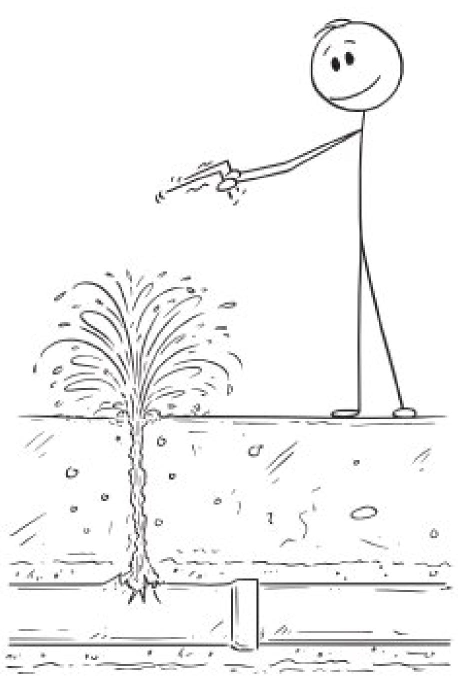


human mind is not innately inclined to accept the actual factual reality of the world; we are instead very wedded to our perceptions and preconceptions. We feel strongly that what we believe is right, even if it has no basis in careful testing, and the feeling of discovering that we have been wrong can be so unpleasant as to drive us not to risk it. (We mentioned this in the context of the Monty Hall problem when we considered whether one force working against a person's willingness to change doors is the fear of having been right and then changed one's mind.)

In terms of meeting the aim of the course to equip students to operate successfully in a complicated world, an understanding of the fact that it requires conscientious effort to seek out and accept facts is a very valuable understanding.

One useful activity, before you show the video, is to ask students to see if they could design an experiment to test whether dowsing works or not. There are discussion questions on page 295 of the student book to help with such an activity.

■ RESOURCE

Kathryn Schulz, staff writer for *The New Yorker*, wrote a book called *Being Wrong: Adventures in the Margin of Error*, which is an excellent resource for TOK teachers. Even if you do not use any of it directly with students, it can help you better understand what we are trying to accomplish in the TOK course. The book spells out a philosophy which is closely related to the aims and objectives of Theory of Knowledge. Some of the really important ideas in the book are that we absolutely have to be willing to be wrong if we are to make any progress in improving our knowledge – both as individuals and as groups or societies. We have to learn, counter to our intuitions, that being wrong is not some sort of failure of character; being wrong is progress toward being right. Refusal to admit when we are wrong results in an insurmountable barrier to knowledge.

This willingness to be wrong, to have our hypothesis disproved, is at the heart of scientific methods. Scientists begin by assuming that they do not know, but that they have an idea which must be tested before it can be trusted.

Learning to be wrong is often a very difficult proposition for students – and especially for IB students – who are used to being right all the time (or at least most of the time). Many students do not want to risk speaking up in class or offering ideas because they are afraid of being wrong, and they are afraid of ridicule from other students. Helping to create a culture in your classroom in which being willing to be wrong is not only accepted, but encouraged, is one of the best things you can do to establish the right kind of context for learning in TOK. A banner such as the one shown below hanging in the classroom can be used as a reminder whenever necessary that we admire the risk-taking willingness to be wrong far more than we admire someone who never speaks except when certain to be right.

The citation for Shulz's book is in the list of Works cited for this chapter. She also gave a TED talk on the subject, which you can access using the QR code on the left.

Scope

The Scope section of the chapter makes the key point that science is a wide-ranging subject which encompasses a great many sub-categories and is involved in nearly every aspect of our lives.

The wide-ranging influence of science

This section of the chapter provides examples from biology, chemistry and physics to illustrate the ways in which we rely on science in our lives although we may not realize it. It might be a worthwhile activity to get students to brainstorm a list of as many aspects as they can of their personal lives and of the community in which they live, which are supported by or made possible by science. Different groups could work on different sciences and then compare findings. The lists should be long. As a follow-up, students could try to think of some aspect of their lives that is in no way reliant on some scientific knowledge.

Science and religion

One area in which science cannot answer many questions is religious knowledge. The scope of religious knowledge encompasses the spiritual and the supernatural, and science cannot test those domains. One particularly good resource for thinking about this issue is Stephen Jay Gould's article 'Nonoverlapping Magisteria', originally published in *Natural History* magazine in 1997. You can access the article using the QR code on the left.

See Chapter 6 of the student book for a more detailed discussion of the relationship between science and religion, and for a deeper discussion of the ideas in and challenges to Gould's article.

KNOWLEDGE QUESTIONS

Relevant knowledge questions from the TOK subject guide:

- What knowledge, if any, is likely to always remain beyond the capabilities of science to investigate or verify?
- How might developments in scientific knowledge trigger political controversies or controversies in other areas of knowledge?

Acceptance of scientific findings

The knowledge questions above also highlight the fact that conflict sometimes arises because people want to accept the validity of scientific knowledge in some situations but deny it in others. This specific aspect of the scope of scientific study will be addressed in detail in the perspectives section that follows.

If you are also teaching the Knowledge and Indigenous Societies unit in your course, there is a discussion question on page 303 of the student book, which would be worth having your students explore, about whether or not the scope of science is the same in Indigenous societies as it is in modern, technologically developed societies.

Perspectives

The section on perspectives in natural sciences treats the concept from several different viewpoints. As we saw in the Scope section, natural science investigates many aspects of the physical universe, and the different branches of science reflect this. Each of the different branches, of course, also gives us a different lens through which we can look at the world, and so each of the different branches of science gives us a different perspective. Once again, we see how the different parts of the knowledge framework are interrelated.

Paradigm shifts

Another way in which perspective affects the knowledge we can gain through the natural sciences arises from the differing perspectives of scientists working on the same real-world question. That leads naturally to the question of paradigm shift, a concept first defined by Thomas Kuhn in his 1962 book *The Structure of Scientific Revolutions*. Paradigm shift occurs when sufficient agreement has been reached that those differing perspectives are effectively eliminated. The stage at which scientists working on the same question do not have sufficient agreement to determine a theory or paradigm is what Thomas Kuhn, in his framing of the process of paradigm shift, called the pre-paradigmatic state. For more detailed information about paradigm shifts and how one comes about, see the resources box on the next page.

KNOWLEDGE QUESTIONS

Relevant knowledge questions from the TOK subject guide:

- How can it be that scientific knowledge changes over time?
- What role do paradigm shifts play in the progression of scientific knowledge?

TEACHING TIP

When considering paradigm shifts, students often want to grab hold of the geocentric–heliocentric paradigm shift as an ‘easy’ example to understand. Unfortunately all too often, students’ discussion of that event in scientific history is superficial at best and misguided at worst. Some teachers will simply forbid students from discussing that paradigm shift in their essays, but you do not necessarily have to resort to such a strict injunction. If students cannot discuss it well, demonstrating a sophisticated understanding, then they should definitely not discuss it at all. But if they can discuss it in such a way as to demonstrate that they do understand the nuances of how that change in scientific belief came about, it can provide a powerful way for students to reveal themselves as knowledgeable about paradigm shifts.

One important idea for students to understand is that paradigm shifts do not happen all at once in a very short time. Scientists did not just accept geocentric theory one week and a few days later, faced with a new piece of evidence, abandon that idea and embrace, enthusiastically, heliocentric theory.

■ RESOURCES

A first resource on paradigm shift is this short YouTube video which uses pom poms and glass jars to create a visual metaphor for what a paradigm shift is. This video does a pretty good job of simplifying the idea of a paradigm shift, but there are some questions which arise from the metaphor because it is not an exact fit:

- ✔ The video shows that at some point some of the facts we discover do not fit into the paradigm, and it then shows how a new paradigm forms, which accounts for the facts which do not fit into the old one. The metaphor in the video shows only the new facts being put into the paradigm; however, that is not precisely accurate. A new paradigm does not completely negate all past knowledge. A new paradigm reframes the way we understand facts in relationship to each other. It is possible that some old 'facts' might be proven to be false, but certainly not all of them. Students should discuss the efficacy of the metaphor in the video in this regard.
- ✔ The video shows the man trying to break the first vase to represent the breaking of the first paradigm, and it does not work. The maker of the video ought to have edited that problem out, but he did not. It is also worth having students discuss the question of whether, when a new paradigm rises to the level of acceptance by the scientific community, all remnants of the old paradigm are swept away. Such a discussion must take place in the context of a specific paradigm shift, rather than as a generalization.

This video provides a good opportunity to discuss the pros and cons of the fact that anyone can put any content on the internet for other people to view. Some questions to consider are:

1. What are the advantages to this video as a source of information about paradigm shift?
2. What are the disadvantages to this video as a source of information about paradigm shift?
3. Is the development of knowledge better served by allowing people to put less than perfect content on the internet?
4. What are our obligations as users of this technology in order to ensure that we are not misled by less than perfect content?

Both of the next two resources use the geocentric–heliocentric paradigm shift as the model for how paradigm shifts work. The first is much simpler than the second, but still provides a better view of paradigm shift than the idea of a simple, quick shift in viewpoint.

- ✔ You can download a poster from the Hodder Education website, using the QR code immediately on the left, which summarizes the five stages of paradigm shift, according to Thomas Kuhn.
- ✔ For a more detailed understanding of how that paradigm shift came about, you can use this series of eight blog posts by Thony Christie on his blog *Renaissance Mathematicus*, which detail the complex developments in mathematical and scientific knowledge which led to the paradigm shift from a geocentric view of the universe to a heliocentric one. Use the second QR code shown on the left here for access.
- ✔ Another short YouTube video, accessible via the final QR code shown on this page, gets at some of the implications for scientific knowledge of the concept of the paradigm shift. This is very helpful for TOK, as we want to get beyond just what something is to consider what it means. Discussion of what a paradigm shift is and how it comes about is good TOK work, because it helps us understand how and why scientific knowledge changes over time. This short YouTube video moves us one step further by exploring the ramifications of the acceptance of a paradigm.

  This video points out that when we have a paradigm, which can be thought of as a story about how things work, our ideas about what we expect to find are shaped by that paradigm. When scientists work within the boundaries of a particular paradigm, then, what they notice and what they are likely to think their observations mean are shaped, inevitably, by that paradigm. We have seen in other chapters how the culture in which we are raised and in which we live and work has the same kind of effect in directing our thinking. One important mechanism in the sciences, then, must be the questioning of accepted wisdom. The video points out that we simply cannot question all knowledge all the time, or we would never make any kind of progress whatsoever. We do need, however, people who are on the lookout for any new observations that do not immediately seem to fit into our paradigm and which need to be explained, either in such a way that they illuminate some nuanced aspect of our current paradigm, or in a way that raises questions about the current paradigm. When enough of those observations amass, we are headed toward a paradigm shift.

TEACHING TIP

Upon first learning about paradigm shifts, students can be misled into thinking that their existence means that all scientific knowledge we have is 'wrong', and that some new paradigm shift will prove that we do not know what we think we know. This implication was in fact a criticism brought against Thomas Kuhn when he first proposed the concept. To help students understand why paradigm shift is not inevitable, you can set them the following series of questions:

1. What changes in knowledge led to the paradigm shift from the geocentric paradigm to the heliocentric paradigm?
2. Why had scientists not had access to that knowledge previously?
3. What kind of information to which we do not currently have access could you imagine astronomers (or other scientists) finding that could cause a shift from the heliocentric paradigm to another *X*-centric paradigm?
4. Can you imagine some as-yet-non-existent technology which could give us access to a set of information that we do not currently have access to which might lead to a new paradigm regarding the movement of the planets and stars?
5. How likely do you think it is that the paradigm of the Earth and other planets and moons revolving around the Sun could ever turn out to be fundamentally wrong? Why or why not?
6. Consider other scientific findings such as photosynthesis, the water cycle, conservation of mass, the periodic table of the elements and gravity. Do you think it likely that any of these might one day prove to be fundamentally wrong? Why or why not?
7. Evolution is as soundly demonstrated a theory as any of those listed above. We now have hundreds of years' worth of data supporting the essential theory. The details – the mechanisms of change, for example – are still under study, but the essential idea of species development through evolution is sound. Why do you think it generates so much more controversy than, say, gravity or photosynthesis or heliocentrism does?

SAMPLE RESPONSE TO A KNOWLEDGE QUESTION

What role do paradigm shifts play in the progression of scientific knowledge?

Truth by coherence

Paradigms are well-documented, widely accepted explanations for some phenomenon. New findings that fit into the paradigm, or which initially seem not to fit, but which eventually can be fitted in if we revise some small detail of how the paradigm works, strengthen the paradigm because they cohere with what is already known. Perhaps a good way to think about paradigms is that they are well-documented, that they will not inevitably give way to a completely new paradigm, but that they are not absolutely certain and, therefore, must be diligently monitored in case data comes in which requires explanation and justification.

The essential nature of the heliocentric paradigm is extremely unlikely to change, because we have hundreds of years' worth of additional observations since the days of Copernicus and Galileo. That information has been gathered with newer and dramatically more powerful technologies which have allowed us to have access to information on the molecular level as well as reaching far into the deep universe. The Hubble space telescope, which can see much further than any telescope on Earth because it is not hindered by interference from the Earth's atmosphere, has been able to observe 265 000 galaxies. The most distant galaxy the Hubble has been able to find, a galaxy identified a GN-z11, is one from 400 million years ago (Siegel). So far, none of data which has been amassed since the seventeenth century has thrown the heliocentric paradigm into question.

As with all scientific theories, as time passes, new technologies are developed which increase our capacity to amass more and more data. When the new data continues to fit into the existing paradigm, it strengthens that paradigm, making it less and less likely, over time, that the theory could turn out to be in some way fundamentally wrong. Scientists use the term 'theory' rather than some other term which would indicate absolute certainty because they are precise and there is always a chance, however small, that the theory could someday turn out to be wrong enough to trigger a paradigm shift. The odds grow ever smaller, however, as new information continues to fit the paradigm.

Note: As we have seen in previous chapters: this answer to the knowledge question is just one possible way to consider the question. We could, for example, have chosen to focus the response on the way that paradigm shifts have embodied significant growth in some aspect of the natural sciences.

Different perspectives among non-scientists with regard to accepting scientific knowledge

We have already seen in this chapter how social, religious, political and cultural beliefs can work against some people's ability to accept some scientific knowledge.

Another reason that it can be very difficult for people not trained as scientists to accept scientific facts is that our capacity to perceive reality directly is constrained by our biological nature. We can only see so far – even with glasses on. We can only hear sounds within a certain range. Our ability to see and hear differs from the ability of other creatures, for example, dogs can hear sounds which are higher; mantis shrimp can see many more colours than we can; some eels can use electricity to sense what is around them, an ability completely denied to humans; and bats can use echolocation to map the space around them. (Some blind people have actually been able to develop the ability to use echolocation – use the QR code on the left to view a video about one such case.)

Our ability for direct perception suggests that the world is flat, that the Earth is neither spinning nor travelling through space, and that the smallest particle there is is something like a tiny grain of sand. From our personal direct experience, we might think that the Sun and the Moon are the only other astrophysical bodies in the universe. All of these beliefs based on our direct perceptions are wrong.

Scientists have tools which extend sense perception far beyond the human biological capacity to perceive. It is in large part because of those tools that we know about atoms, the spherical nature of the Earth, the movement of planetary bodies in space, other galaxies, gravity, photosynthesis and many, many other facts about the physical universe which we cannot perceive directly. In order to be able to accept that scientific knowledge, we must have access to a source of scientific knowledge (not necessarily equal for all people – think about inequities of educational opportunities in countries around the world) and we have to be willing to accept the word of experts who have experiences that we have not had, and which we are not able to get. The average person couldn't begin to go around replicating scientific work to find out if what the experts are saying is true.

Once we must accept someone's word for something, the next problem becomes how to know whose word to trust.

Throughout the TOK course, you will have numerous opportunities to ask students to differentiate between individuals who can be considered an authority (people with actual expertise who have the right to have their opinions and declarations on a particular subject listened to and respected) and those who are in authority (people in authority positions who do not necessarily have the expertise they ought to have). The inability to distinguish between these two groups can lead to the acceptance of claims from people considered to be experts, whether those people are actually experts or not.

That last situation is what we have when people who accept some scientific knowledge as being legitimate deny other scientific findings on the word of self-proclaimed 'experts'. The introduction to the student book provides an example of this in the context of the anti-vaxxer movement and the consequent global rise in diseases which had been eradicated entirely in many countries and dramatically reduced in others. Below are some questions which might be discussed about the idea that some non-scientists bring a different (non-scientific) perspective to scientific knowledge, resulting in their denying that knowledge.

1 Can society function effectively if a large number of people reject scientific knowledge?
2 Do we individually have an obligation to develop consistent habits of mind, so that if we accept some well-established scientific knowledge, we ought to accept all well-established scientific knowledge?
3 How can we tell the difference between well-established scientific knowledge and questions which have not been substantially resolved?
4 How do we know who is qualified as a legitimate expert in a given field?
5 How can we ensure that we are accepting the truth of the way that things are, rather than the 'truth' of the way we wish things to be?

KNOWLEDGE QUESTION

Relevant knowledge question from the TOK subject guide:

- How does the social context of scientific work affect the methods and findings of science?

One reason for controversy among non-scientists about scientific knowledge is that scientific knowledge contradicts (or appears to contradict) knowledge from other areas such as politics and religion. The student book takes evolution and religion as a case study and demonstrates that most religions have formally acknowledged the truth of evolution or have formally stated that evolution does not contradict their doctrines. The continuing controversy, then, arises from a minority of very impassioned people, and it persists, as noted in the student book, where evolution has been politicized, and one political party takes the anti-evolution position as part of its platform, thus overtly encouraging people who are adherents of the party for other reasons to deny evolution. The controversy over evolution – which exists entirely among non-scientists – is an excellent example of how politics, religion, culture and values shape attitudes toward some scientific knowledge, although the same people easily accept much other scientific knowledge and its influence in their daily lives.

■ **RESOURCES**

- ✔ Author and publisher of *Skeptic* magazine, Michael Shermer has made a career out of debunking pseudoscience and science denial. He gave a TED talk relevant to the subject called *The Pattern Behind Self-Deception*, in which he introduces what he calls Type 1 and Type 2 errors. A Type 1 error is an error in which we believe in something which is not there, and a Type 2 error is when we fail to believe in something which is real. Shermer explains that humans have evolved to make Type 1 errors rather than Type 2 errors, because it was much safer, centuries ago, to believe that a noise meant that a predator was hiding in the bushes than it was to ignore the noise, assuming it was just wind. In the first instance, if humans believed in a lion that was not there, the humans lived to believe again another day. In the second instance, if the humans did not believe in the lion and it was there, they did not live to make that mistake again. You can use the first QR code on the left to access the TED talk.
- ✔ Shermer has another TED talk on similar concepts which you can access using the second QR code shown on the left.

Methods and tools

■ The scientific method

The student book includes a list of assumptions that underlie the scientific method (see pages 312–3). We are reproducing that list here, because it is so essential to an understanding of how knowledge is made in the natural sciences.

■ Underlying assumptions

The basic framework of the scientific method has its roots in a set of assumptions that scientists make. The Geological Society of America published a brochure entitled 'The Nature of Science and the Scientific Method', in which it detailed a list of those assumptions, including the following:

1. The world exists apart from our sensory perception of it.
2. Humans are capable of perceiving the real world accurately and attempting to understand the physical universe.
3. Natural processes are sufficient to explain or account for natural phenomena or events. Scientists must, therefore, explain the natural world in terms of natural processes. They must not explain the real world in terms of supernatural processes, which cannot be observed or tested.
4. All human perceptions are shaped by our past experiences, which means that our ability to perceive is shaped by those experiences. Our perceptions, therefore, *may be* inaccurate or biased.
5. Scientific explanations are limited. Scientists cannot observe every instance of any phenomenon; therefore, scientific knowledge is necessarily *contingent* knowledge rather than absolute. This means that scientific knowledge must be open to revision if new evidence arises. It is impossible to know if we have thought of every possible alternative explanation or every variable. The technology available to us at any given time might be insufficient for helping us observe all that is there, in the real world.

The student book goes on to investigate the implications of all these assumptions in terms of how they affect the methods and tools used in the pursuit of scientific knowledge. Over the rest of this section, there are three developed examples of scientific studies, including two activities which can be done with students. After each one, you will find a chart which shows how that study reflects these five underlying principles. As an excellent activity, have students do this analysis themselves for one of these – or for any other science simulation that you use in class.

KNOWLEDGE QUESTIONS

Relevant knowledge questions from the TOK subject guide:

- Is there a single 'scientific method'?
- Is the depiction of the 'scientific method' traditionally found in many school science textbooks an accurate model of scientific activity?

Work on the second question above provides a great opportunity for students to connect their work in group 4 to their work in TOK. You can also collaborate with the group 4 teachers to investigate the nature of the scientific method.

In the student book, on pages 311–2, we laid out a description of steps that would have been taken had we actually done the dirt and water chemistry experiment which opened the chapter. Those steps fit with the model of the scientific method which is very familiar to most people from their high school science experience, but it is actually rather misleading. Science is seldom so tidy outside of the classroom. There is not really one easily identifiable scientific method. The process which leads to any given scientific finding depends on the particular knowledge being sought, the context in which the seeking is taking place, the financial support available for the project, and so on. Frederick Grinnell in his book *Everyday Practice of Science* offers some insights into the cultural and pragmatic forces which shape what happens in a scientific investigation (18). He points out, in a very useful table, that before science can begin, someone has to commit to a project, and that committing means committing time, money and effort to something which may or may not pan out. He points out that, contrary to our popular idea that scientists collect data and then analyse it, which sounds like a very tidy and inevitable process, data from any given experiment might be confusing, and important ideas might be missed. There might not be enough to make any solid conclusion.

Another aspect of scientific inquiry that Grinnell points out is that when scientists do not get the results they were expecting, they do not necessarily know why not: maybe it is because the hypothesis was wrong; maybe it is because the experiment was not a good one. Maybe it is because the experimental design is fine, but something went wrong in the actual running of it. Scientists cannot just run one test and then determine that the hypothesis has been disproved; other avenues have to be explored. Nor can scientists run just one test and determine that the hypothesis has been supported. Positive findings must be checked and replicated. Failures, just as much as successes, might lead to new questions or different hypotheses, which in turn lead us to new knowledge. The process of science, in other words, can be very messy.

Scientists do, nevertheless, make progress in establishing truths about what the world outside ourselves is like. The way they do that is to take great care to monitor their assumptions, designs and procedures. They check and recheck their perceptions and conclusions. They share their findings with the community so that those findings can be subjected to the scrutiny of people who might be presumed to have a more objective perspective. Scientific findings are, like mathematical findings (as we saw in the last chapter) established by the scientific community, not by any individual. Finally, even findings which have been accepted are subject to retesting and further checking, especially as new evidence relevant to those findings becomes available. This can, in some cases, lead eventually to a paradigm shift, as we saw in the perspectives section earlier in the chapter.

Example of overcoming our biological limitations

Science is predominantly an observational endeavour. Scientists are trying to figure out the nature of the world outside of the human mind, so they have to seek what is out there, using the observational tools available. We saw in the section above that often the intuitions that we have based on our individual abilities to experience external reality through our perceptual mechanisms mislead us about what is really out there. Scientists must know the limitations of their personal perceptual abilities and how to overcome them. In Chapter 4 of this book (page 102), we pointed out a trap that students often fall into in which they think that because language is arbitrary, we have no way of knowing whether what we perceive is the same thing that others perceive. We said at that time, that such a claim reveals a lack of understanding of science. Science can explain how the eye works, what the effect of our colour rods are, what the properties of light are, and what happens to light when it bounces off objects and onto our eyes. We can explain why the same object might look different to different people and in what circumstances.

ACTIVITY

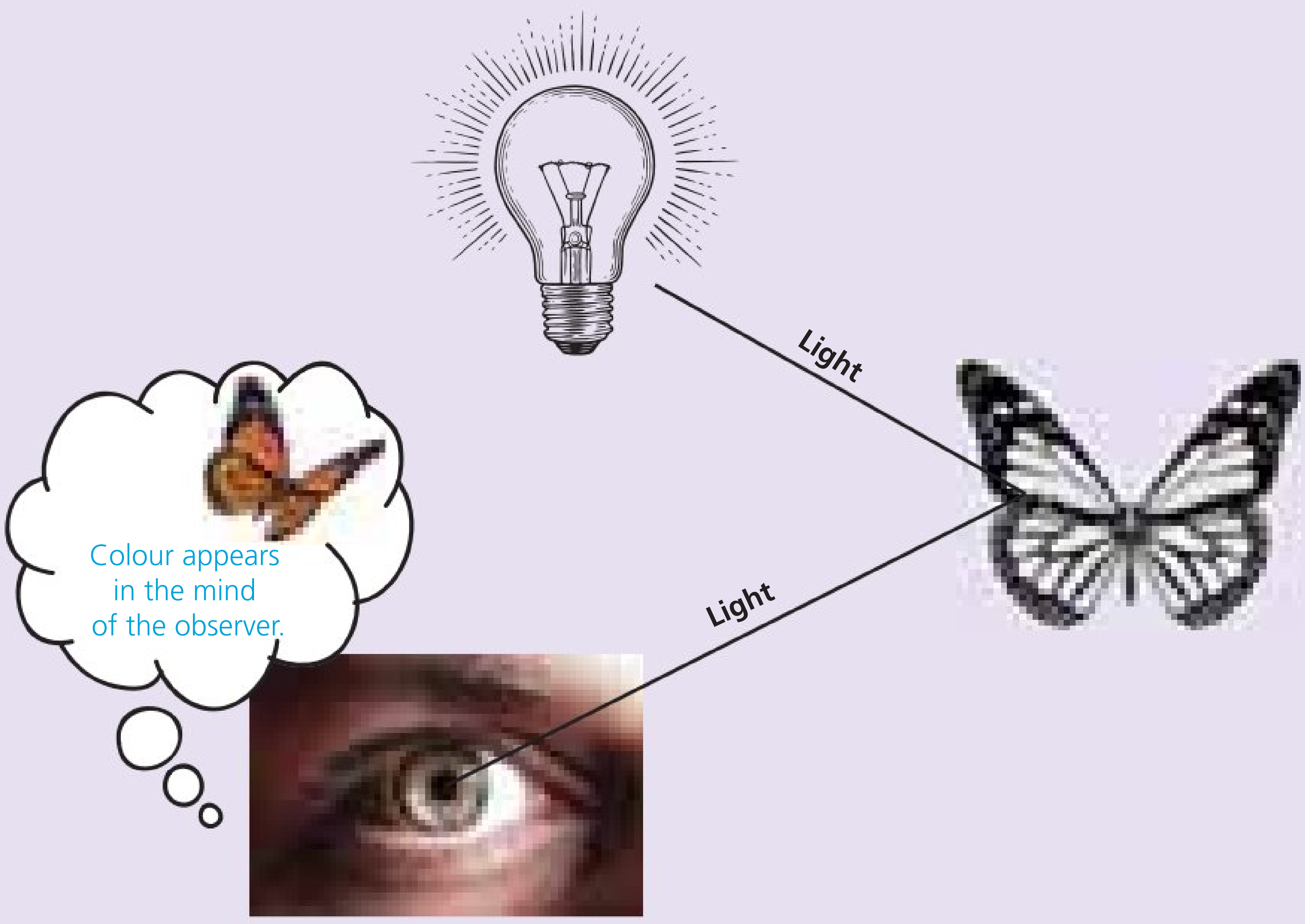
1 To demonstrate to students (or to have them demonstrate to themselves!) that they are already accustomed to recognizing and understanding influences on their perception which make objects change their appearance, have them photograph a brightly coloured object in several different kinds of lighting. They can photograph it outside in bright daylight, in indoor light, in dim light, in the dark or near dark, and in a scene with something else which is even more brightly coloured. If possible, they could photograph the object under black light. They can then line up the photographs in order of most brightly coloured to least.

The two pictures of the oranges below demonstrate what one pairing out of the collection might look like. The oranges in the first photo were photographed in very bright light. In the second photo, the very bright light was removed, and the exact same oranges were photographed again. The two pictures look significantly different, though they are exactly the same object. Our eyes process colour differently depending on how much light there is and what type of light it is.

2 Students could be asked to explain the differences in the photographs, and then they can be asked to think of other factors which might influence how the objects appear to different individuals.

Apart from individuals viewing the objects in different light, some influencing factors would include colour-blindness and looking at the object through sunglasses. Different animals perceive colour differently as well. In the introductory chapter of this book (page 16), we talked about the mantis shrimp's vastly more extensive ability to see colours because it has many more colour cones in its eyes than we do. Dogs, on the other hand, have two colour cones where we have three, so they can perceive fewer colours than we can. Dogs can see some colours which are combinations of yellow and blue: greyish brown and greyish yellow, light and dark yellow and light and dark blue (Stromberg).

3 The final question to consider, once students realize that colours change when circumstances change, is the question of what colour is really out there, without human eyes to see the oranges. The actual answer is that there is no colour in the objects themselves: colour is the product of the interaction between an object, light and the biology of the eye that receives the reflected light. The diagram below shows how the interaction works.



If we could see the world as it actually is, there would be no colour. Because our experience of the world is inextricably connected to our perception of colour, the realization that colour does not exist in the objects can be shocking. But if we stop and think about it for a bit, the fact that we know that other animals see colour differently – and that we ourselves see colours differently when the light changes – is a natural outcome of the fact that colour is not a physical feature of objects, but the product of a complex interaction. Our deeply intuitive understanding that the world is full of colour is wrong, and science can explain both why it is wrong and how the colour in our minds comes to be there. Before scientists can describe the physical universe correctly, however, they have to know the limitations of human perception, and they have to develop methods of overcoming those limitations.

Example of scientific observation vs our usual experience of observing

One ramification of the need for scientific observation to transcend the usual everyday observation that gets us through our day is that scientists observe things in much more detail and for much longer than most of the rest of us do. Setting up the conditions under which the required observations can even be tried can be time-consuming, difficult and expensive. The student book gives the example of some marine biologists studying octopuses. To be able to observe the octopuses, they must fly many hundreds or thousands of miles and arrange boats, crew, cameras, diving equipment and a support crew for housing and feeding all the people involved. Then they send divers down and follow octopuses for hours and miles, as they have to simply wait to see what the animals do. The student book also gives the example of the building of the Large Hadron Collider in order to have a chance to observe the Higgs Boson particle. That effort cost $4.5 billion and took 10 years to build (Knapp). Scientific observation is not a matter of simply raising one's head and noticing what is around.

Once the conditions are right to be able to observe whatever it is that the scientists want to observe, their observations must be much more deliberate and careful than the observations that most of us make on a daily basis. You can demonstrate this fact to your students by having them engage in a scientific observation activity which reveals the importance of the five underlying assumptions that the Geological Society identifies. There is a chart at the end of the description of the activity which explores those connections in detail.

ACTIVITY

This activity uses real, but dried and preserved, butterflies. If you are going to pursue this method, here are some considerations:

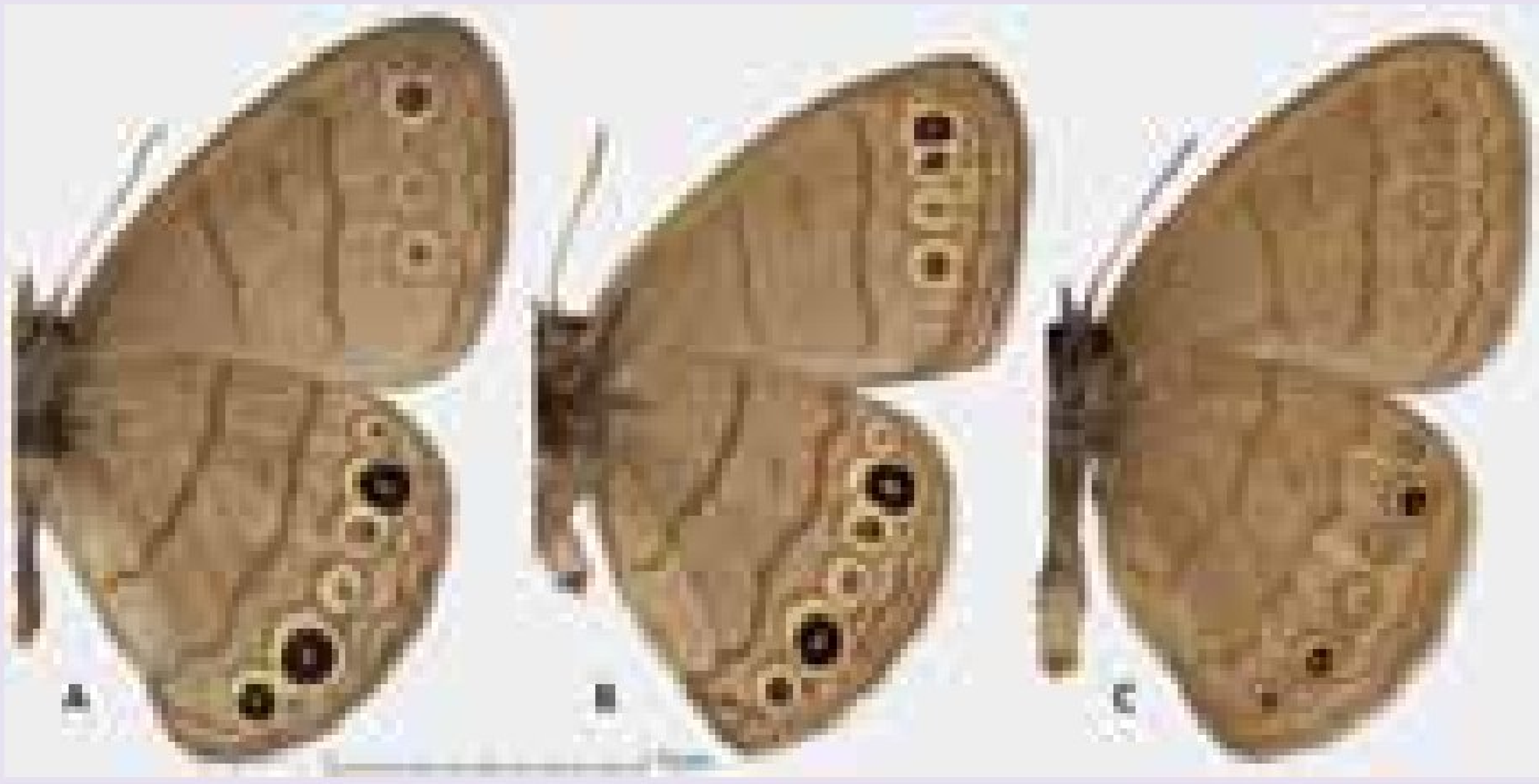
You can purchase dead butterflies from biological supply companies who raise them for educational purposes, so that they are not taken from the wild. One such supplier can be found using the QR code on the left. You should do some research, however, to see if you can find a supplier in your area (make sure you use a reputable company that adheres to import laws). Ideally, you should try to acquire butterflies which are native to your area, as that will serve the double purpose of helping students learn about scientific observation and learning something about the butterflies in your area. The critical element, however, as you will see below, is that the butterflies you use must be easily confused with other butterflies. (It is not too difficult to locate these!)

If you wish to take this route, you will have to be able to spread and display the butterflies. You can use the QR code on the left to access the first of a four-part video series on how to do this.

If you cannot acquire the necessary supplies, or if you do not wish to try to deal with actual butterflies, the activity could be done with photographs, though perhaps somewhat less effectively, as the angle of the photograph limits the observations which can be made. Alternatively, you could use any other organism which has easily confused species: leaves could work, or flowers. Here are some examples of North American butterflies which are easily confused. The pairs have been chosen specifically in order to exemplify a range of features that have to be carefully observed in order to be able to distinguish between the two species.

The butterfly on the left is called a Viceroy. The one on the right is called a Monarch. These two butterflies are not related, which we can tell from their Latin names. The Latin name of the Viceroy is *Limenitus archippus* and the Monarch is *Danaus plexippus*. If the two were related, the first part of those names would be the same. The Viceroy is a mimic of the Monarch. The Monarch tastes very bad to birds, and the Viceroy evolved the same colouring as a defence mechanism. The way you can tell the two butterflies apart is by the heavy black line on the hindwing of the Viceroy. The Monarch does not have that line. It is easy to miss that subtle difference if you aren't used to observing closely, and if you don't know what to look for.

The butterfly on the left is the Northern Pearly Eye, *Enodia anthedon*. The butterfly on the right is the Southern Pearly Eye, *Enodia portlandia*. The genus name, *Enodia*, tells us that these butterflies are related. There appear to be some differences in the way the spots are formed toward the outer edges of the wings, but sometimes those colour markings can be deceptive. In fact, the best way to tell the difference between the two butterflies is by looking closely at the antennal clubs – the little knobs at the outer end of the antennae. On the Northern Pearly Eye, the antennal clubs are half-black and half-orange. On the Southern Pearly Eye, they are all orange. If you look closely at the photos above, you can see that difference.



The image above shows three distinct species of butterfly. A is the Intricate Satyr *Hermeuptychia intricata*, B is the Carolina Satyr, *Hermeuptychia sosybius* and C is the South Texas Satyr, *Hermeuptychia hermybius*. The South Texas Satyr is easier to distinguish from the other two, but it is genetically much more similar to the Carolina Satyr than to the Intricate Satyr. The Intricate Satyr and the Carolina Satyr are distinguished from each other by their DNA and by the male genitalia. These butterflies must be dissected so that the physiological structure of the male genitalia can be observed, and their DNA must be analysed in order to tell them apart (Pensoft Publishers). That level of observation is not uncommon in entomology. Students in your class could not, of course, have applied such observational techniques, even if they had thought of it, but it is often quite eye-opening for them to learn that such effort and care must be taken in the pursuit of scientific knowledge. Observation is a critical scientific tool. It requires particular training in order to be able to observe in a scientifically effective manner. Intuition is not an effective source of knowledge for this kind of work.

Procedure

Prior to the activity:

1 Prepare your mounted specimens.
2 Create a PowerPoint presentation with images of all the specimens and images of one or more butterflies which are NOT the same species which you have in the class, but which are easily confused. Each slide needs to have this question on it: 'Did you see this butterfly yesterday?' Mix the order, so that sometimes the butterfly that was in class comes first, and sometimes the one or ones which were not in class come first.
3 Duplicate all the slides at the end of your slideshow, so that you will be able to go through them a second time. This time put the answer on the slide: 'yes', if the butterfly was one of your in-class specimens and 'no' if it was not.

Day 1:

4 Once you have mounted your specimens on pins, stick each one, on its pin, into an inverted Styrofoam cup. Number the cups with a black marker pen, but do not indicate the name of the butterfly species.

5 Tell students that they are going to have a quiz the next day to see if they can identify the butterflies. They are to observe the specimens in the classroom carefully, so that they can be identified later. The amount of time you give them will depend on the number of specimens you have and the number of students who need to look at them: allow 5–10 minutes per specimen, so if you have 10 different butterflies and 20 students, you may want to give the students an hour or more to observe.
6 Do not give them any further instructions about how to do the observations. Much of the point of the activity is going to be for students to realize what kinds of assumptions they made about what scientific observation is like.
7 If students ask if they can take notes, draw pictures or take photos, tell them yes, but do not make those suggestions.

Day 2:

8 Tell students to get out a piece of paper and a writing implement.
9 Show the slides. Students write down the number of the slide and the answer – yes or no – as to whether they saw that butterfly the previous class period or not.
10 After the 'quiz' (which you probably will not want to count in the students' grades!), ask students to discuss the difficulties they had in identifying which butterflies they saw. You may wish to go back through the slides more slowly, pointing out the differences between butterflies.
11 Ask students to discuss what they have learned about the nature of scientific observation.

Table 9.1 How the butterfly study relates to the five underlying principles of natural science

Principle	Notes on its significance
The world exists apart from our sensory perception of it.	■ The fact that various types of butterflies cannot interbreed is a fact of nature, not something that we can control or change. (The question of what constitutes a separate species in the animal or insect world is a very complicated one and still much under debate. A good rule of thumb, however, is that animals of different species cannot interbreed and produce viable offspring. That is, the offspring of animals from two different species are sterile, as with the mule, which is the offspring of a horse and a donkey. For our purposes, the fact that these butterflies have been given different species names in the Latin name tells us that scientists consider them to be different species.) ■ The need for observation reflects the desire to find out what the actual situation is among butterflies. In the case of this specific activity, it is already known (because of previous work done by entomologists) which butterflies are different species, and the job here is to determine how, since we know they are different species, we can tell the difference.
Humans are capable of perceiving the real world accurately and attempting to understand the physical universe.	■ The activity reveals the understanding among scientists that intuition and casual observation of something are insufficient to be able to tell what the nature of that thing is. Education is needed. ■ Observation must be done over time and using the tools available. The three samples of easily confused butterflies show that the use of a magnifying glass, DNA testing facilities and a very finely constructed dissecting kit with the capacity to dissect very small things are important aids to observation.

Cont ...

Natural processes are sufficient to explain or account for natural phenomena or events. Scientists must, therefore, explain the natural world in terms of natural processes. They must not explain the real world in terms of supernatural processes, which cannot be observed or tested.	■ The explanation of which butterflies are different species depends only on the physical nature of the butterflies. Such things as colour markings (on the wings in one case and on the antennal clubs on another), DNA and the physical form of the genitalia determine the difference, and we need to be able to observe them in order to tell that. ■ The experiment does not turn to any kind of supernatural process or any other non-observable phenomenon in order to explain the speciation.
All human perceptions are shaped by our past experiences, which means that our ability to perceive is shaped by those experiences. Our perceptions, therefore, may be inaccurate or biased.	■ This activity highlights this problem. Very few students in high school will have had sufficient experience with the identification of butterflies to be able to know what to look for or to understand how minute the search for evidence must be. ■ Their experience with observation will have shaped most students to expect that noting large-scale feature such as colour and size will be enough for later identification, and the point of the lesson is to reveal to them their bias.
Scientific explanations are limited. Scientists cannot observe every instance of any phenomenon; therefore, scientific knowledge is necessarily contingent knowledge rather than absolute. This means that scientific knowledge must be open to revision if new evidence arises. It is impossible to know if we have thought of every possible alternative explanation or every variable. The technology available to us at any given time might be insufficient for helping us observe all that is there in the real world.	■ Speciation in butterflies is an ongoing discussion, and there have been many instances of the identification of certain butterflies being the same species being overturned, as well as the identification of butterflies thought to be different species being revised to show them as the same species. ■ If you read the article about the three different Satyrs, you will know that the discovery that there were three different types, rather than just one, is quite recent.

■ Examples of how the information being sought shapes the scientific inquiry

KNOWLEDGE QUESTIONS

Relevant knowledge questions from the TOK subject guide:

- What is the role of imagination and intuition in the creation of hypotheses in the natural sciences?
- What is the role of inductive and deductive reasoning in scientific inquiry, prediction and explanation?

The student book provides a case study of an entomologist who ran an experiment with Yucca moths that lasted more than 30 years (see student book pages 318–20). The methods that were used changed about halfway through that experiment, at which point the goal changed. For the first 17 years, the goal was to find out whether more yucca moths would emerge from diapause. Initially, the data was not encouraging; few yucca moths emerged in any given year. Unexpectedly, however, a mass emergence occurred, requiring an explanation as to why that would happen. Due to a chance discovery of some information about the weather, the experimenter formed a hypothesis that could explain the mass emergence. At that point, the goal changed. The new goal was to test the hypothesis.

An experiment requiring five years to complete was designed and run. The initial result supported the hypothesis. In this case, the experiment to this point had taken more than 20 years. The likelihood that anyone would ever replicate it to verify the findings was very small, so the situation required a different approach: the experimenter himself replicated his findings in two additional five-year cycles. Three repetitions, all of which supported the hypothesis, made the conclusion much stronger than it had been when the hypothesis was first formed, or even after the first five-year test was made. We can see in this example how the specific circumstances of the study necessitated certain procedures to be followed in order to verify the findings. The scientist could not simply follow a simple scientific method; he had to create the methods he needed to achieve the goal of finding an objectively compelling knowledge claim.

Table 9.2 How the Yucca moth study relates to the five underlying principles of natural science

Principle	Notes on its significance
The world exists apart from our sensory perception of it.	■ Diapause is not something invented by humans, and the determination of how long diapause can last and what triggers emergence from diapause is not ours to control.
Humans are capable of perceiving the real world accurately and attempting to understand the physical universe.	■ The daily observation and record keeping for 30 years in this experiment reflects the belief that we are capable of perceiving accurately.
Natural processes are sufficient to explain or account for natural phenomena or events. Scientists must, therefore, explain the natural world in terms of natural processes. They must not explain the real world in terms of supernatural processes, which cannot be observed or tested.	■ When the first large emergence came, 17 years into the experiment, the assumption was made that there was an explanation for why that happened, and that that explanation would be found in some process of the natural universe. ■ The natural universe was not limited to the moths and the yucca plants, however, as evidenced by the fact that the experimenter was able to imagine that weather data might be relevant to the question at hand.
All human perceptions are shaped by our past experiences, which means that our ability to perceive is shaped by those experiences. Our perceptions, therefore, may be inaccurate or biased.	■ The fact that this experiment was run at all reflects both of these last two principles. There was, prior to the beginning of this study of yucca moths, knowledge about diapause, and knowledge about how long diapause could last. ■ The running of the experiment, especially past the 12-year mark, which was the longest known period of diapause for any insect, indicated a choice not to rely on the assumption that existing knowledge was complete and correct. As a result, new evidence did arise, and new knowledge was made. ■ As the student book recounts: the experimenter continued observations beyond the replication phase of his experiment. That choice, too, embodied the assumption that the knowledge we have is contingent. There could be more evidence to be found.
Scientific explanations are limited. Scientists cannot observe every instance of any phenomenon; therefore, scientific knowledge is necessarily contingent knowledge rather than absolute. This means that scientific knowledge must be open to revision if new evidence arises. It is impossible to know if we have thought of every possible alternative explanation or every variable. The technology available to us at any given time might be insufficient for helping us observe all that is there, in the real world.	

The following lesson plan provides an opportunity for students to experience this kind of demand to design an experiment to suit particular circumstances. This activity features a scientific question and experiment which is dramatically different from the yucca moth experiment, and so provides a useful contrast.

LESSON PLAN: EXPERIMENTAL DESIGN – THE NATURAL SCIENCES

Introduction

This lesson will allow students to investigate a real-life situation which led to a scientific experiment. They will use the scenario to design an experiment themselves.

Framework section

Methods and tools.

Aims

The aims all have knowledge-related terms: 'understand', 'experiment', 'data' and 'good science'.

Students will:

- understand how a scientific experiment is shaped by the knowledge which is being sought
- appreciate the difficulty of designing an experiment which will produce trustworthy data
- recognize that good science generates more questions to be pursued.

Objectives

These objectives are more specifically about the natural sciences, in contrast to some earlier lesson plans which include broader objectives.

Students will be able to:

- justify their experimental design as being efficacious for the purpose
- explain how an experimental design reduces or eliminates personal bias on the part of the experimenter
- identify follow-up questions to be pursued based on the results of the real-life experiment.

Knowledge questions from the TOK subject guide

Some suggested ideas about answers to these questions appear in the reading notes Table 9.3 on page 215.

- Is there a single 'scientific method'?
- What kinds of explanations do natural scientists offer?

Relevant course concepts

Evidence, explanation, objectivity.

Prior learning

- This lesson would work best after students have developed a basic understanding of the nature of scientific method. They should have read the section in the student book on observation and the case study of the experiment with the yucca moths.
- Students must also have at least a basic understanding of the definition and characteristics of the relevant course concepts.

Required resources

- Chapter 1 of *The Lady Tasting Tea*, by David Salsburg, pages 1–4. The book is included in the Works cited list for this chapter and is available online as an ebook.
- A blank chart for analysing the five underlying principles of natural science inquiry (for a follow-up activity). A version of this can be downloaded and printed by using the QR code on the left.

Activities

1 Read aloud to the students the beginning of the first paragraph of the chapter, from the first sentence up to '… let us test the proposition!' (Salsburg 1).

Most groups will realize right away that they need to provide the woman with a series of cups of tea that she does not see poured to find out if she can tell. Many groups will not realize that the experiment must be a double-blind test, so that the person serving the tea also does not know which cup is which. Some questions to ask the groups are: 'How many cups do they intend to serve the woman and why?'; 'How many does she have to get right and why?'; 'In what order will you present the cups of tea and why?'

Statistically speaking, the odds of the woman getting 10 in a row right by guessing is $(1/2)^{10}$ or one chance in 10000. If she were to get 12 in a row right, that would reduce the chances of her having simply guessed them all to less than 3 in 100000 (the calculation is $(1/2)^n$, where n = the number of tries in a row). If she can correctly identify ten in a row, the experiment would have provided satisfactory evidence that her claim was accurate. You may want to tell students that after they share their ideas, but not while they are working on their design.

Many groups will lose sight of the basic question. They will want to try different flavours of tea, different types of milk, different temperatures for the tea, different cups and so on. All of those ideas are irrelevant. The original claim the lady made was that she can always tell. She has obviously had tea of different types with different kinds of milk, at different temperatures and in different cups. She did not stipulate, so the test does not need to stipulate. If she can pass the first test, demonstrating that she can, indeed, tell, then further experiments could be designed to try to pin down the reason for that ability. If groups are trying to work in this kind of extraneous factor, ask them to justify the need for it in terms of the claim the woman made.

Activity 4 ensures that the lesson moves to the level of understanding methods and tools of the natural sciences, rather than just engaging with an interesting real-world situation.

2 Assign students in groups of three to design an experiment they could use to test the woman's claim.

3 Ask students to share their experiments with each other. This can be done for the whole class, if time allows, or in groups of two or three groups. Groups who are listening to an explanation should try to find problems with the experimental design.

4 The class needs to discuss what they have learned about experimental design. Here are some questions for discussion:
   - a In what way did the hypothesis ('The lady can tell the difference between tea into which the milk has been poured and milk into which tea has been poured') shape the experiment?
   - b What difficulties did you encounter in trying to design an effective experiment?
   - c What design features could keep the results from being helpful?
   - d What design features would be most helpful in terms of either supporting or negating the hypothesis?

5 Tell the students that it is not known exactly what the experimental design was, but that the lady was presented with a series of cups, into some of which the milk was poured first and into others the tea was poured first. We don't know how many cups she tasted, but she got them all right (Salsburg 8).

Follow up

Now that we know the lady's claim that she could tell the difference between the two preparations of tea was substantiated through experiment, ask students to consider what would be the next questions that need to be answered. If time allows, they can sketch out experiments to test some of those questions.

Students can then read the rest of the extract and discuss the implications in terms of methods of making knowledge in the natural sciences.

As an additional optional activity, ask students to analyse the experiment in terms of how it reflects the five underlying principles of natural science inquiry.

*Note: The text in **blue** in Table 9.3 on the next page, relates directly to the knowledge questions and the course concepts referenced in the lesson plan. It identifies ideas that students might bring up in discussion of the three identified concepts and the two knowledge questions.*

Table 9.3 Reading notes for Chapter 1 of *The Lady Tasting Tea*

Point made in extract	Significance for knowledge development
When the woman made her claim about her tea-tasting abilities, it caused an immediate reaction on the part of the scientists present, whose inclination was to design an experiment immediately to test the proposition.	The scientists presumably found the claim to be somewhat fantastic, but rather than dismiss it or the woman, the inclination was to test it scientifically to see if there was evidence to support what she said. This is the essence of science: we do not assume we know; we test.
Many people will scoff at this experiment, because they will say that it is not worth the time and effort.	Laypeople do not understand the point that often the driving force of science is not utility, but rather curiosity. The point is to find out how the physical world works. If that knowledge can then be used for a pragmatic purpose, that is fine, but it is secondary. In this case, the scientists wanted an objective test that could reveal the truth of the woman's claim. The explanation would be related to the human ability to differentiate very closely related tastes.
The experiment was designed and implemented. The man running the experiment noted down the data without comment.	This comment reveals the deliberate employment of objectivity. When the experiment commenced, the experimenter did not react to the data as it came in. He just wrote it down for later consideration. This description also reveals the employment of the scientific method appropriate to this test, which suggests that there is not one method, but that the design of specific experiments must embody objectivity and function to collect observable data in whatever way will work for the question at hand.
The author talks about his employment as a statistician and he talks about needing assistance from some other mathematician, as he was the only one in the employ of his company.	The desire for feedback and checking of the work reflects the need for ensuring that the observations and analysis have been objective.
The author tells us that one of the participants in that experiment later used it, presented as a hypothetical situation, to lay out an examination of the kinds of considerations that must go into experimental design.	This discussion reveals the way in which the specific nature of a scientific inquiry demands a specific approach. The aim of the approach is the collection of evidence and a conscientious effort to remain objective. The discussion shows that in order to achieve these things, scientists must take great care in experimental design.

Table 9.4 How the tea tasting study relates to the five underlying principles of natural science

Principle	Notes on its significance
The world exists apart from our sensory perception of it.	The woman's claim that she can taste the difference between the two formulations of tea is assumed by her listeners to be a function of the external physical world, rather than of her psychology. Even if this claim turns out to be true, and even if it turns out to be entirely idiosyncratic to this one human being, the presumption is that the ability is related to the physical properties of her gustatory system.
Humans are capable of perceiving the real world accurately and attempting to understand the physical universe.	The design of an experiment to test the proposition shows confidence in the ability to perceive data and, subsequently, to analyse its significance. The observations in this case will consist of observing the woman tasting the tea and marking down her claim about which type of tea it is. No one doubts that that can be done accurately.
Natural processes are sufficient to explain or account for natural phenomena or events. Scientists must, therefore, explain the natural world in terms of natural processes. They must not explain the real world in terms of supernatural processes, which cannot be observed or tested.	As noted in the first box in this table, the clear assumption inherent in this experiment is that if the claim is accurate, the cause will be physical.
All human perceptions are shaped by our past experiences, which means that our ability to perceive is shaped by those experiences. Our perceptions, therefore, may be inaccurate or biased. Scientific explanations are limited. Scientists cannot observe every instance of any phenomenon; therefore, scientific knowledge is necessarily contingent knowledge rather than absolute. This means that scientific knowledge must be open to revision if new evidence arises. It is impossible to know if we have thought of every possible alternative explanation or every variable. The technology available to us at any given time might be insufficient for helping us observe all that is there, in the real world.	The fact that these professors, who cannot think of any explanation in either biology or chemistry which could account for the claim the lady made, nevertheless set out to test it scientifically reveals the intention to work against bias. The professors accepted the fact that they do not know not as a reason to deny the claim, but rather as a reason to investigate further. They assume that whatever knowledge they currently have of tea and the chemistry of tea and milk is at least incomplete, and therefore worthy of further study.

RESOURCES

Here are some excellent resources for information and ideas about the nature of science as a knowledge-making endeavour (all are listed on the Works cited page for this chapter):

- ✔ *Science Surprises* by Lawrence Flammer (the author's name sometimes appears as Kurt Flammer). This guide is aimed at younger students but has some extremely useful explanations about what science is and what it is not, as well as discussion about the nature of the scientific method. You can purchase a very inexpensive copy in PDF format ($3.99 US at the time of the writing of this book). Once you purchase it, it is licensed for free distribution for non-commercial uses, so you can distribute it to all of your students. You can also access a free online version by using the QR code in the margin.
- ✔ *Everyday Practice of Science* by Frederick Grinnell. This book, which we mentioned earlier, is aimed at the layperson. It presents a model of how scientific knowledge is made. One particularly useful feature of the book is that Grinnell not only explains how scientists do science, but he also explains how science interacts with, influences and is influenced by society. There are two particularly useful models: one which shows how discovery and validation cycles work in tandem (5), and one which shows the role that scientists play in the larger context of society (92).
- ✔ *What is Science For?* by Bernard Dixon. This is an older book about the nature of science, and Chapter 2 'What is science?' is particularly useful for the TOK teacher. One idea that Dixon investigates, which is not often dealt with in other sources, is the fact that sometimes chance plays an important role in scientific discovery. We saw an example of that in the yucca moth experiment that was discussed in this chapter.

Ethics

Ethical practice of natural science

Much of this chapter has already demonstrated the ethical values which shape scientific inquiry. The five underlying principles of natural science that we investigated throughout the methods section of this chapter form the foundation for what constitutes ethical practice. We have seen that, given those assumptions, scientists are ethically obligated to use methods which ensure objectivity as much as possible. Such methods must focus exclusively on processes of the physical universe, and which explain processes in the physical universe in physical terms, rather than in supernatural terms.

The student book provides two more examples to demonstrate the importance of these ideas, including one example of a scientist who was found to be engaged in the unethical behaviour of inventing or distorting data. Such an action removes all possibility of objectivity, and it denies the reality of the processes which actually occur.

Ethical application of scientific knowledge

In addition to considering how ethical practice shapes the development of knowledge in the natural sciences, the chapter in the student book explores the question of how scientific knowledge can be ethically (or unethically) applied. The student book provides two case study examples: the use of 'science' to try to support slavery and the use of science to try to argue for human rights. In the former case, the 'science' that was being used was pseudo-science, which takes us back to the first topic we explored in this chapter. In the second case, the science being used is real science, but it is being inaccurately presented in a way that conflates natural science findings with human science findings to misrepresent some known facts. Neither of these constitutes the ethical application of knowledge.

Your students can be asked to think of many other examples in which people have misused or misrepresented science or tried to claim that something which is not science is really science, in order to further some agenda. Here again, this kind of effort is very often political, as is the case with both of the examples in the student book.

It is worth asking students, however, to consider the many ways in which scientific knowledge is ethically applied for the benefit not only of individuals, but for society in general. We saw in the Scope section of this chapter some of the wide array of effective applications of science in the development of technology, infrastructure, medicine and so on.

■ Science and societal mores

KNOWLEDGE QUESTIONS

Relevant knowledge questions from the TOK subject guide:

- Do scientists or the societies in which scientists operate exert a greater influence on what is ethically acceptable in this area of knowledge?
- Should scientific research be subject to ethical constraints or is the pursuit of all scientific knowledge intrinsically worthwhile?
- In what ways have developments in science challenged long-held ethical values?

One aspect of the relationship between science and ethics which the student book does not take up (except indirectly) is the question of how societal values and moral codes influence the making and application of knowledge (see a similar discussion in Chapter 10 of the student book about ethics and the human sciences). That relationship is essentially political, and so is covered in some detail in the chapter on Knowledge and Politics, and often relates to the way that power is used to control information. In this book (page 159), we have the example of the Trump administration policy toward restricting information about global warming. This example was used to show how power and politics affect knowledge, but it is also an example of the way that those in power have the ability to shape the knowledge that gets made and disseminated within a society. On pages 266–7 in the mathematics chapter of the student book, there is a further example of how power in a society drives what scientific knowledge gets made in the case study of the United States' drive to put a man on the Moon in the wake of the Russians' successful launch of Sputnik. The political decisions either to fund the development of knowledge or to suppress the dissemination of knowledge are examples of the interaction of the ethics of a society and the ability of scientists to generate new knowledge. If a political entity sees particular scientific knowledge as being ethical, then it can make it easier for that knowledge to be developed. If, however, the political entity sees some particular scientific knowledge as being in some way unethical, then it can block the development of that knowledge.

Students can explore the knowledge questions presented above in the context of these examples, and they can be asked to generate other examples of places where the ethical values inherent in a culture either conflict with or cohere with scientific endeavour. Some familiar examples of scientific work which has generated social controversy are the fight over abortion, the effort to develop medical technologies using stem cells and the use of animals for testing a wide range of products. We have additionally discussed, in several places in the student book, controversies over vaccines, global warming and evolution. All of these are places where scientific knowledge is opposed by some people whose ethical values conflict with it.

Conclusion

KNOWLEDGE QUESTION

Relevant knowledge question from the TOK subject guide:

- Do the natural sciences provide us with good examples of people who approach knowledge in a rigorous and responsible way?

CONNECTION TO: THE CORE THEME

This chapter has provided several examples of the work of individual scientists who could be used in a consideration of this knowledge question. We trust that the examples we have provided suggest that the answer to the question is 'yes'. However, we do need to remember that there are individuals who violate the principles of science and who do not, therefore, serve as good examples of ethical scientists. Andrew Wakefield, whose work we discussed in the introduction to the student book, is one of these. His biased study into vaccines was, and continues to be, a significant contributor to the anti-vaxxer movement, although his work has been repudiated and he has been struck off the register of practising physicians in the UK. This example brings us to two final questions for students to consider:

- What is the responsibility of an individual who is not an expert to develop an objective understanding of science?
- Is it acceptable for people to just accept everything they hear, right or wrong, and then blame others for their actions, which were based effectively in ignorance later?

With regard to the second question, the aims of the Theory of Knowledge course definitely reject such an attitude. We aim to help develop students' ability to function well throughout their lives because they know how to, and take pains to, find out what is true and what is not true and to act in accordance with truth. In the natural sciences, the need for people to know and understand the truth arises from the fact that it is in understanding science that we have the power to control our physical destiny. It is not too much to say that the survival of our species depends on it.

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CHAPTER 10

The Human Sciences

OBJECTIVES

After reading this chapter of the student book, students will be able to:

- identify and reflect on the differences between the natural and human sciences
- identify and understand some of the main perspectives available in psychology and economics
- reflect on elements of the 'scientific method' as it applies to human behaviour
- understand the difference between qualitative and quantitative data in the human sciences and reflect on the effect of this distinction on the reliability of the AOK
- explore the role of models in economics and reflect on how well they apply to the world
- reflect how ethical values are an important part of the scope of the human sciences and how this might constrain the development of new knowledge.

Introduction

Many teachers use the human sciences as a way of offsetting the conversations they have had about the natural sciences, which means that generally it will come after their unit on the natural sciences. Many teachers also weave their discussions of the human sciences and the natural sciences together – shifting between the two in relation to the subtle nuances between the two AOKs. As always, the knowledge framework is a good way of managing this comparison. We have focused on two main issues here and in the student book, the 'scientific' status of the human 'sciences' and the relationship between various perspectives in the human sciences, both in comparison to the natural sciences. This is not to suggest that there aren't a wealth of other equally (or more?) interesting ways of unpacking the AOK of The Human Sciences!

Scope

A favourite discussion in TOK classrooms stems from the question: 'What makes the various disciplines in the human sciences "sciences" at all?' This is the primary issue in the Scope section of the Human Sciences chapter in the student book. This general tension and a variety of related questions are all hinted at in the example knowledge questions listed under Scope in the TOK subject guide.

This question requires a careful exploration of the scope of science more generally, contextualized by considerations of both the natural and human sciences, and it is worth spending a bit of time on this (and guaranteeing that this discussion is raised whenever the opportunity is provided in both AOK sections). This is because many of the critical discussions of the assumptions, limitations and perspectives in the human sciences can trace their origin in the challenges of disciplines like psychology, economics, human geography or social and cultural anthropology being considered 'sciences'.

ACTIVITY

1 Ask students to consider the list of subjects offered by the IBDP under groups 3 (Individuals and societies) and 4 (Sciences). What do the disciplines within each group have in common? What are the main differences across the groups?

2 Individuals and societies includes economics, psychology, global politics, social and cultural anthropology and geography, which in the TOK curriculum would normally land under human sciences. What is it about these disciplines that makes them *scientific*?

Likely discussion points arising from this activity include:

- Any 'science' focuses on a full and precise description and explanation of the physical objects and events in the world.
- The sciences all incorporate a method which prioritizes observation and prediction and uses experimentation for the construction and testing of hypotheses.
- The processes studied by the *natural* sciences are considered *deterministic*.
- Human beings are both objects in the world, but also *persons* with their own *wills* (desires, plans and projects) and are therefore hard to predict.

A good way of approaching this is through an explicitly comparative approach, like the one used in the student book where we ask the students to fill in a table comparing the natural sciences and the human sciences. This is an introductory activity so it would be worth holding on to the students' responses so that they can gauge their learning over the course of the unit. Taking a comparative approach is a perfectly reasonable way of dealing with the human sciences and doesn't necessarily mean you haven't covered all five of the AOKs.

KNOWLEDGE QUESTIONS

Relevant knowledge questions from the TOK subject guide:

- Is it possible to discover laws of human behaviour in the same way that the natural sciences discover laws of nature?
- Are predictions in the human sciences inevitably unreliable?
- Is human behaviour too unpredictable to study scientifically?

These three questions cut to the heart of the main point you will likely be discussing, and illustrate the important point we have been making, that the elements of the knowledge framework overlap considerably. Here are two issues being explored:

- The nature of science (scope) is to develop '*law-like generalizations*' which describe the regularities we see in the world.
- The methods of this AOK depend on what is believed to be the nature of the AOK.

These questions take for granted that science is out to identify and articulate law-like generalizations. The assumption is that the natural world is incredibly regular; it seems to follow regular patterns and the role of the scientist is to observe them and describe them. Scientific laws are these descriptions. Boyle's Law in Chemistry (or the Boyle-Mariotte Law), for instance, suggests that there is an inverse relationship between the pressure of a gas and its volume when the mass and temperature remain the same. This law not only describes the individual instance Boyle observed in his lab in the seventeenth century, but is thought to describe all ideal gases in all parts of the universe. Of course, this claim (that all ideal gases 'follow' the same law wherever they are in the universe) must be an assumption because we have not tested this everywhere in the universe.

What the laws provide are *predictions*. We know (assume) that the law applies everywhere so when we encounter gases, we can predict what will happen. The student chapter opens with a discussion of the Rosetta spacecraft and the predictions which allowed us to be reasonably sure that we could send it off and that ten years later we would know just where it would be.

Discovering these types of 'laws' to describe individual human beings, however, is a far greater challenge. Gases and planets, spacecraft and hurricanes all 'follow' impersonal laws. Human beings, however, tend to do whatever it is they want, and they are notoriously capricious in their wants. This lack of regularity makes it incredibly difficult to predict their behaviour. Of course, the better we know individuals the better we can predict their behaviour, but the prediction is never based on natural laws about how the physical universe works; predicting your friend's behaviour is based on what you know of their general tendencies, not what physical laws say about their atoms and molecules. So, it would seem that the knowledge questions must be answered by downplaying the predictability of the human sciences and questioning their status as sciences.

However, descriptions of how people behave at a wider level do tend to be more predictive (this idea is developed throughout the chapter in the student book). There is something about the human psyche that makes it possible to predict how groups of people tend to behave. Psychology is the study of the relationships between cognition and human behaviour and here the assumption is that people tend to be quite similar in this regard. Economics assumes that people tend to behave similarly as well, this time in relation to their attitudes and behaviour related to the distribution of goods and resources. Here again, we might argue that at the macro level we find that we can observe clear tendencies in human behaviour.

Nevertheless, we cannot ever claim that human beings can now be the subject of predictions to the same degree as natural objects, although some who wish to emphasize our physical natures might be holding out for a physical description and understanding of human behaviour. Describing human behaviour in this manner would subsequently provide far stronger predictions, based on the same natural laws that we use to describe the world around us.

Humans are not as predictable as events in the 'natural' world

Your students may have more knowledge about some topics than you

TEACHING TIP

Many teachers are not very familiar with the knowledge required by other subjects, but it is worth keeping in mind that the TOK teacher is not responsible for understanding this knowledge. You might find that there are students who better understand Boyle's Law or other topics and you can rely on them to explain it to the other students. The TOK teacher is meant to help the students understand the TOK aspects of the knowledge, as we have tried to do here.

KNOWLEDGE QUESTION

Relevant knowledge question from the TOK subject guide:

- Can other people know us better than we know ourselves?

CONNECTION TO: THE CORE THEME

The knowledge question above from the Knowledge and the Knower section of the TOK guide (page 15), can be used as a way of unpacking students' ideas about the authority of academic disciplines in their own thinking. We'll explore this later in this chapter in relation to ethics. Students might fully accept that social or human scientists can tell us more about ourselves than we might care to admit. Psychology is full of examples (such as implicit bias, explored in the student book's perspectives section) of the discipline claiming that there is some aspect of us and our own mental states that they know better from the outside than from the inside.

But we might challenge this. Do we have to accept the authority of an economist who uses decision theory to explain why we make the decisions we do? Is the body of knowledge in psychology so powerful that we have to accept its claims about why we form the attachments we do?

Will someone reading your fMRI images know you better than you know yourself?

What if, for instance, you were asked to undergo an fMRI (functional magnetic resonance imaging) scan to determine whether you were in fact in love with someone? Biological anthropologist Helen Fisher explores the human brain under the influence of love and makes a compelling case to suggest that brain science might be an important part of a full description of that most human of experiences. The implication is that we might find ourselves in a position where the biologists, reading a fMRI scan, could know many more things about us than we might care to admit.

Should all forms of human experience be reduced to purely 'scientific' descriptions?

■ RESOURCES

You might like to build an activity around the discussion above using the following TED talks by Dr Helen Fisher:

✔ TED Talk: Why we love, why we cheat.

✔ TED Talk 2008: The brain in love.

✔ There are further resources available at Dr Helen Fisher's website.

SAMPLE RESPONSE TO A KNOWLEDGE QUESTION

What are the main difficulties that human scientists encounter when trying to provide explanations of human behaviour?

The main difficulties which human scientists face when constructing knowledge stem from their attempts to apply various elements of the scientific method in contexts which deal with human motives. Human beings are both part of and seemingly distinct from the 'natural' world around them. The most important difference is that human behaviour is commonly thought of as being explained through appeal to more than just natural physical laws. The behaviour of planets, electrons, digestive systems and weather fronts can all be fully described and explained through reference to basic physical laws. A full account and explanation of human behaviour, however, seems to require reference to the agent's own internal beliefs, motives and desires. Human scientists are attempting to make the same sort of 'law-like' claims as natural scientists, that is, they are trying to identify patterns in human behaviour and identify the underlying causes through appeal to broad generalizations which are thought to apply in different contexts.

Applying the traditional 'scientific method' to human behaviour, however, runs into several difficulties. It is not clear that humans follow behavioural patterns in the same way that objects do. The actions of human beings tend to be quite circumstantial, that is, people behave the way they do because of a whole list of particular circumstances, none of which might ever occur again. This makes identifying patterns challenging.

One of the essential components for an explanation of human behaviour is reference to reasons, that is, beliefs, values and desires. The human sciences must attempt to make connections between behaviour and beliefs and desires, otherwise they are simply describing what people do, not why they do it. However, there are two main assumptions at work here. Firstly, the human sciences need to assume that the beliefs and desires that are the root cause of the actions are themselves detectable – that someone can identify them – whether it be through the self-reporting of the person committing the action or the scientist investigating the action. Psychology and psychiatry often claim, however, that people are not terribly good at identifying the reasons for their own behaviour. Many forms of psychological therapy, for instance, are designed to give people the tools to uncover what really motivates them and correct for things they are unhappy with.

Secondly, we generally assume that people's reasons are, in fact, reasonable; making a cause-and-effect relationship requires us to identify motives that are properly related to that behaviour. Economists in particular will assume that individuals are rational agents and make decisions for reasons we can identify. This means that when they see people making decisions, in order to connect the decision to a reason, they must assume that the reasons are logically related. Of course, there can be many different reasons why people act the way they do, any one of which or any combination of which might have been the actual motivator. Economic theory says people make spending decisions based on principles like maximizing their ratio of reward to cost, but maybe we buy the most expensive phone simply because we want to look cool and to spite our parents who told us not to, motives that do not fit easily into economic theory.

In order to uncover people's internal mental states (desires and motives), psychologists need to perform experiments (a crucial step in the scientific method used to test hypotheses). These experiments, however, are notoriously difficult to get right. Again, people's responses are often not genuine, or they are affected by unknown and uncontrolled variables, or they might violate fair treatment concerns of the participants. Natural scientists, working with chemicals and non-conscious cells in laboratory environments, can control variables far more easily and not worry about the feelings of whatever's in the petri dish or popping out of the Large Hadron Collider.

If scientific knowledge is going to do anything it should at least give us the opportunity to exert some level of control over the world around us. We learn about the environment we live in, in order to put it to good use. Electricity, medicine, powered flight and pole vaulting are all possible because we have been able to harness various elements of the world around us. In order to do this, we need to be able to make clear, measurable and rigorous predictions which we can then use to navigate the world. Indeed, they might feel that they are more than 'predictions'; we might treat them as 'knowing the future beyond doubt' (imagine if it was only a prediction that the wings of the airplane would produce enough lift to hold the jet in the air – we wouldn't get on the flight!).

Human sciences, however, struggle to make substantive predictions about individual behaviour. We might, for instance, describe all the social, economic and academic factors in an individual IB student's profile and then we might identify other past IB students with similar profiles in order to find out how well students with that profile tend to do on their IB. However, this tells us nothing really about our individual student, since our student will make their own choices. Economics might not fare any better: the global economic downturn of 2008 was predicted by some, but by and large it took the world by surprise and the constant updates on the status of the world's stock markets is a continual reminder that the whole thing is deeply unpredictable.

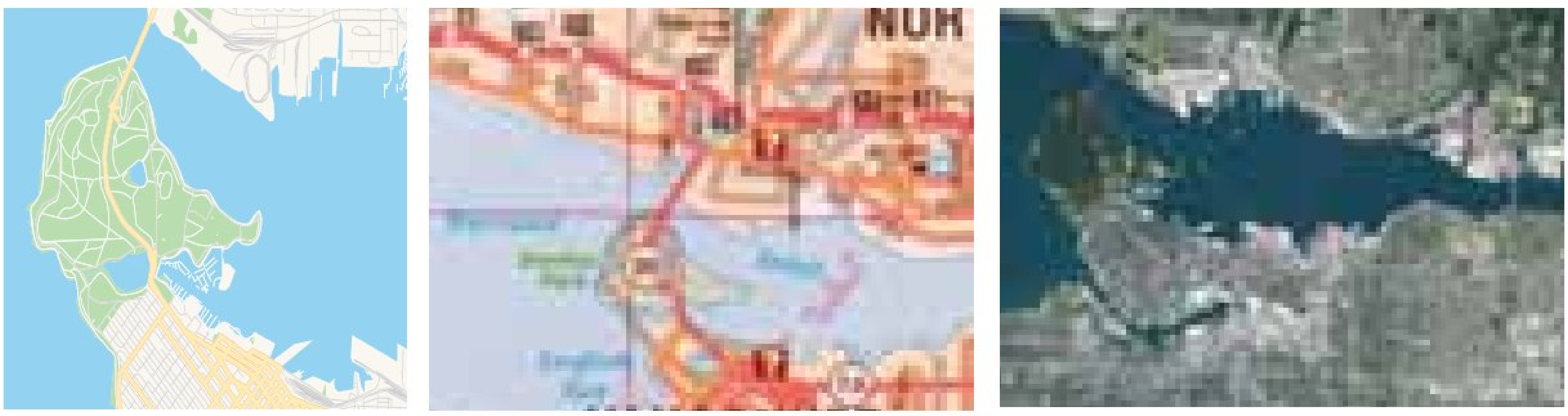
Do the results from standardized tests provide universities with enough data to predict whether a student will be successful at their university?

These issues represent a few of the main challenges human scientists must face in their attempts to apply the scientific method to their investigation into human behaviour. Different disciplines within the human sciences will investigate different aspects of human behaviour, but each suffers from the same central worry – individually, human beings are capricious, complex and contradictory. This makes a complete and objective science of them a genuine challenge.

Note: This KQ might just as easily be found under the methods and tools element of the knowledge framework of the human sciences AOKs in that providing examples of obstacles and challenges is part of a knowledge creator's process. This again underscores the interrelationships between the elements of the knowledge framework. The challenges and difficulties encountered by human scientists are dealt with throughout the chapter in the student book, but we have tried to draw them together here in a more precise fashion. A full response would include a more rigorous treatment of the examples and perhaps a wider range of disciplines. We are also taking quite a literal strategy here, focusing on the main difficulties. In terms of how you might encourage your students, we would suggest that the response above is a preliminary response which lays out the groundwork and would then need a careful and specific link to how one AOK or another would respond to these challenges.

Perspectives

We recommend that teachers make use of the map metaphor when discussing 'perspectives' in the human sciences, as it is a powerful way to highlight the relationship between the knowledge we construct about human behaviour and the reality of it. It is very much a case of 'the map is not the territory' here.



Different perspectives provide different information about the same world

The idea that different perspectives provide different information about the same world comes out most clearly when discussing the different perspectives taken by psychologists and economists, some of which are outlined in the student book. A table of different psychological perspectives is provided (student book page 338); this could serve as the focus of a discussion using the map metaphor as a framework.

Further information on the different perspectives can be found at the Simply Psychology website linked to by the QR code in the margin.

KNOWLEDGE QUESTIONS

Relevant knowledge questions from the TOK subject guide:

- Is it possible to eliminate the effect of the observer in the pursuit of knowledge in the human sciences?
- How might the beliefs and interests of human scientists influence their conclusions?
- How can we know when we have made progress in the search for knowledge in the human sciences?

These questions from the TOK subject guide raise two important issues in both the natural and human sciences:

- The extent to which the personal and social circumstances of the researchers and those they study can influence the construction of knowledge.
- What to make of the historical development of the discipline through time.

In another example of how the ideas and concepts provided by the TOK subject guide intermingle and overlap, we can develop conversations around these two distinct issues in a way that weaves together the issues raised.

TEACHING TIP

Encouraging students to see connections between the different elements of TOK, whether these elements be individual knowledge questions, elements of the knowledge framework, themes or AOKs, is important to bring out the comparative nature of the subject.

Psychology: The Diagnostic Statistical Manual

The previous iteration of the TOK course included five elements of the knowledge framework: scope and application, methodology, concepts and language, historical development and links to personal knowledge. The idea in the new course is that these five can be woven into the current four. One way to characterize this is to say that any of the conversations that you would have under the previous five headings, you can still have under the current four headings.

For example, discussing the historical development of the *Diagnostic Statistical Manual* (DSM), which is used to help psychologists make diagnoses, raises all sorts of interesting questions about the nature and methods of the field of psychology specifically, but also more generally in the construction of knowledge in any of the AOKs.

Psychology and psychiatry were barely even academic disciplines at the turn of the twentieth century. People suffering from harmful mental disorders were generally relegated to asylums for 'treatment', though the diagnosis and treatment of these disorders were generally carried out in order to guarantee the smooth running of the asylum, rather than to care for the individual patient. The tools the psychiatrists had to diagnose were based on descriptions of patients' behaviours and the concepts used in such descriptions varied from doctor to doctor, so there could be no generally accepted set of concepts or diagnoses to identify what was wrong with patients. This severely hampered the discipline's ability to produce knowledge that was reliable.

You might like to suggest that your students try to imagine that their various mathematics teachers over the years didn't use the same categories or concepts. How would this affect their ability to learn mathematics? Would it even be possible to learn mathematics?

In the 1930s and 1940s there began a movement to create a taxonomy of diagnoses. A taxonomy is a system of classification and the idea was that if a particular set of mental disorders could be agreed upon, then a psychiatrist in one part of the world would be using the same set of concepts and disorders as a psychiatrist in another. Patients then would be diagnosed using the same set of criteria. This classification system finally resulted in the Diagnostic and Statistical Manual, the first edition of which was produced by the American Psychiatric Association in 1952. It suggested 128 different types of mental disorder, 93 of which were described through appeal to descriptions of the symptoms rather than any biological cause. Here is an example of a description for something called 'psychophysiologic cardiovascular reaction' ('psycho' refers to mental states, 'physio' refers to physical features of the body, 'cardio' refers to the heart and 'vascular' refers to the blood vessels – so this phrase refers to something like a reaction in the heart or blood vessels, and relates to the relationship between a patient's mental and physical state): 'This category includes such types of cardiovascular disorders as paroxysmal tachycardia, hypertension, vascular spasms, migraine, and so forth, in which emotional factors play a causative role' (Blashfield, *et al*).

ACTIVITY

Ask students to consider the description of 'psychophysiologic cardiovascular reaction' above and think about the following questions:

1. How useful do you think it would be for a psychiatrist attempting to diagnose a mental disorder?
2. Which elements of the description are *qualitative* and which are *quantitative*?
3. Which elements do you think could be measured or can be *evidenced* through appeal to biological facts?
4. How do you think the various elements of the description could be identified?
5. How should a doctor conclude that 'emotional factors' played a 'causative role' (ie, that emotional factors *caused* the other problems like hypertension (high blood pressure) or paroxysmal tachycardia (an irregular heartbeat)?

Based on their discussion, ask students how useful they think this description would be for a psychiatrist trying to diagnose a mental disorder.

The American Psychological Association has published seven versions of the DSM. Since the third edition, the focus has been on diagnostic reliability – the idea that different psychiatrists can use the DSM to arrive at the same diagnosis. This is something that was not possible because of the earlier versions' emphasis on descriptive symptoms, like 'emotional factors played a role' – it was impossible to prove and was subject to the interpretation of individual psychiatrists. Continued research in the field has identified more and more reliable methods to diagnose various mental illnesses, often based on biological facts. DSM-III also attempted to develop a definition of mental disorder, which drew on a patient's distress or impairment in functioning.

ACTIVITY

Here is the definition of 'mental disorder' in full:

> Each of the mental disorders is conceptualized as a clinically significant behavioural or psychological syndrome or pattern that occurs in an individual and that is typically associated with either a painful symptom (distress) or impairment in one or more important areas of functioning (disability). In addition, there is an inference that there is a behavioural, psychological, or biological dysfunction, and that the disturbance is not only in the relationship between the individual the society
>
> (Blashfield, *et al*)

Ask students to consider this definition and evaluate each element, then think about the following questions:

1. Do you think there are elements of this definition which are qualitative, or rely on an individual's reporting? How might 'distress' be identified for example?
2. Do you think the claim that there is an 'inference' that some 'behaviour, psychological or biological dysfunction' at the root of the distress introduces a vulnerability into the definition?
3. Given that this is a definition of mental disorder and therefore important when applied to individual people, do you think this is an adequate definition?

For the fifth edition of the DSM, started in 1999 and finally published in 2013, the internet played a huge role. In an attempt to broaden the reliability of the classes of mental disorders, various drafts of DSM-V were posted on the web by the American Psychiatry Association's website and the community of psychological experts were able to comment on the early drafts. The current version has made conscious attempts to link psychological disorders with modern molecular biology and neuroscience in an attempt to provide stronger connections with the quantitative research, rather than relying on individual interpretations of qualitative concepts like distress.

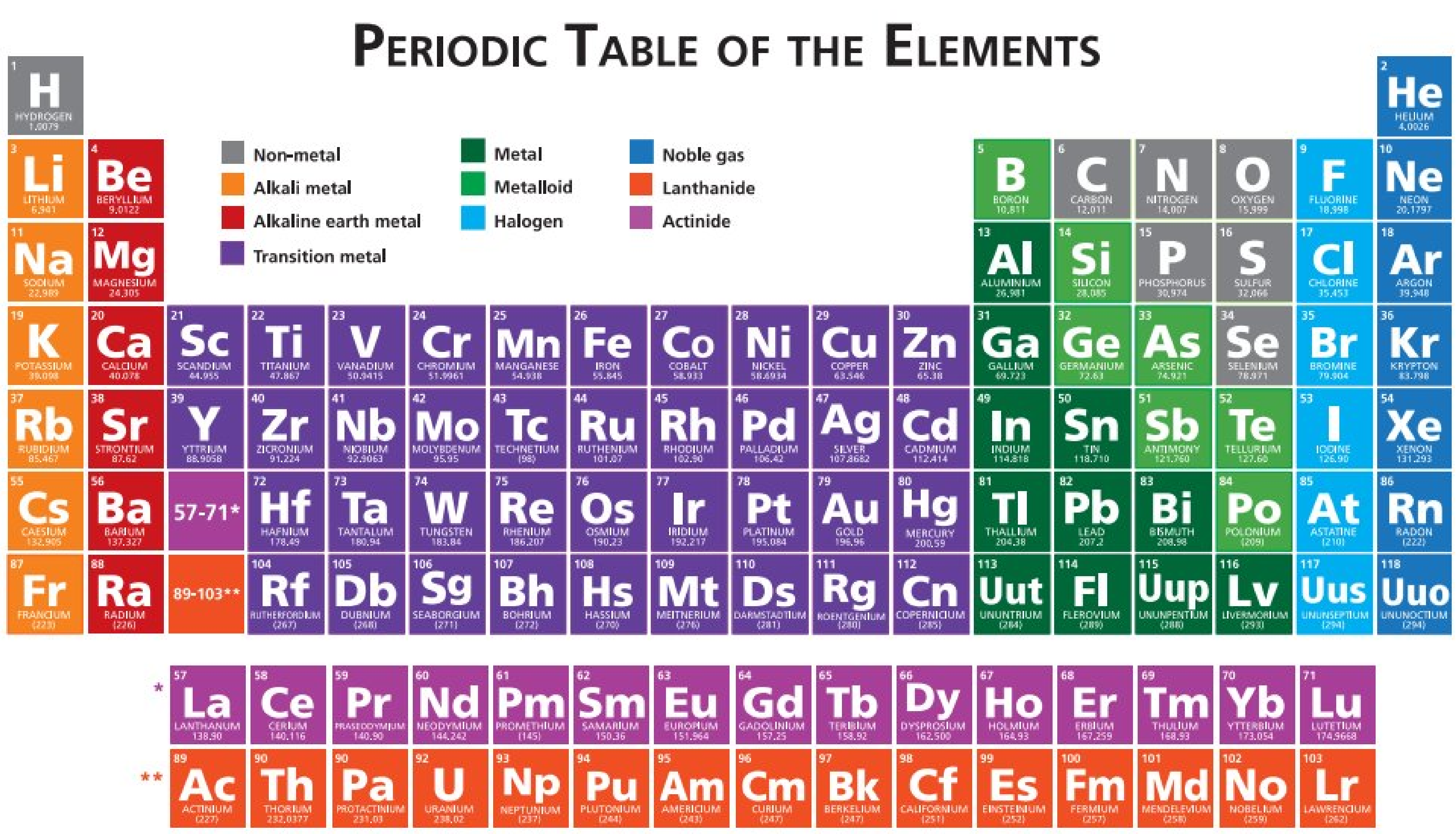
Table 10.1 Editions of the DSM, dates of publication and the growing amount of data/number of diagnoses (Blashfield, *et al*)

Edition	Publication date	Number of pages	Number of diagnoses
DSM-I	1952	132	128
DSM-II	1968	119	193
DSM-III	1980	494	228
DSM-III-R	1987	567	253
DSM-IV	1994	886	383
DSM-IV-TR	2000	943	383
DSM-5	2013	947	541

Impact of social trends

Looking at Table 10.1, certain questions arise. Why has the number of diagnoses grown so dramatically over the 60 years of the DSM? What is it that this number represents? What has caused these changes?

From a Theory of Knowledge perspective, one might ask just what the DSM is attempting to achieve. The Periodic Table of the Elements in Chemistry is an interesting comparison. There, chemists have identified the basic molecular 'elements' which are the building blocks of all substances in the universe. In 1869, Dmitri Mendeleev published his table, which places the various elements into categories illustrating relationships between them. What is interesting is that there are recognized 'gaps' in the periodic table, predicting that there are elements not yet discovered. Many of these gaps have been filled in with ongoing research. In other words, there seems to be an objective reality which the table describes, and the new elements of the table represent genuine findings, actual elements which can be shown to exist (although some only exist for fantastically short periods of time and only in laboratory situations).



Do these systems of classification identify or create reality?

Comparing this back to the growth and development of the DSM, we can ask, does each new version uncover genuine facts about human mentality? Are there further mental disorders waiting to be discovered and researched and included in a future DSM?

There are a number of critiques of the DSM suggesting that in fact the diagnoses in the DSM are not like the elements in the Periodic Table. The primary concern is that the focus of the DSM is on the subjective experiences of mental illness and on the symptoms as reported by the sufferers. We saw that there is an 'inference' that there are underlying biological causes of mental distress, but the DSM's emphasis on using patient's own reports as the main diagnostic tool suggests that there is much room for subjectivity and far less agreement between experts. The more modern attempts to define disorders through appeal to biological facts is an attempt to move away from this.

There are also genuine worries that social trends heavily influence the DSM and its development. A famous case, and one that has resulted in decades of suffering, is DSM-I and DSM-II's categorization of homosexuality as a mental disorder, suggesting that it needed to be treated and cured. By 1973, however, social attitudes and the social activism of the 1960s instigated a shift in the psychiatric community away from treating homosexuality as a disorder. DSM-III had removed it from the list of diagnoses (Drescher). The charitable view is that our understanding of mental disorders is progressing in the same way as other sciences progress as we develop more and more evidence. If social norms play such a powerful role in determining what is or what is not a disorder, however, we certainly need to take care and reflect on the role of social attitudes when offering judgments of this sort.

Another particularly horrific example was 'drapetomania', a nineteenth-century diagnosis for 'slaves who have a tendency to run away from their owner due to an inborn propensity for wanderlust' (Drescher). Wanting to run away from a slave owner was a mental disorder; consider the background social beliefs and values at work in this diagnosis.

What diagnoses are available to psychiatrists or psychologists? How many are there and why do they change over time?

RESOURCE

- ✔ The first QR code leads to a thorough history of the DSM that gives a sense of the various influences on the different versions. The document itself provides excellent Theory of Knowledge material, explaining how different social and research trends influenced the development of what constitutes mental disorders.
- ✔ The second QR code also contains a detailed history of the DSM's view of homosexuality, including the social influences and political conflicts within the mental health community.

ACTIVITY

1. Ask students to research the historical development of another human science like economics, sociology, anthropology or medicine.
2. Students create a presentation in which they identify the big developments in the methodology and scope of the discipline. They should explain whether they think those changes either increase or damage that discipline's reliability. Do they think that you can argue that the discipline is progressing? If so, what is their criterion of progress? What values are included in that definition of progress?
3. Students should be encouraged to expand this question into other areas of knowledge as well, asking how social trends might influence what the AOKs say are genuine facts. This very much underscores the human side of knowledge construction and again we might talk about the 'community of knowers'.

   In terms of this comparison with other AOKs, we might say that the arts deal quite happily with human emotions, social trends and customs, whereas mathematics and natural (and human) sciences have rigorous methods which are meant to avoid social influence and focus only on facts. However, some even argue that mathematics itself (particularly the construction of mathematical knowledge) has been heavily influenced by human bias and prejudice (Vilson). Where do the human sciences, particularly psychology or psychiatry in this case, stand in this conflict? There are clearly facts about human mental health and clear instances of people suffering from mental disorders. That some of these disorders have objective grounding in biology is shown in the effectiveness of medical treatment of disorders. But there are also clear social factors at play in the diagnosis of mental illness; what we call a 'disorder' might have much to do with the prevailing non-scientific social attitudes of the time, rather than objective fact.
   Questions that you might want to discuss with your class include:

   a. What do you think the various iterations of the DSM suggest about the status of knowledge in the mental health community?
   b. Does the DSM show how the field is progressing, identifying more and more genuine features of mental illness, while rooting out diagnoses which are thought to be purely social convention?
   c. Or does the DSM represent whatever current social attitudes towards what 'normal' and 'abnormal' mental health looks like?

Models

TEACHING TIP

In the perspectives section of the student book, we explore the use of models in the human sciences. One way of developing your own understanding of this fruitful area of TOK is to analyse the use of a model in your own discipline. After such an analysis you can use your own research to present to the students and provide a model for their own investigations.

ACTIVITY

You might use the table below with students. They could use these questions to interview a subject specialist. A copy of this table can be downloaded and printed using the QR code on the left.

KQs	Model
What sort of knowledge does this model seek to illustrate?	
What were the historical conditions under which this model was developed? What problems were encountered that this model helped to solve?	
What assumptions does the model make?	
Where does the model distort or misrepresent the reality it is meant to illustrate?	
What do you think are the strengths of this model and how do these translate into more reliable knowledge in your discipline?	
What do you think are the weaknesses of this model and how do these translate into less reliable knowledge?	

Methods and tools

KNOWLEDGE QUESTIONS

Relevant knowledge questions from the TOK subject guide:

- How do we decide whether a particular discipline should be regarded as a human science?
- Is it possible to eliminate the effect of the observer in the pursuit of knowledge in the human sciences?
- If two competing paradigms give different explanations of a phenomenon, how can we decide which explanation to accept?
- What assumptions underlie the methods used in the human sciences?
- To what extent are the methods used to gain knowledge in the human sciences 'scientific'?

The following discussion of acupuncture might be used to unpack several knowledge questions from the human sciences listed above.

Acupuncture

We have suggested that qualitative data has weaknesses in relation to quantitative data. In certain areas we might then try to avoid questions based on self-reporting which would lead to unreliable conclusions.

We might, however, consider an incredibly subjective question like, 'How are you feeling?' as capturing a genuine fact in the surprising context of medicine. We have included medicine as a human science here because of the 'human' element: while medical doctors certainly have to consider the biological aspects of their patients, they cannot discount the person they treat, and this person has their own beliefs and expectations that result in issues that biological research does not have to worry about. Some of those issues are discussed here.

We visit the doctor for a number of reasons, many of which have nothing to do with what we feel. There is something wrong with our body and we need to see a doctor to have it fixed. Broken bones, infections and heart disease are all observable and quantitative, and we would rely on the natural sciences to develop treatments to help.

People also visit their doctor for other reasons, which might not be as observable as a broken bone – chronic pain, for instance. Pain has been treated with acupuncture for over 2000 years. Many people report that undergoing such treatment actually does reduce the levels of pain, in other words, their qualitative experience of pain goes down after such treatments. There is much debate about whether it really works, but it is worth asking, 'How would we determine whether it works?' In the case of any individual's pain relief, it seems the best source of data as to whether it works is just to ask, 'Are you in more or less pain now, after treatment?' If the answer is 'less' then it seems to have worked.

The reason acupuncture is controversial, however, is that there is huge disagreement over the physical mechanisms by which it is meant to work. In 'western medicine' the emphasis in medical treatment is on a full understanding of the mechanisms by which medicines and interventions heal the body, and the concepts available to the 'western paradigm' are observable and quantifiable events. Many forms of non-western medicine, however, draw on concepts which are unobservable, unquantifiable and untestable. Acupuncture, for example, depends on a system of concepts having to do with things like *qi* (pronounced 'chee', referring to a 'life-force') and meridians (a system of channels in the body through which *qi* flows). It is suggested that acupuncture works by using needles to unblock these channels and let the life-force flow naturally around the body. The social

What does it matter that a procedure might conflict with a 'western' paradigm, if it works?

context in which acupuncture is assessed, therefore, is quite different: western medicine does not accept concepts like 'qi' or 'meridians' as part of a medical explanation, so any treatments depending on them will not be considered valid. However, if a person visits an acupuncturist and genuinely feels better, then who is to say that it is not working? While some studies suggest that acupuncture might work for things like chronic pain, the reasons why it is thought to work are quickly translated into concepts acceptable to the western tradition, like neuro-hormonal pathways, or by reducing certain inflammation-inducing proteins (Palermo).

ACTIVITY

1. Ask students to find a form of traditional medicine from their own culture (cupping, Ayurvedic, etc) to research and consider the cultural, social, historical and biological arguments for its effectiveness.
2. Ask them the following question: 'How does the "western paradigm" approach the topic and do you think that approach is appropriate?'

This is not an activity to 'find out if the medicine works' (that would be a scientific question), but a TOK activity about the methods by which such a question might be answered.

The placebo effect

Interestingly, it is a well-documented fact that sometimes people will report feeling better even though they have been given no medicine; our minds can trick us into believing that a fake treatment (a 'placebo' like a sugar pill, or plain water) has an actual effect. This effect seems to be most prominent in ailments like pain relief, insomnia, fatigue and nausea, not cancer or broken bones (Harvard Health Publishing). Some researchers suggest that this effect is the result of a patient's expectations – they are expecting to feel better and this has an effect on whether they do. In terms of medical treatment there is also the experience of being in a certain environment (white coats, clinical offices, medical devices, doctors and nurses) and these might be a signal to the brain that 'things are getting better'. However, a recent study suggested that patients feel better even though they know that they are receiving a placebo. The study asked migraine sufferers to take a false medication labelled 'placebo' for pain relief. It turned out that the placebos were 50 per cent as effective as the real drugs, but certainly more effective than taking no medication at all.

What does a patient have to believe for a placebo to work?

Here again, we have the subjective nature of the data posing a problem for traditional science and its methods. The emphasis on quantifiable, observational data in science seems to be inadequate when studying certain elements of human beings. In medical trials placebos are given to patients (unknowingly) so that researchers can identify the effects of genuine medicine (found in the population to whom the real medicine was given). But if patients are reporting that they feel better even when given a placebo, the data might be less useful.

LESSON PLAN: BUILDING A QUESTIONNAIRE

Introduction

This lesson is related to the activity in the student book (page 351) where TOK students studying the human sciences ('students') are asked to build their own questionnaires for the leaving IB2 students ('participants'). The lesson is designed to meet a very practical need – evaluating how the IB2 students have felt about their TOK course. It is also an excellent way of encouraging the IB1 students' reflection on the nature of qualitative data and its use in developing scientific knowledge.

This lesson was developed in response to the local school's requirement that teachers provide students the opportunity to feed back on their experiences.

The lesson will take more than one session, depending on how teachers manage the process and the access the students have to participants.

The lesson is about gathering feedback from the IB2s, so teachers will want to take some care (and control) over which questions are actually presented to the IB2 participants. Teachers will need to have a level of self-confidence and thick skin proportional to the freedom they give to the students to manage the process. Some genuine control is needed as feedback is a good thing and teachers will want useful and honest feedback. Generally speaking, the IB1 students developing the questionnaires take the process seriously and manage to produce a useful questionnaire.

Getting feedback is a challenge in all cases, but more so when you are new and might not be confident yet. Perhaps you could offer more guidance here in terms of what you need feedback on, so the questions prompt helpful responses.

Framework section

Methods and tools.

Aims

Students will:

- understand how quantitative and qualitative data can be captured through the use of questionnaires
- reflect on the challenges of gathering useful quantitative data and whether it can be used to confirm or falsify a hypothesis in the human sciences.

Questionnaires can collect both types. For example, 'How many hours did you use to prepare your internal assessment?' results in quantifiable data, whereas, 'Did you feel that the process of development adequately prepared you for the assessment?' will result in qualitative data.

Objectives

Students will be able to:

- research the challenges and solutions to developing useful questionnaires to gather both quantitative and qualitative data
- develop a questionnaire for the leaving IB students to gather information about their experiences as a TOK student
- manage the process by which the participants take the questionnaire
- gather and analyse the data
- report back on their findings.

The format in which the students feed their findings back is up to you. Perhaps they will write a report, offer a presentation, make a poster or just participate in a discussion in class.

Knowledge questions from the TOK subject guide and the psychology subject guide

- Are observation and experimentation the only two ways in which human scientists produce knowledge? (The human sciences: methods and tools)
- To what extent are the methods used to gain knowledge in the human sciences 'scientific'? (The human sciences: methods and tools)

There are lots of different connections to the knowledge framework and the psychology subject guide. This supports the work your psychology colleagues are doing in group 3. Perhaps you might enlist their support?

- How does the use of numbers, statistics, graphs and other quantitative instruments affect the way knowledge in the human sciences is valued? (The human sciences: methods and tools)
- Does a researcher's choice of methodology affect the reliability or credibility of research? (Psychology subject guide)
- Are the methods of the natural sciences applicable in the social sciences? (Psychology subject guide)

Relevant course concepts

Evidence, interpretation, objectivity.

Prior learning

Students should have already developed an understanding of the scope of the human sciences and possibly the roles of qualitative and quantitative data in testing hypotheses. The lesson could be developed as a way for students to develop an understanding of the differences between these types of data.

Required resources

Access to the leaving IB TOK students.

Activities

If this activity has been run before, perhaps the students can critically evaluate the previous questionnaires?

1. Students research and discuss the difficulties in forming a questionnaire in the human sciences, including:
   a. the challenges of forming *good* questions
   b. the danger of leading or non-neutral questions
   c. the challenges of providing the right options for responses
2. The teacher explains that the school needs data on student attitudes towards their TOK experience. The idea is that this data will help teachers make decisions about how or whether to change the course in the future.
3. Depending on the number of students in both the TOK class and the number of student participants in IB2, divide the class into manageable groups. Different groups might have to give their questionnaire to different groups of participants in IB2.

Again, you might offer more guidance here to make sure that the questionnaires are useful.

4. Putting what they have learned about qualitative, quantitative data and the challenges of developing questionnaires, students then discuss and choose what their questionnaire is meant to achieve, the questions they will ask to achieve this, and the logistics of how the participants will take the questionnaire.
5. Students then develop the questionnaire and manage the process of getting the participants to take it. (This might be online, on paper, during lessons or after school.)
6. Students then collect and analyse the data and report back to the teacher.
   a. What do the data show in relation to the information being sought?
   b. Do the data show any trends?
7. Students should reflect on the process:
   a. What were the challenges they faced in terms of asking appropriate and well-formulated questions?
   b. What challenges did they find in terms of what responses were available to the participants?
   c. How did they overcome these challenges?
   d. How useful do they think the data are? Are the sample sizes large enough to identify trends? What other explanations might there be for the data that the questionnaire does not account for?

Here too you might organize some activity in conjunction with the psychology teachers so they can support the TOK teaching and so that their psychology students develop a better understanding of their curriculum as well.

e What decisions do they think the data collected would be helpful for? Do they think there are clear 'action points' needed, based on the data?

Follow up

Students write up an evaluation of what they think they might do differently having now produced one questionnaire.

Students find a real questionnaire that they may have taken or been asked to take. They offer a critical evaluation of it, using what they have learned about the use of questionnaires in the human sciences.

Ethics

The ethics section of the human sciences chapter explores two main issues: first, the concept of *value* being embedded in the basic paradigms in economics (expressed by 'positive statements') and second, the ethically worrisome processes used in some psychological studies to develop knowledge.

In the economics section, the notion of *value* is used broadly to indicate general assumptions about what *should* be sought in a 'healthy economy'. The two TED talks by Dan O'Neill and Kate Raworth linked to in the activity on student book page 361 are helpful ways of challenging the basic assumption that *growth* is the only or best way to measure an economy. As we know from the world today, the constant drive towards more and more has led us to the brink of environmental disaster. The challenge, however, is that anything like an 'economics of *enough*' requires an acceptance that our own individual needs are not the *only* needs worth fighting for. This idea about whether or not we can genuinely be motivated by others' needs is discussed shortly in the analysis of ethical egoism and psychological egoism.

The second issue discussed will likely be a popular one for students to engage with. The history of psychology is littered with uncomfortable and sometimes horrific experiments that would never be allowed today. Some of these are identified in the student book in an activity asking students to research them and develop an analysis of the ethical issues presented. Two specific examples are discussed in the book: the conditioning experiments with 'Little Albert' from the 1920s and a disconcertingly recent example from one of the most prestigious universities in America, the UCLA Schizophrenia study from the 1980s.

ACTIVITY

This activity could be effective in providing some context for the questionable experiments research activity on page 364 of the student book.

Have students look at the ethical guidelines for psychological experiments conducted as part of the IB Diploma Psychology internal assessment. Ask them the following questions:

1 Why do you think they are present?
2 What ethical principles or knowledge are at the root of these guidelines?
3 Do you think the limits imposed by these guidelines are *fair*?
4 Will they make it more difficult to construct important psychological knowledge?

KNOWLEDGE QUESTIONS

Relevant knowledge questions from the TOK subject guide:

- What are the moral implications of possessing knowledge about human behaviour?
- Can other people know us better than we know ourselves?
- If two competing paradigms give different explanations of a phenomenon, how can we decide which explanation to accept?

SAMPLE RESPONSE TO KNOWLEDGE QUESTIONS

These questions explore the relationship between theories about human behaviour and ethical theories. How do the two depend on one another and how do they impact one another? Here we explore how one theory about human behaviour, psychological egoism, has direct consequences on ethical theory. We further explore whether we should prioritize our own personal experience or our own knowledge of ourselves if this conflicts with theories offered by the human sciences.

One popular ethical theory is called 'consequentialism' and is built on the principle that the rightness or wrongness of an action is dependent on some analysis of the consequences of that action. Utilitarianism is the main example of consequentialism. Utilitarianism suggests that the rightness or wrongness of an action is dependent on the overall happiness or suffering caused by the action. The goal is to maximize happiness for all those concerned and minimize suffering for all those concerned.

Here we will introduce another form of consequentialism, but a form that is aimed only at measuring the happiness and suffering for the agent alone – no one else's happiness or suffering matters.

This position is called ethical egoism and states that the rightness or wrongness of an action depends solely on whether it meets the needs or preferences of the person committing the action. So, giving to a charitable organization, for example, is 'good' provided it results in an avoidance of guilt for the individual. Donating an organ might result in people thinking better of the person donating. Stopping to help someone change a tyre on a rainy highway might impress a partner. In each case, the goodness of the action depended entirely on some long- or short-term benefit to the agent and the agent alone.

Students are inordinately attracted to this idea, but they often only get to this idea through another theory called psychological egoism, which is the claim that we cannot be motivated by anything other than our own needs or desires. If psychological egoism is true, then ethical egoism has to be true, since other theories like utilitarianism say that we might be motivated by others' needs, which is precisely what psychological egoism says is not possible. In addition, it would not be meaningful to claim that it is 'right' to promote others' needs over our own if this were a psychological impossibility. Psychological egoism is not the claim that we just happen to be motivated by our own needs, but instead is the stronger claim that anything which we consider a 'motive' has to be aimed at meeting our own needs. The concept 'motive' is inherently tied to 'meeting our own desires'. Many students will argue that we show love to others in order to promote our own wellbeing, or that we support others in their attempts to achieve their goals because this promotes connections which will ultimately benefit us, or that we scratch someone's back only because we want our own scratched. This is a psychological claim, a claim about the relationship between human beliefs and human behaviour, one for which there is some evidence. However, as we considered in the discussion about the evidence for ethical relativism, we must ask what claim does that evidence actually support? We do not deny that there are many people who are deeply selfish in this way; it is an empirical fact that there are many of them. But the claim of psychological egoism is stronger than simply 'some people are only motivated by their own desires'. The claim is that we cannot be motivated by anything other than our own desires.

Is there evidence to suggest this psychological claim is false? Of course there is. Anytime we have been driven to action in order to help others counts as counterevidence to the psychological egoist's position. Suppose, for example, a friend leaves for school early but one day calls us asking us to bring in a folder they forgot, and we do. We see a stranger looking lost on a street corner and we take the time to give them directions. A friend's house has been flooded and we take the time to help them clean up. We see that the residents at the retirement home are lonely and so we spend some time with them every week to talk to them.

Each of these cases is possible evidence for the claim that the need of others might be what motivates us to act, and so is a direct counterexample to the psychological egoist's claim. In each case we found that someone had a need and that need motivated us to act. How might a psychological egoist respond? It is likely that they would say that there was a good result for us in each of the cases and that this is why we did it – our motive. For example, we were able to maintain a good relationship with friends, which might help us later. We were able to avoid feeling guilty by ignoring the lost stranger. We knew that helping the elderly would look good on a college application or that it would allow us to have a better self-image or that others will think well of us knowing that we do this every week. The psychological egoist, in other words, will show that there are consequences to the action which benefit us and that it is those consequences that drive our behaviour.

Look what has been done here, however. Each time we offer a counter-example, the psychological egoist has reinterpreted the situation, found something that might benefit us (even if we were unaware of those benefits) and then reapplied the theory, saying it was those benefits that really were the motivations. In other words, they have tried to convince us that our own experience of motivation is an illusion, and that the theory explains better what is really happening. Other people's admittedly self-directed behaviour is being used to show that our behaviour is similarly self-directed.

This means that so long as the psychological egoist can conjure up some benefit to the action, then nothing we say about what we think really motivated us will ever count. The theory, in other words, is being offered as more convincing than our own experience.

The problem, of course, is that theories are meant to explain evidence, not ignore it or explain it away. In this case we might ask, whose word should count when it comes to our own motives? It seems that if we reflect on our motives, and if we understand how sometimes we have motives unknown to us, and we still consider the explanation of our action as being motivated by the need of others, then we should be the one listened to, not some questionable theory which says we cannot be right. What has happened is that the psychological egoist has ignored the distinction between consequences and motives which suggests that we might know full well that there are beneficial consequences for helping a friend clean their house or for helping keep the elderly from feeling lonely, but it is logically possible that those consequences are not *why* we performed the action. We are motivated by the need of others, not by the predicted benefits to us of that action. A theory which denies this possibility and tells us that every altruistic motive we have is an illusion, flies in the face of our own personal experience of our own inner motives. So, we cannot accept that theory. If our supposed 'knowledge' of human behaviour means we cannot help be selfish in every action we make, then we will most likely deny the theory, especially when we have hordes of examples to the contrary.

KNOWLEDGE QUESTIONS

Relevant knowledge questions from the TOK subject guide:

- How might the beliefs and interests of human scientists influence their conclusions?
- Can knowledge be divorced from the values embedded in the process of creating it?
- Are there types of knowledge that are specifically linked to particular communities of knowers?

Accepting that psychological egoism might be false opens the door to the possibility of ethical egoism also being false. What reasons do we have to think that the only 'right' actions are those that meet our own self-interest?

Some will argue that everyone seeking their own benefit will ultimately result in everyone's happiness being raised, but it must be remembered that this is not the intent of the theory. That other people might benefit from our actions or not is not a reason for any individual to accept the theory since this supposed benefit is neither here nor there. For the ethical egoist, an action which benefits only us and another action which benefits us and others are on equal moral footing. The benefits to others is not even on the map of the ethical egoist: benefits to others is not considered a 'good' – they are merely neutral consequences.

The power inequalities built into the system, however, suggest that this won't be possible anyway. The theory may help those who already have the social power to make their own desires come true and feel good about their actions. But for those who are unable to seek out their own desires to any real extent, a theory which says that we should only aim at our own desires being met is empty. Imagine telling those who barely exist above the poverty line, who have no access to employment or who are routinely discriminated against in society, they should do 'good' by enacting their own desires. This would be an empty suggestion.

This leads to a second problem with ethical egoism, namely the argument that it is somehow a 'fairer' system. It is fairer to allow people (not 'give' people) the freedom to aim for their own desires. This sounds reasonable, but really only from the perspective of equal participants in a society with goods for everyone. In a world which has inequality built into the social fabric, telling others that this is 'fair' or that they should also take it upon themselves to meet their own desires might be only another form of maintaining the status quo. The suggestion is that denying our own needs for 'the greater good' is somehow a sign of weakness on the part of the individual or a sign of an overpowered social collective bent on denying the priority of the individual. This claim depends entirely on the society being fair in the first place – many in our society cannot muster the social power to enact their own desires, and if ethical egoism is correct, then this is precisely the situation that would be desired by the power elite. It is better for those who can enact their own desires to believe that doing so is also ethically 'right'. Inequalities will always benefit the socially powerful whose needs get met daily, and any systemic unfairness will always result in their own needs being better served, so they have no ethical obligation to change their behaviour. This may make it difficult for economists like Dan O'Neill and Kate Raworth to make their case that 'growth' is not an appropriate economic model in our modern world.

Conclusion

A careful study of the human sciences provides a rich arena in which to develop intriguing comparisons. This will help the students come to terms with some key concepts in TOK, especially method, perspective, paradigm and historical development. Another important learning objective that a study of the human sciences helps with is effective comparison. The human sciences do not really stand alone in the same way as other disciplines, or at least they stand less distinctly than others. They are trying to be scientific, but because of their objects of study (humans) this presents certain challenges. Articulating just what those challenges are will be an inherently comparative exercise. Helping students develop these comparative skills in their analysis of the human sciences will reap benefits throughout the course.

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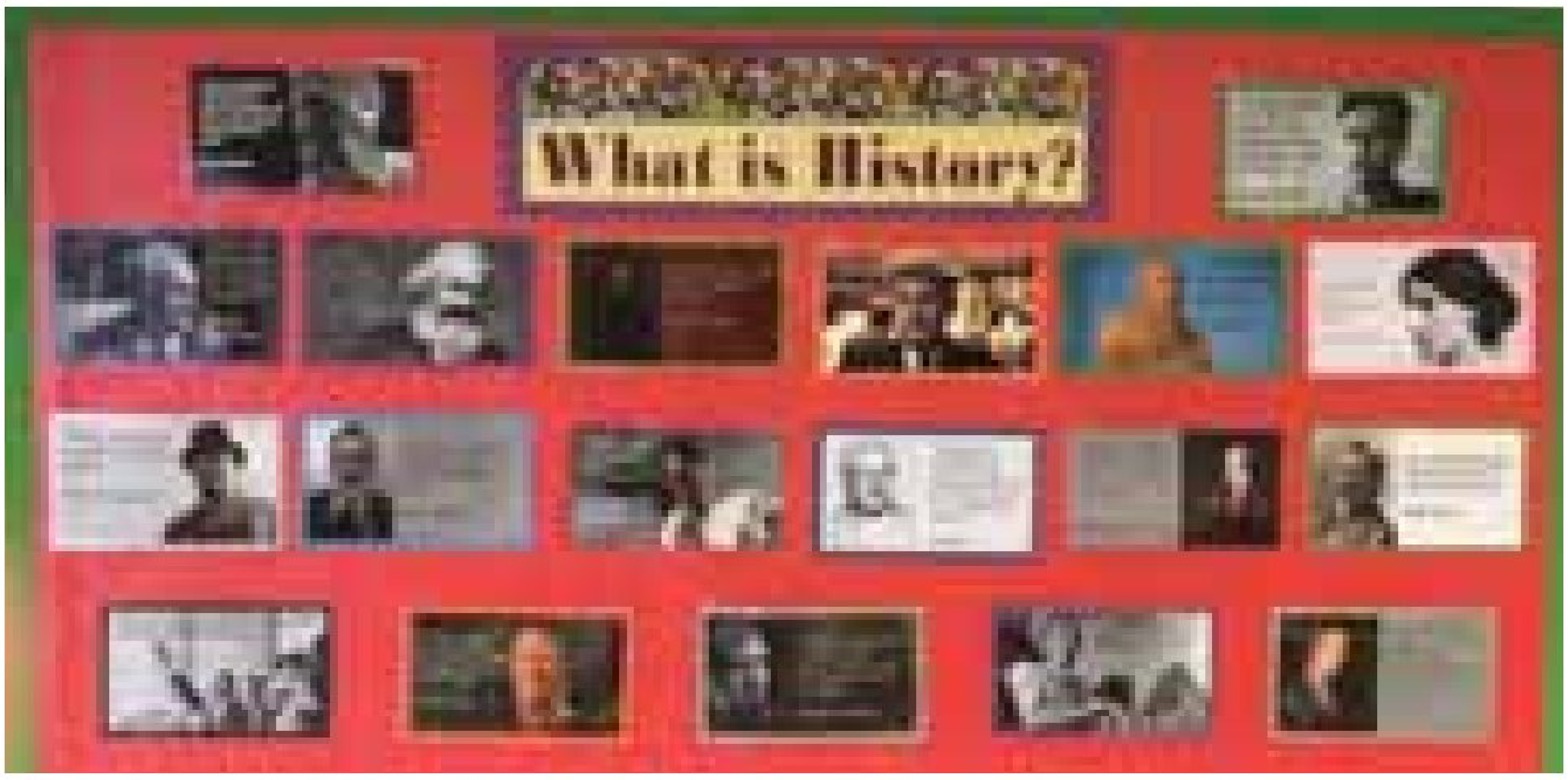


- 'For most of history "anonymous" was a woman.'
- 'The very ink with which all history is written is merely fluid prejudice.'
- 'History is a set of lies, agreed upon.'
- 'History, despite its wrenching pain, cannot be unlived, but if faced with courage, need not be lived again.'
- 'To remain ignorant of things that happened before you were born is to remain a child.'
- 'We are not makers of history. We are made by history.'
- 'Study the past if you would define the future.'

The sentiments captured in the quotations are excellent starting points for any number of discussions about the scope, perspectives, methods or ethical implications of the historian's work. In this case, the teacher tentatively offered this as something that might be used as a prompt to encourage TOK discussions, without realizing that these quotations are a perfect way into thinking of history as an AOK. That the historians have so much to say about the nature of their own subject, underscores the usefulness of thinking of history as a good way into Theory of Knowledge.

The IB history subject guide offers a number of TOK-related questions to help you get started thinking about history as an AOK (IB History guide, page 8):

- What is the role of the historian?
- What methods do historians use to gain knowledge?
- Is it possible to describe historical events in an unbiased way?
- Do we learn from history?
- What is the difference between bias and selection?
- Who decides which events are historically significant?
- To what extent does studying history help us to better understand ourselves in the present?
- What is the role of individuals in history?
- How does the context within which historians live affect historical knowledge?

These are all good knowledge questions which should serve as opportunities to develop good TOK analyses. In the student book, we explore a number of these issues, including the methods used by historians, the difference between bias and selection, and how the context in which historians live might affect their historical knowledge.

In the student's book introduction to the history chapter we have included four activities designed as opportunities for the students to begin to break down some key ideas in the TOK approach to history as an AOK. Having 'broken ground' with these activities, students will be able to then refer to them throughout the chapter and your teaching. The 'China Profile: Timeline' activity later in this chapter explores some of these topics and themes.

The first activity (student book page 369) presents students with two different accounts of the Wounded Knee massacre. Both an exercise in careful reading and also a way to introduce the key dilemma faced by an historian, these texts (the second developed by the authors) are contrasting enough for the students to pick out differences in them. The question about whether one offers a better explanation than another will naturally lead to the final question about the implications of this for the nature of the historian's job.

However, you should also encourage students to identify the similarities. They are both recognizably 'history' in the sense that they follow the 'historical method', both making decisions about what facts to include, both making decisions about what background knowledge is used or is needed.

The next two activities (pages 369 and 370 of the student' book) ask students to think about what they did a week ago last Saturday and about the most important day in their lives. Memory, choice, selection and evidence are highlighted in these two activities (memory being one of the 'ways of knowing', a central category in the previous iterations of the TOK course but de-emphasized here). Students should be able to use this activity to experience the dilemma about how historians are limited by the available evidence, even though they know that much more occurred than they are able to find evidence for. Later in the chapter, students are encouraged to discuss selection, and this will be a good place to plant that seed: what did you select and how does your selection of your own history show what you value?

This chapter as a whole encourages students to drive a wedge through the notion that history is an objective science, and to uncover the interpretive stance that all historians take, both in a harmless sense of simply having to connect the evidence, creating relationships where all we have are 'what's left in the sieve' and also in the sense that they interpret the evidence in making those connections. We can encourage the students to think about history as taking the form of narrative, a specific literary form which encompasses concepts like story, conflict, character or theme, but which yet still requires a loyal adherence to evidence.

Scope

Thinking about the 'scope' of any of the AOKs invites analysis of what makes that AOK unique among the others, its 'nature'. In history's case a fruitful way of unpacking this is to start with similarities with the natural sciences and with the 'scientific method' in particular, but then diverge into an exploration of where history cannot meet all the aims of that method.

Key to understanding how we should be treating history as an AOK is to think of it as what professional historians do. Many students, when prompted with, 'What do you think history is?' will default to an initial position that 'history is what happened in the past'. In the student book we make a lot of distinction between the events that happened in the past and writing about or interpreting what happened. The latter, of course, is the work of the expert historian, and would include searching for and analysing primary sources and artefacts, being familiar with relevant secondary research on the topic and maintaining a rigorous, self-aware and thorough interpretive process through which they arrive at their historical conclusions. Taken together, we would consider this 'the historical method'.

KNOWLEDGE QUESTIONS

Relevant knowledge questions from the TOK subject guide:

- Is it possible to have knowledge of the past?
- Is truth the goal of historical inquiry?
- What counts as fact in history?

Of course, there are any number of issues related to the scope of history, but there are a number of traditional ones, some of which are explicitly dealt with in the student book. As mentioned before, the most fruitful way to explore the scope of any AOK is to consider it in comparison with other AOKs.

In more general terms, when thinking about what sorts of issues you are likely to come across or what sorts of concepts are helpful when unpacking the 'scope' of history, you will want to keep these ideas in mind. Please don't consider these either exhaustive or even incontestable. If you or a student were to develop a critique saying 'this is not my understanding of what history is!' then you would be on the right track, since it is the discussion, not necessarily the conclusion, which is important here.

History is about cause-and-effect relationships between events in the past

Arguably, the most important of the knowledge questions above is the first: Can we have knowledge of the past? The challenge of course is that the 'object' being investigated (events in the past) have in a sense disappeared – we have no direct access to them. Many of the other knowledge questions in relation to history are consequences of this dilemma.

ACTIVITY

You might consider the various knowledge questions posed above and see if you can develop a conceptual link between the fact that history explores events that no longer are present, with the tension or dilemma highlighted by the quotations which we began this chapter with on pages 241–2.

For instance, how do we get from the fact history is about past events, to the point that 'obliterating' someone's understanding of their own history, is an effective way to destroy people? What does this journey tell us about the nature of history?

History is about past events …

→ … therefore we are not able to observe *what happened*

→ … therefore we are left only with indirect evidence for historical claims

→ … meaning we must interpret evidence *in the present* with our background beliefs about the present …

→ … which results in *seeing ourselves* reflected in our interpretations of the past …

→ … which might provide *meaning* and identity for people in the present …

→ … so by removing access to our history, the powerful might control how we construct meaning or identity in the present, so …

→ … obliterating a person's (or a people's) history is to destroy the person (or the people).

In terms of the object of historians, one simple formulation is that they study cause-and-effect relationships of past events. They do not simply develop a list of events ordered chronologically. We can understand why this list is not history by considering what is implied by such a chronological list. Looking at the China Profile timeline on the BBC's website (see activity on page 248), will show that there is an implied narrative even in a simple 'list of events', and uncovers some of the essential elements of a history, including cause-and-effect relationships, creating significance, developing a narrative.

Like the sciences, experts in history are expected to justify their accounts through direct links to evidence. They must also show significant amounts of self-awareness to avoid personal bias or subjectivity to impact the rigour of the process. However, historians cannot use observations of the events themselves to ground their interpretations because the events do not exist anymore. This means that what they do observe are not the events themselves, but echoes or footprints of events lost to time.

These are methodological concerns and can be discussed under the methods and tools aspect of the knowledge framework. But these differences in method stem from a deeper difference in the nature of the subject which we can explore under the heading 'scope'. Other methodological consequences of the nature of history have to do with the impossibility of repeatability of historical events, meaning that a major tool for establishing credible claims in the sciences is not available to historians.

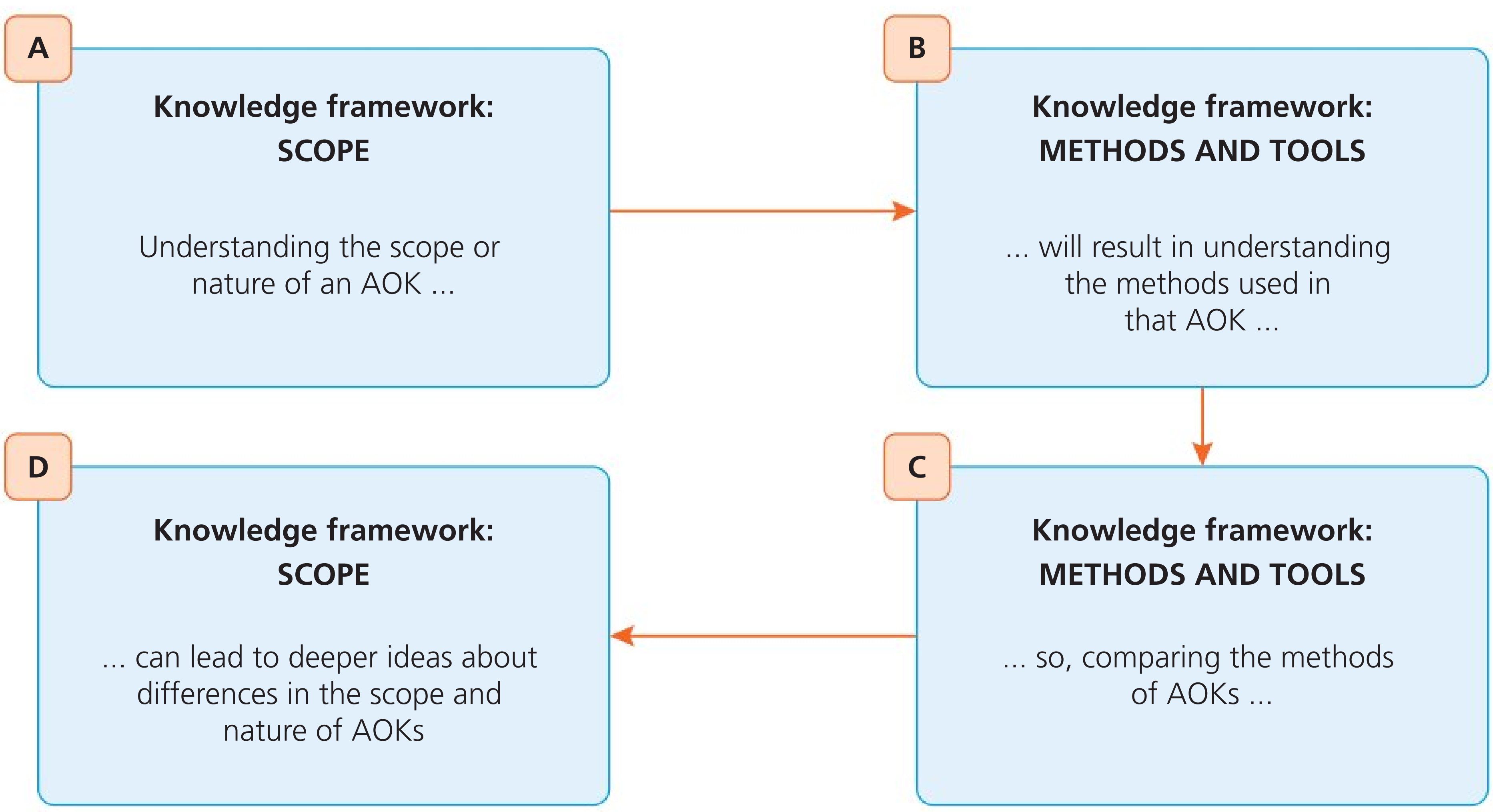
TEACHING TIP

Developing comparative links between the AOKs and between the elements of the knowledge framework is always a good idea. It will help with the essay questions in particular.

Always be on the lookout for opportunities to develop comparisons between AOKs. Comparisons at the level of the elements of the knowledge framework is a good way of promoting them. Here are two examples of such questions:

- In what ways do these differences in the methods used by these AOKs point to differences in their scope?
- Do the concepts and terms used in the methods of this AOK have the same meaning in this other AOK, and what is the significance of this?

One basic principle which we can use to identify connections is that in nearly all cases, differences in the methods of an AOK can be thought of as consequences of some difference in the nature of the AOK. This is something we explored in the introduction to this book (pages 11–12).



History provides a good example. We might be exploring the famous aphorism by George Santayana, that 'those who cannot remember the past are condemned to repeat it' (Flamm), by questioning the role that history plays in understanding current circumstances, pointing out that applying history to current events is always, at best, an interpretation of historical knowledge. Historical events are one-off events, so historical knowledge of them is limited to knowledge of only those events. For example, the troubles encountered by the US military in Afghanistan since 2000, are like (but never the same as) the Soviet Union's troubles there in the 1980s. Perhaps learning about one will help uncover new ideas about the other, but they are distinct events.

One consequence of this is that historians cannot test their conclusions by using them to predict future events. Nothing that has happened in the US war in Afghanistan can be used as direct evidence that an historical claim about the Soviet Union's war in Afghanistan is more or less reliable; they are different events. They may seem similar, but they are not the same event.

So now say we are comparing the differences between the historian's use of prediction (at best as an analogy) and the scientist's use (prediction as a way of testing a hypothesis in the context of an experiment). Natural scientists can use this to test hypotheses, because the events they are studying are impersonal, objective forces and features of the physical world, meaning the testing of some physical law in one case, would be to test the same physical law in another.

This might lead to a new awareness of the historian's dilemma, which is that their AOK is an attempt to 'make sense' of events which are not governed by the impersonal forces of nature, but rather are governed only through the personal, sometimes irrational, sometimes unknowable choices and decisions of people in the past. So, we have developed our understanding of the nature of history, from starting with recognizing that historians study one-off events in the past, through its method, and back to understanding further that historians are expected to make sense of past individuals' beliefs and motives and desires.

History is about the 'inside' of events

Collingwood's distinction between the 'outside' (described without reference to human thought) and the 'inside' (the human thoughts which 'explain' the outside) is discussed in the student book (pages 374–8) and is a helpful way of focusing the understanding of history on human agency. This distinction is also a helpful way of distinguishing the study of history from the study of the natural sciences (which only look at the 'outside' of events) and literature, which does not have the same sort of relation to evidence that the sciences do. Use the first QR code in the margin to access an extract of Collingwood's writing plus some related discussion questions. There is also a version with some teaching notes added, which can be accessed via the second QR code shown on the left.

History is a form of narrative

This is a point about the general form that history might take. Both Collingwood and Dewey (as discussed in the student book, page 381) highlight the narrative nature of the product of the historian. Narrative here is not meant to be synonymous with other concepts like story or a novel, but there are important overlaps. Historians do 'tell a story' in that they are focused on particular questions and will therefore focus on particular facts and evidence, and they necessarily have to link those facts together. Collingwood suggests that this is a creative process, but one with constraints.

History does not describe laws

The historical development of history (that is, the development of the field over time) would include the view held by some historians (particularly Marxist historians) that both nature and societies are governed by 'laws' and that part of the historian's job is to discover and articulate those laws. A law in this sense is a sort of observable pattern which can be used to predict future events. In the sciences, the assumption is that there are regularities in the natural world which are so regular that there is likely an explanation which would include reference to natural forces at work in the world. Appealing to these forces provides the natural sciences with a very strong predictive element to their laws (see the chapter on the human sciences for a discussion on laws and theories in the sciences).

Some historians have suggested that there are forces at work in the historical development of societies as well, but it is hard to see how these 'historical laws' have anything like the predictive power of 'scientific laws'. We discuss in the chapter on the human sciences the challenge of finding and articulating these laws in the present, but it is even more challenging to see these 'laws' in history. At best, we might identify patterns, but this identification will have more to do with an interpretation of events rather than an observation of some genuinely objective pattern.

The 'Deeper thinking: Historical "facts"' box in the Scope section of the student book (pages 372–3) provides a discussion about the suggested distinction between events and history. You can see the different sorts of questions and claims in the table below. Students should be able to point out some of the differences in approach – the historical questions (and the claims that would result) are interpretive and therefore debatable, in a way that the 'facts' presented on the left would not be. Evaluative concepts like 'impact' or 'effective' or 'significant' are concepts about the relationships between facts (often cause-and-effect relationships), which (on this view) are standalone features of the world. One could argue, for instance, that 1965 was not the date of Singapore independence, but there is a fact of the matter, even if no historian ever claims it properly.

Table 11.1 Distinction between facts used in historical analyses and genuine 'historical questions'

'Facts' (purported)	Genuine 'historical questions'
Singapore became an independent republic in 1965.	How did British colonialism impact the role Singapore played when it was a state in the Malaysian federation from 1963 to 1965?
The Japanese army laid siege to Allied forces in Kohima in 1944.	To what extent did the events at Kohima contribute to the overall Allied victory over Japan?
Montezuma II was an Aztec ruler in the sixteenth century.	In what ways did Spanish conquistador Hernán Cortés use local mythology to effectively weaken the Aztec position in Mexico?
In the UK, women were given the same right to vote as men in 1928.	What actions by Emmeline Pankhurst and her daughters were the most significant in the women's suffrage movement?

■ RESOURCE

Historian Edward Hallet Carr, writing in 1961, suggests something similar, in the first chapter of his book *What is History?* This is an excellent and accessible resource to explore the nature of 'historical facts'. In a way similar to Collingwood and Dewey, he suggests that there is a difference between what happened (which has been lost to time) and 'historical fact' (that which the historian claims to have happened). Here he is suggesting that the 'basic facts' of what happened in the past are crucial, but are not genuine 'historical facts'. Getting this right is essential to the job of the historian, but it would be like praising an architect for the quality of the wood in their building. 'It used to be said that facts speak for themselves. This is, of course, untrue. The facts speak only when the historian calls on them: it is he who decides to which facts to give the floor, and in what order or context' (Carr 11). In other words, the 'basic facts' become history when the historian selects them, categorizes them and uses them in an historical narrative, linking them to other facts and discussing their importance in some larger context, something individual facts cannot do on their own. He says facts are, 'like fish swimming about in a vast and sometimes inaccessible ocean; and what the historian catches will depend, partly on chance, but mainly on what part of the ocean he chooses to fish in and what tackle he chooses to use – these two factors being, of course, determined by the kind of fish he wants to catch. By and large, the historian will get the kind of facts he wants' (23).

A helpful analysis of Carr's chapter can be accessed using the first QR code in the margin.

ACTIVITY

1. Ask students to consider the BBC's 'China Profile – Timeline', which purports to be a 'chronology of key events'. This can be accessed using the second QR code in the margin.
2. Ask them how this list helps us understand the nature of history or understand that history is *not* just a list of events.

Students might discuss the fact that the timeline suggests that the only events being included are the 'key' events. This highlights the fact that there is a very strong element of choice at work here. Not *every* event is included, and not even every important event, only the 'key' events are included. This underscores the fact that historians have quite a lot of *choices* to make when selecting the question they want to ask, and which evidence they are planning on using in the answer to this question. The student book explores the role of selection throughout the chapter, but particularly in relation to John Dewey (pages 383–4) in the Methods and tools section.

Other things to note in the timeline:

- Dates show varying amounts of specificity, implying that these dates signify important transitions.
- The dates in the twentieth century and beyond are *very* specific, implying that the evidence for events during those times is available so more can be *evidenced*, and therefore more can be said about those times.
- The impact of outside influences is described, implying a generally global outlook. Could a 'history' of China have been told without reference to 'the west'? That Marco Polo is included suggests that historians might be drawing on the interests of their readers, tailoring their chronology to concepts brought to the table by the readers. The 'build-up' of the Chinese military is cited as a concern, but a concern for 'whom'?
- Cause-and-effect relationships are developed in juxtaposing events. Mao Zedong's rise to power is an implied cause of Japan's defeat.
- There are other seemingly irrelevant facts to the timeline (that severe snowstorms affected up to 100 million people in 2008). What is the implied significance of this? That it seems 'disconnected' to the narrative might highlight the general narrative structure of the timeline.

TOK TRAP

This activity requires students to speculate what the motives of the BBC writers were when compiling this list. They will have to make some claims about why the authors made the choices and interpretations they did. But the point here is not what the authors were actually thinking, but what is included in the timeline. For instance, when the timeline begins with a point about how the Shang Dynasty 'unites much of north central China', it shows that the list had to begin somewhere and in this case began with a 'political unification', suggesting a theme that is then developed throughout the rest of the chronology. While this might be a harmless theme to develop, it illustrates that using themes to evaluate events is not just listing events. You might push students away from the claim that 'the authors thought this was important' (which is not known, and is speculative) and towards 'the timeline starts with a unification – how does this starting point influence your thinking?' This removes the need to speculate and instead focuses on the timeline itself and its impact on the students' thinking.

CONNECTION TO: THE CORE THEME

Another recurring theme in TOK discussions of history is the extent to which our histories, or at least the ones we identify most closely with, serve as a way of providing individuals or a culture with a vision of themselves. We touched on this earlier when linking the knowledge questions from the TOK subject guide to the nature of history.

The student book discusses this in the ethics section of the history chapter. The idea here is twofold. First, when we interpret history, we bring with us all the background beliefs, values, and judgments that we have presently and apply them to the past. This might be a conscious decision or not. Perhaps you are interested in current debates about the role of women in our society: you might then use that interest to see how that role has developed through history. It might, however, be unconscious and lead to a judgment of past historical agents which is not argued or justified. Secondly (in the other direction), how we understand 'our' history might provide us with a view of how we should understand the present or a framework through which to understand ourselves. Many students are deeply invested in the current discussion with 'identity' and this would be an excellent opportunity to explore the historical framework in which they place that identity. The activity on page 398 of the student book asks students to consider the choices that have been made in their own history curriculum. This activity is meant to drive a discussion about the role of history as a way of achieving a consensus of understanding, in order to develop a consensus of values.

Simon Schama's quotation towards the end of that section is meant to highlight the power that history can wield against this consensus, even though it was perhaps the study of history that helped form it:

> History is not about self-congratulation. It's not really about chasing the pedigree of the wonderfulness of us. … Nor is it about chasing the pedigree of the reprehensible awful nature of us. … History is meant to keep the powerful awake at night and keep them honest.
>
> **(Furness)**

Perspectives

Under perspectives, the TOK subject guide provides a variety of knowledge questions which bring together a number of the key issues and tensions involved with a discussion of history as an area of knowledge.

KNOWLEDGE QUESTIONS

Relevant knowledge questions from the TOK subject guide:

- If it is difficult to establish proof in history, does that mean that all versions are equally acceptable?
- Are historians' accounts necessarily subjective?
- Is empathy more important in history than in other AOKs?
- How might the existence of different historical perspectives be beneficial to historical knowledge?
- Can the historian be free of bias in the selection and interpretation of material?
- Is it inevitable that historians will be affected by their own cultural context?
- How can we gauge the extent to which history is being told from a cultural or national perspective?
- Are we more prone to particular cognitive biases (such as hindsight bias) in some disciplines and AOKs rather than others?

Scratch the surface of any of these knowledge questions and you will find a significant tension being explored here between the 'truth' of an historical account and the role of the historian as an individual. Whereas in the natural sciences differing accounts can generally be 'decided' upon through appeal to objective observations of the world, historians don't have this strategy at their disposal. Indian historian Ramachandran Guha addresses this in the quotation opening the 'perspectives' section in the student book, and we have addressed this notion of perspective by encouraging students to reflect on their own status as 'knowledge holders' and the extent to which that knowledge will impact their ability to develop a reliable historical narrative. The discussion of 'revisionism' brings out the fact that different histories written by different individuals are bound to be different, but that this is not necessarily bad. At no point do individuals simply get to write whatever they wish – there are important rules and constraints in the historical method to prevent this. On the other hand, given the nature of the subject there is a lot more freedom involved to bring those individual perspectives to bear. All of this should bring to mind the discussion above about the nature of the subject and the consequences of that for the individual historian.

SAMPLE RESPONSE TO A KNOWLEDGE QUESTION

Are historians' accounts necessarily subjective?

The tension involved in the question has to do with the person of the historian. The nature of history is such that the individual historian who is attempting to develop a narrative linking the available evidence is subject to all sorts of influences, many of them non-conscious. This tension does not arise as obviously in the sciences, largely because the natural sciences study objects and natural forces, rather than human beings. Any subjective elements relevant to the human being doing the science (biases, prejudices, non-conscious or otherwise) can be dragged into the light through appeal to further observational evidence.

In history, however, no such further experiments are available, so these subjective elements are harder to root out. Therefore, subjectivity remains a concern, but what does this 'subjectivity' amount to in this context? Historians are, themselves, influenced by any number of things which impact how they see the world. They will have an education, gender, race, come from a particular social class and bring their own values and outlooks to everything they do. This will undoubtedly influence their interpretation of the facts and open them up to the charge of 'subjectivity'.

There is another sense as well to the notion of subjectivity in history, one which we can use to make sense of the 'necessary' element of the question, namely, the historical conclusions being articulated are not themselves seen in the evidence, they are interpretations of the evidence. They are not objects being uncovered, they are the views and beliefs of the historian. So, in this sense they are 'necessarily' subjective.

However, the important question is how do historians manage these 'subjective' elements? We might answer 'yes' or 'no' to the knowledge question as stated, but the best responses to it will explore the significance of that response. No historian will accept an 'anything goes' type of response, so no historian will ever commit themselves to the claim that because history definitely has these subjective elements, there cannot be any sense in which there are at least better or worse historical claims. Guha in his quotation in the student book is suggesting that it is worse to allow your own inherent 'chauvinism of identity' to impact your work. It is precisely the job of the historian to remain self-aware to these perspectives and challenge them and to challenge them in others.

This then underscores the importance of 'the historical method' – a broad set of practices and values which are designed to help mitigate the impact of our own subjectivity and perspective.

Note: This exploration of the knowledge question is, as always, only one way in which the question might be explored. This response did not, for example, explore the various 'schools of thought' in history, but these could have been entirely appropriate. Someone using different examples would approach the question in a different way. The nature of a knowledge question is that it is open-ended, and so there is not a 'right' answer: there are just well-supported responses or badly supported responses.

CONNECTION TO: THE CORE THEME

The inclusion of 'Knowledge and the Knower' has provided the TOK student an excellent opportunity to unpack their own views and experiences and to reflect on how these impact their understanding of their world. History, in our view, is an incredibly fertile ground in which to do this. As indicated in the student book, there are a lot of political issues involved in historical knowledge, in terms of its construction, how that constructed knowledge is disseminated to those who don't know it and how it is then used to provide a subsequent framework to understand ourselves. Sheila Rowbotham and Reni Eddo-Lodge were offered as two examples of the role of history in providing a framework to understand our own identity. (Of course, these two authors don't only provide that framework for women or black people in the UK; they provide a framework for men and white people to understand themselves as well.)

'Identity politics' is a hot topic in social debates at the moment, and this discussion of how we use history to promote social awareness ('wokeness') change in the present could be a powerful tool for our students.

More broadly, the ways in which our history curricula are used to shape our understanding of ourselves, is a powerful way to explore history and ourselves as knowers. It is inherently controversial, however, so teachers must carefully consider the sensitivities of the students, individual and local school policy and the local and international political climate before delving too deeply into these issues.

A simple internet search will provide many different resources to use when discussing this issue with students. Four examples are linked to by the QR codes shown on the left.

Methods and tools

The methods of the historian sit at the centre of the TOK web for history: it is possible that all roads run through a discussion of the historical method, including those that look at the similarities to the methods used in other AOKs and those that look at the differences.

KNOWLEDGE QUESTIONS

Relevant knowledge questions from the TOK subject guide:

- What methods do historians use to gain knowledge?
- What is unique about the methodology of history compared to other AOKs?
- On what criteria can a historian evaluate the reliability of their sources?
- Have technological developments enabled us to observe the past more directly?

These knowledge questions deal with what we might commonly refer to as 'the historical method'. Unlike the scientific method, however, we are reluctant to imply that there is anything like an established set of rules that define the historical method. Who would be in a position to establish that? Who would enforce it? Rather there are a series of related activities which tend to be used by professional historians and which are used as benchmarks to establish credibility and reliability in the community of historians. In the online document, Introduction to Teaching Ethical Theory, we discussed the opportunity this affords us to offer historical judgments against David Irving's Holocaust denial, as opposed to (or in addition to) any moral judgments of racism or anti-Semitism we wish to make. Irving violated the general conventions of the historical method and should be seen as an unreliable historian.

In the student book we have broken down the broad elements of the historical method into the following:

- Selection of a topic.
- Identifying relevant facts and ideas.
- Critically reflecting on sources.
- Synthesis.
- Presentation.

Again, this breakdown serves to highlight the general elements that are significant. Neither the 'scientific method' nor the 'historical method' are things in themselves, but are a collection of concepts and practices that mark out the centre of a bundle of methods used by experts in those fields. The categories presented in the student book are helpful headings which provide the opportunity to have a range of TOK discussions.

LESSON PLAN: THE ROLE OF SELECTION IN HISTORY – QUESTIONS, SELECTION AND FACTS IN JOHN DEWEY'S IDEA OF 'HISTORICAL NARRATIVE'

Introduction

Students tend to respond really well (responsibly, respectfully and charitably) to the personal nature of this lesson.

This lesson asks students to attempt to formulate an historical narrative based on a set of artefacts – photographs, newspaper clippings, etc. You will need to collect your own artefacts, and while this might be arduous, it is very rewarding. Any set of historical artefacts would be appropriate here, even if there was no intended connection between the artefacts themselves. Some connections are good because they give rise to questions that an historical narrative would seek to answer.

One of the authors of this book regularly does this activity with TOK classes using a series of quite personal old photographs and newspaper clippings from the early life of his father, a time about which he actually knows very little aside from the evidence collected in these images and clippings. Not knowing much about the subjects of the artefacts can prove beneficial, as it means you won't have a definitive answer regarding most of the questions that students raise like, 'Who's this?', 'Where's that?' or 'What's happening here?' This places you and the students squarely in the role of the 'objective' historian

– trying to develop explanations based only on what you can tie together using the evidence before you. At the same time, however, if you do have a personal relationship to the artefacts, you might have certain attitudes, feelings and desires which you bring to your interpretation of the data. This can be used to initiate discussions about bias as well.

However, the material does not have to be personal. Whatever the collection of material you find and use, you will be able to bring out different aspects of the notions of selection, bias and perspective.

Students should first read about John Dewey and his ideas about selection in the student book (pages 383–4). You can review the ideas while the students are sifting through the material, hands on – pushing pictures around the desk. They would also benefit from reading the first chapter of Carr's *What is History?*

One of the key points we wish to bring out here, generally through discussion, is that there is a difference between 'bias', which is a pejorative accusation, and 'selection', which is rather more neutral. This allows for finer distinctions when it comes to discussing historical interpretations and a way to avoid the 'all history is biased' claim, which strikes us as 'analysis by bludgeon'. Students should read the TOK trap on pages 385–6 of the student book that explains that not all historians are 'biased'.

Knowledge questions from the TOK subject guide

This activity presents opportunities to explore a range of knowledge questions. These could be used in follow-up writing assignments.

- What methods do historians use to gain knowledge?
- What counts as a fact in history?
- If it is difficult to establish proof in history, does that mean that all versions are equally acceptable?
- Are historians' accounts necessarily subjective?
- On what criteria could we decide whether people in the past have a right to privacy in the present?

Aims

Students will be able to:

- recognize, identify and evaluate the consequences of decisions historians make when selecting various pieces of evidence to use
- recognize the possible difference between bias (prejudice in interpretation – generally negative) and selection (making choices about how to interpret – possibly neutral, possibly unavoidable).

Objectives

Students will be able to:

- analyse various photographs
- choose which photos are relevant to different historical questions
- collect evidence in different ways, relevant to different questions
- explore the IB History and GCSE specification to identify various choices made.

Prior learning

- Students should have some understanding of 'the historical method'.
- They should be familiar with John Dewey's discussion of the role of selection in historical narratives as discussed on pages 383–4 of the student book.
- Students should have read the TOK trap on pages 385–6 of the student book that begins 'Not all historians are "biased"'.

Required resources

Of course, you don't have to use anything personal to you, but students appreciate seeing you in the role of historian. The personal connection drives home the point that history is important to individuals and communities.

A collection of photographs, newspaper clippings or other artefacts. Estate sales, street fairs, garage sales and flea markets might be good places to source these. Ideally the artefacts will have some connection between them.

You might do this while the students sort through material too, which creates quite an organic approach.

Just listen to their conversations while the students sift through the material. Even the shy students will be talking to their friends, giving you an opportunity to hear them and get them to contribute.

Let the students sift informally and naturally, getting stuck into the materials. Listen for opportunities to jump in and ask these questions. All this can be handled quite casually, giving the students a safe space to test out ideas.

Ask the students, 'If you had to group these artefacts into three piles, how would you do it? Are there different ways of breaking them up? Would you say that this is a form of interpretation?'

You could ask one student to choose two pieces of evidence. Then ask another to find another piece which could connect the two.

If a student shows specialist knowledge, point this out. Ask, 'What background knowledge have you brought to your understanding of that artefact?'

Activities

(Teacher prompts/answers are shown in italics.)

1 Briefly summarize or review the ideas of John Dewey to set up the lesson.

2 The ideas of Dewey can be brought out in real time by using the photographs. Show students the artefacts and have them sift through and begin identifying connections and categories. Students enjoy the sifting around; they immediately get curious and start asking questions. These are the 'problems' which Dewey claims is the beginning of the process of 'historical reconstruction'.

Below are some guiding questions to ask while the students are sifting artefacts around.

a What questions arise in your own mind about these pictures?

These could be the origins of the questions historians will seek to answer. Dewey argues that an historian is always trying to answer a present question in the historian's mind by looking to the past and constructing a narrative linking the past to the present question.

b What levels of selection are at work here as you investigate the material?

At one level, the creators of the artefacts made their own decisions/selections, choosing to write about one topic for the paper, rather than another, or aim the camera one way rather than another, or ask people to stop and pose for a photo.

Then someone had to collect these artefacts and bring them together. Why might they have done this? Why would someone have cut out this article rather than another?

Finally, the historians (students) themselves are making decisions and selecting some artefacts as 'relevant' over others, depending on the questions they are asking.

c What would an historian do with this material?

Historians would try to identify connections and describe them in terms of a narrative linking the evidence.

d What decisions would an historian make in relation to the artefacts before him or her?

An historian has to decide what relevance each artefact has, depending on their initial questions.

e What categories can you group them under?

Categorizing evidence is a form of interpretation.

f What connections are easy to make?

g Would you each construct the same narrative, given the same artefacts or photos?

It is very likely that different students will construct different narratives. Explore why that might be. Different background knowledge base? Different interests? Different imaginative leaps? Different attitudes to how big those imaginative leaps should be?

h What expectations do you have regarding these images?

Historians will make assumptions about the material. For instance, students often assume that this material all relates to a single family (which might be a correct assumption).

i What attitudes, desires and emotions might an historian bring to the interpretation of these artefacts? (Here you can introduce the selection vs bias distinction.)

Historians have their own understanding of the world and might bring that to their analysis of the material. Perhaps a student knows something about what the images represent, for instance, if there is a man in a Second World War-era military uniform, everything the student knows or believes about the Second World War might form part of their interpretation.

If the artefacts are personal to the teacher, students might wonder whether the teacher's own position in relation to the evidence might colour or shape how they construct their historical narrative. This then provides the framework for discussions of objectivity and subjectivity or bias.

3 In groups, ask students to develop a question that they have regarding the photos (don't share it yet) and then choose a handful of photos that are directly relevant to that question. Share the evidence and what the question was. Compare those selections.

4 Did the groups choose the *same* questions? What were the different questions about?
   - An individual's history?
   - A family's history?
   - A history of fashion?
   - A history of architecture?
   - A history of technology?
   - A history of photography and photographic technology?

5 Finish with a group discussion on the following question:

   'What are the key concepts learned in this lesson which we need to record and explain in our workbooks?'

   Have students record their conclusions. Alternatively, ask them to write a two-minute essay on one of the following titles:
   - What do you think are the effects of the selections made by historians on the reliability of knowledge?
   - What are the elements of selection made by the historian? (This question is descriptive rather than evaluative.)

These final activities are important since it is not really a taking notes sort of exercise (by design). Some sort of 'let's review what we have learned' exercise is important here.

Follow up

1 A short reflective writing exercise on the following topic: Think of all the evidence you are leaving behind as part of your own 'history'. What facts would you want a future biographer to select? In what way do you think that the choices you make now influence the availability of facts? Do you keep a journal? Instagram? Facebook?

2 Students select a question and five photos which can be used to answer that question. Ask them first to create an historical narrative, linking the photos together, then write about how reliable they think that historical narrative is. Did they have to make unjustified assumptions?

Below are two further activities that can be used in the classroom to help students understand the historical method.

ACTIVITY

The basic activity (group-solving a mystery) was first shown to one of the authors of this book as a student of Miss Formet's English class, some 35 years ago. Good lessons never leave us! RG Collingwood then supplied the idea to treat a murder mystery as a model for the historical method in his *The Idea of History*.

This is an excellent and fun starter to a unit exploring history. The aim of the activity is to identify and describe a number of key elements of what we would later specify as 'the historical method' and to give the students the responsibility for managing themselves during the lesson.

1 The objective of the activity is to solve a murder mystery by communicating the various clues given to the students on note cards. Each student is given

two or three note cards with various facts on them related to the mystery. Teachers might develop the facts from any 'mystery' source: a mystery novel, a crime drama on TV, a movie. You should aim for something that the students won't be familiar with or the ruse is over. Use the QR code in the margin to download and print a set of suggested clue cards.

The only instruction the teacher offers is to tell the students 'you are not allowed to physically share the cards', then you step back and let the students manage themselves. After some initial awkwardness they will realize that they have clues to a murder and will start asking each other to read them out. The game is on!

Your role is to record the sorts of things they *do* which illustrate aspects of 'doing history'. Keep track of specific examples of these behaviours to draw them out later. It is best to do this on a whiteboard so you can discuss it with them in the plenary. The sorts of things students generally do are listed below. Keep track of specific moments in the discussion so you can refer to them in the debrief, for instance, 'Grace's comment about how the events in her clue had to occur before Roger's is a good example of the importance of how historians look for cause-and-effect relationships.'

Students tend to:

- develop then test hypotheses
- reconstruct the physical events
- develop a chronology
- reconstruct the causal links between events or causal links between unseen events and evidence
- look for specific evidence to find the answer to a specific question
- test the consistency of facts
- test the coherence of explanations
- determine what is the relevant evidence
- 're-think' the character's actions
- determine what is 'plausible'.

2 Before the end of the lesson, draw the students back to a plenary so you can explain the various things they have been doing, with examples, which comprise elements of the historical method. At no point should you give them the solution to the mystery, the point being that no historian will ever know if they are 'right'. Historians only make judgments which are consistent with the evidence.

ACTIVITY

Although it is not perhaps entirely clear who first said, 'Journalism is the first rough draft of history' (Shafer), the relationship between journalism and history is a rich opportunity to explore general historical issues like selection, choice, perspective, bias and rhetoric. Find an example of 'investigative reporting' and evaluate the piece as evidence for future historians with your students. Ask them to think about the following questions:

1. What perspectives are contained in the piece?
2. How are the facts presented?
3. Is there obvious 'spin' on the facts?
4. Have the choices made by the journalist in terms of content, style and sources coloured the facts, or *shaped* the reader's interpretation?
5. What *other* evidence do you think will need to be presented to even out the interpretation?

Ethics

KNOWLEDGE QUESTIONS

Relevant knowledge questions from the TOK subject guide:

- Do historians have an ethical obligation to not ignore contradictory evidence?
- Is it unfair to judge people and actions in the past by the standards of today?
- Should terms such as 'atrocity' or 'hero' be used when writing about history, or should value judgment be avoided?
- Do historians have a moral responsibility to try to ensure that history is not misused and distorted by people for their own ends?
- On what criteria could we decide whether people in the past have a right to privacy in the present?

The first three questions here might be interpreted as straightforward ethical issues. The 'TOK trap' here is that students might treat these knowledge questions as simply being about whether some action should be taken, or whether some action is good or bad or right or wrong and they might then apply some ethical theory to answer the question. 'Ignoring contradictory evidence is bad because …' could lead the student into making a non-TOK point.

One way to avoid this trap while exploring the ethical issues raised by an AOK is to explore the notion of responsibility more than notions of good, bad, right or wrong. The question of what it means to be a responsible historian, or what is responsible use of historical knowledge, seems more suited to a genuine knowledge question. So, you might recast the second question as, 'Would a responsible historian pass judgment on people and actions in the past based on the standards of today?' The idea would be to shine a light on what a responsible historian is, rather than what the consequences of passing judgment might be.

This is because our view of what it means to be a responsible historian arises naturally from a discussion of the scope or nature of history, coupled with a discussion of the resulting methods which will best promote the nature of the AOK. On one reading of the historical method (perhaps one like Collingwood's), where we cannot help but apply our own critical reflections when we 'rethink' the inside of the events, or one (like Dewey's) where we choose to focus our analysis on particular issues we are interested in, it would be hard and perhaps disingenuous to stay that we are even able to avoid judgment. For instance, Eddo-Lodge (discussed in the student book) chooses to tell the history of the UK's treatment of the black community precisely because she wishes to point out the ways it has disadvantaged the black community. Rowbotham (discussed in the student book) chooses to judge the past historians in their avoidance of the role of women in key events. In each of these cases, a major part of the point of history is to help us navigate current social challenges and injustices.

It seems that the first three knowledge questions are best approached from the perspective of a 'responsible' historian and could be managed well with clear links to the nature and methodology of history.

We explored the 'presentation' of historical knowledge in the methods and tools section, and the fourth question seems to be well suited to explore issues surrounding the job of the responsible historian extending into the consumer's reading of that history.

Journalism and history

TOK TRAP

The journalist and the historian are not doing the same thing. Journalism is not history. However, taking seriously the claim that 'journalism is the first draft of history' shows that there are quite interesting TOK discussions to be had about their similarities and overlapping roles.

This discussion, however, highlights a trap: the possibility that students will simply talk about journalism and not link that discussion to the AOK of history. Whenever students shift away from a precise focus on an AOK (to develop a connection with something like journalism), as a teacher you must remind them that the 'tangential' discussion must always ultimately reflect some new facet of the AOK in question. We place 'tangential' in quotes because, properly handled, the discussions need not be tangential at all, but aim right at the heart of a better understanding of the AOK. The section in the student book is an attempt to unpack some of these connections.

One of the most popular TOK topics students often gravitate towards is the issue of censorship. By its nature, censorship seems like the perfect TOK topic: it is about knowledge, it is current and 'live' and it is hotly debated.

Very often, however, discussions of censorship tend to lose their connection to the context provided by an AOK and students then shift into a discussion of whether censorship is acceptable under certain circumstances or why certain books are censored and ought not to be. Were students to engage with this question by simply asking whether censorship was acceptable, and by applying something like an ethical theory to find out, then they would not really be developing a TOK approach. We don't ever wish to tell students that they should not talk about what they want to talk about, but in terms of the skills and approaches we are trying to promote we want to emphasize genuine TOK skills.

The student book section entitled 'Journalism, censorship and history' (pages 393–4) is our attempt to offer a sense of how the question of censorship might be approached in the context of the AOK of history and in a genuinely TOK way. There is no doubt censorship could be discussed in any of the AOKs, but the role that history plays in helping us understand ourselves and orienting our values makes censorship there a particularly important context. To focus the discussion even more precisely, we contextualized the issue in terms of journalism and shifted the question from something like, 'Should we accept censorship in history?' to the more specific, 'What is the effect of the censorship of the journalist on the writing of history?' Case studies are a helpful way of focusing student thinking, and the case of Marie Colvin serves as a recent and powerful example of how some journalists are under pressure to tell certain stories in certain ways.

RESOURCES

- ✔ The Committee to Protect Journalists, linked to by the first QR code, covers the challenges journalists face in all sorts of contexts and is compiling a live database recording journalist deaths and political censorship across the world.
- ✔ The second QR code links to PressFreedomTracker.US, which tracks the constraints on the freedom of the press in the USA.

Again, this topic is inherently controversial and discussing it in your class might need some finessing for all sorts of reasons: students might be culturally or nationally related to the political organizations that are committing the censorship, while the local political situation might make such a discussion dangerous as well. Please use caution.

ACTIVITY

After discussing the characteristics of a responsible historian, consider the Code of Ethics developed by the Society of Professional Journalists (available via the QR code on the left), which focuses on the following rules:

- Seek truth and report it.
- Minimize harm.
- Act independently.
- Be accountable and transparent.

Students should compare and contrast the duties of the responsible journalist and the responsible historian. Where are the differences, and what do these differences teach us about the nature of the historical endeavour?

ACTIVITY

1 Ask students to think about what journalists are writing about in their own cities or in the newspapers they follow.
2 Wherever they are, the question of the 'freedom of the press' is live and contentious. How free is the press in their context? Where do the pressures on the freedom come from?
3 Now ask students the important question: 'How do you think the censorship of the press in your context would influence future historians were they to write about these topics?'

This might be either a discussion exercise, or a research exercise, depending on the students' context. Try to shift the discussion on to the effect the censorship will have on future histories written about the current time period. Consider carefully the source of the pressure as this will undoubtedly shape the effect on any future histories written.

ACTIVITY

There may be different types of censorship. Certain terms might be removed from the discussion or forced upon it (eg, 'comfort women' instead of 'sexual slaves' or 'incident' instead of 'massacre'). Access to facts might be removed (pulling journalistic credentials, closing museums or destroying artefacts), or financial support might be pulled from existing research departments or reporting agencies.

1 Ask students to think about how these different types of censorship might affect the work of the historian.
2 How does being aware of recent examples of this impact their sense of the reliability of historical accounts from the distant past?

Conclusion

History is one of the most fruitful and accessible topics on the TOK menu. The inclusion of Knowledge and the Knower as a core theme provides a new and exciting way for students to see the effects of history (told by their school, their country or their social communities) on their own identity and how the study of history is a tool for political change.

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CHAPTER 12

The Arts

OBJECTIVES

After reading this chapter of the student book, students will be able to:

- provide an effective definition of art
- appreciate the broad scope of the arts
- understand the role that art plays in human experience and culture
- explain what kinds of knowledge we can get from the arts
- understand the relationship between the artist, the artwork and the audience in terms of generating meaning
- understand the complex ways in which judgments about what constitutes quality in art are made
- appreciate the role of truth in the arts
- recognize the wide-ranging methods of making art and the important methods of interpreting art
- understand the role of ethics in the making of art
- understand the role of art in helping to form ethical viewpoints.

Introduction

KNOWLEDGE QUESTION

Relevant knowledge question from the TOK subject guide:

- Are the arts best seen as a system of knowledge, a type of knowledge, or a means of expressing knowledge?

TEACHING TIP

Whereas most students recognize that they are not experts in mathematics, history, psychology, economics, physics, politics, Indigenous knowledge or most of the topics included in the TOK course, the arts are a much more familiar subject. Additionally, because of the personal nature of our interaction with a work of art, the arts provide a powerful temptation to students to think of themselves as authoritative. One common outcome of this is that many students will be inclined to argue that there is no definition of ‘art’, nor is there any way to determine what constitutes ‘good’ art.

A claim which teachers and examiners often encounter is that ‘art is whatever I want it to be’. Such a claim is not really tenable, and it is detrimental to what we want to accomplish in Theory of Knowledge. If everything is art, if there is no feature which we can use to categorize things into ‘art’ and ‘not art’, then everything is art, and the term is completely meaningless. If we cannot define ‘art’, then we cannot begin to consider what knowledge we get from art, and how that knowledge – and the knowledge-generation processes inherent in art – compare and contrast with other areas of knowledge.

Sometimes students will want to carry this argument to extremes, claiming that literally everything could be art to some unspecified someone: the local garbage dump, the road outside the school, a dead tree, a baby, a jar of spaghetti sauce and so on. If pressed to identify someone who actually treats these things as art, they cannot generally do so, but may persist in asserting that it is possible.

One way to resolve such a problem is to suggest that the concept of what constitutes art can be considered from three perspectives: the perspective of the individual and the perspective of a social group and/or experts. While it is (remotely) possible that some one person might consider the local dump to be a work of art, no society or expert is going to extoll the virtues of the trash pile as an artistic masterpiece. People are not going to visit the dump to admire its aesthetic qualities, nor will they take their children there to expose them to the higher echelons of human achievement.

The other way is to provide students, or guide them to, a clear definition of art.

We have found that before you can do any useful exploration into the kind of knowledge that the arts create, you will need to help students sort out some basic understandings which you did not have to sort out for other areas of knowledge. Very often a significant number of students will want to argue that anything is art, and they will want to conflate the questions of what art is and what constitutes high-quality art. The introduction of the student book, therefore, focuses on the question of what art is and how art differs from other things. The key points which are made in that discussion are as follows:

- Art must be created by humans. The word 'art' is related linguistically to the word 'artifice'. Art is by its nature artificial. Some students may want to argue that nature is God's art, but in TOK we are concerned with the human construction of knowledge, and so we will confine our investigation to human-made art. God's works (or the works of the gods) are better explored in a religious education course.
- Art is that which serves no other function than the *aesthetic*. That is, objects which we use for purposes other than provoking an aesthetic response are not art. Art, in other words, does not have a function as a tool for accomplishing some additional purpose.

That second point is to some degree a matter of interpretation, of course. Here are some examples of potential grey areas with regard to the question of what function a work of art fulfils:

- **Social commentary**: Much art makes critical comment on social, cultural or political practice. We probably still want to call such art 'art', so the determining factor is that the commentary comes from the aesthetic response evoked by the artwork. Art as social commentary is discussed in some detail beginning on page 414 of the student book.
- **Commercial value**: Most artists sell their work, and so it might be argued that the art fulfils an economic function, beyond the aesthetic function. We still want to call such objects art, so the determining factor is that the primary function of the art is aesthetic – the conveyance of a worldview from the artist to the audience through perceptual mechanisms – and the money is a practical necessity for the artist to be able to continue to create art.
- **Objects in museums** which were once functional, such as lamps, furniture, sets of china and clothing: The differentiating factor here is that those objects have left the realm of the functional and entered into the realm of the purely aesthetic. The decision to move the objects to a museum was the decision to treat them as works of art, and to enjoy them purely for their aesthetic purpose. Should we remove them from the museum and begin using them again, they would cease to be art and would become, instead, functional objects with artistic features.

- **Fashion design**: There is an interesting case to be made that a lot of high fashion design which is shown off at shows by supermodels, for example, is not actually clothing which will be purchased and worn by people in the world outside the fashion show. In those instances, such clothing would indeed be treated as works of art and could be considered to be art. Clothing which is intended for sale and actual wearing has a function beyond the artistic, and so does not fit into the category of art. The dress and the background in this image seem to have been put together for the specific purpose of creating an aesthetic effect. The intention does not appear to be to show a dress which someone would wear to a social function. If, however, the dress were to be worn to a social function, then it would no longer be considered to be solely art. It would depend, then, on what the wearer intended. If they were wearing the clothing simply as a matter of making a statement, it might still be art. If, however, they were wearing it because the clothing made them feel special or beautiful, or gave them confidence, then the clothing would be functional in a manner that transcends the artistic.
- **Architecture:** Like many other objects that we have considered here, architecture often has quite striking aesthetic features (like the Sydney Opera House discussed shortly), but in our definition, so long as the building is actually functional in a society for housing, business, cultural events and so on, it is not art. If such an architectural building ceases to be functional in these ways, and becomes, for example, a place to which people come solely to admire the architecture, then that building would be treated as art. Frank Lloyd Wright's house, 'Falling Water', in Pennsylvania in the US is such a building. The Taj Mahal in India is another.
- **Cultural records**: Some art was made to document or celebrate historical events. Use the QR code on the left to view a series of 10 paintings about war. These range from the highly realistic to the surreal. In all cases, the artist has not simply documented the event, but has, rather, interpreted the event and made the art in order to create a visceral reaction in the audience. Like artwork which makes a social commentary (and we might argue that these historical pieces are, in their own way, more social commentary), the reason that we want to call these works art rather than, say, journalism, is that the methods and the message are aesthetic.

The key in using this definition of art – that it is made by humans and that it has no function beyond the aesthetic – lies in the attitude of the owner or user of the artwork. We would probably all agree, for example, that the famous painting on page 263, *The Anatomy Lesson of Dr Nicolaes Tulp*, by Rembrandt, is a work of art.

Let us imagine, however, that you came into a massive fortune, and decided that you wanted a safe investment. You purchase this painting and lock it away in a vault. You never look at it (you don't really even like it), but you did your research and know its value. After 15 years you take it out of your vault and sell it at auction. You treated this painting not as art but as an investment. Let's further imagine, however, that the people who bought the painting from you immediately put it on display in an art museum for visitors from the world over to come and see. Now the painting is being treated once again as art.

These two features constitute the definition of art that we use in the book. It is not the only possible definition, but it does provide a clear standard for applying to all objects in order to determine if they ought to be categorized as art or not art. If students want to argue that it is not an effective definition, they must come up with one which differentiates art from non-art specifically, and the standard must be applicable to all objects. Any 'rule' which can only be applied to one object or a few objects is not a rule which can be a determining factor.

It can be quite useful to work with students to differentiate the aesthetic function of art from the artistic features of art, which make it attractive. Clothing, buildings and household furnishings, for example, have artistic features, but are functional well beyond the aesthetic, and so do not fit into the definition of art we have proposed.

Is it art?

The first activity in the student book chapter provides students with 12 objects and asks them to categorize them into two categories: art and not art, and to develop a clear statement of the determining factor for how they categorized the objects. Here are some notes about the 12 objects in the context of our two rules from earlier.

Object	Man-made?	Functionality
Cat	No	The cat is a creature of nature. We could argue that cats were domesticated, but that process was not artistic. Cats were domesticated for a variety of purposes: to be worshipped as gods (in Ancient Egypt), to catch mice (in farmyards and on ships), and as pets. None of these functions are artistic.
Aboriginal painting	Yes	The artwork draws on important cultural symbolism to convey a message to viewers aesthetically. This is clearly a work of art.
Surrealist painting	Yes	This, too, is clearly a work of art. The lack of realism is one feature in this particular work (and in others of the same school) which removes it from any hint of functionality other than the aesthetic.
Portrait of a young woman	Yes	The painting is purely artistic. Some portraits are photographs which were made for purposes other than the aesthetic – such as journalism or including in company brochures to introduce the staff of a business to potential customers – but this portrait is artistic only. The fact that we are not told who the woman is contributes to its removal from functionality.
Lawnmower	Yes	A lawnmower is a machine with a specific practical function. It might be seen as attractive, but it has been designed primarily for functionality as a machine and any artistic features (such as colour) are secondary.

Cont ...

Object	Man-made?	Functionality
Car	Yes	The same features that apply to the lawnmower apply to the car. The car might perhaps be seen to be somewhat more artistic than the lawnmower, since it is significantly more attractive. The age of the car also seems to move it more toward the art end of the art–functional object continuum. If the car is taken out and driven, however, it is not art. If it is in a museum and admired only for its beauty, then it can be considered to be art.
Landscape painting	Yes	The trees in this painting differ dramatically from the actual tree, which is the next object. This somewhat impressionistic representation of trees is clearly art made to appeal to a sense of the aesthetic.
Tree	No	Trees are not man-made. We might argue that, as with the cat, humans have domesticated trees for many purposes: to provide fruit, to provide firewood, for making paper and wood products and for building houses, for example. All of these purposes, however, are pragmatic; neither the living tree nor the chopped down tree is art. It is possible, however, for an artist to use wood as a material out of which to make art.
Indian wedding clothes	Yes	As with the discussion of the fashion clothing above, we can see that wedding clothes, though highly and deliberately artistic, have a specific function in the real world. In the photograph in the student's book, the clothes are being worn by a bride and groom. If we were later to take the clothes and put them in a museum because of their beauty, we would then be converting the functional to the artistic.
Child's painting	Yes	I think everyone would agree that this painting is a piece of art; it has artistic features and it has no function other than the aesthetic. The more pertinent question would be about the quality of the artwork. This piece of art is not of a high quality, it is not professional, and it is not going to work its way into the cultural record of any society. We take up that question later in the chapter, on page 421 of the student book.
Sydney Opera House	Yes	As mentioned previously, much architecture is very beautiful or striking, and has been designed to have that effect. The Sydney Opera house is certainly strongly artistic, but as it is in use for many cultural purposes, it is not truly a work of art.
Statue of Buddha	Yes	The statue of the Buddha is easier to classify as art than the Sydney Opera House, because it was built solely so that people might go to see it and worship it or appreciate its aesthetic qualities. One might wish to make an argument that, because it generates a great deal of revenue from tourists, it has a non-art function. We might wish, in that case, to differentiate: the society which benefits from the revenue uses the statue for other than art, but the individuals who visit it go for the aesthetic experience.

TEACHING TIP

The definition of art in the student book is as straightforward as we can make it, but you may find that students object to it. It provides limits which they may not wish to apply, based on a strong feeling that they should have personal control over what counts as art and what does not. If a student objects strongly, then you can encourage them to come up with another test for what qualifies as art. The job of the student, in writing a TOK essay, will be to justify whatever claims they make about what art is and which objects ought to be considered to be art. This definition cannot be arbitrary; it must be a test which can be applied evenly to all objects in order to determine whether they are or are not art. If everything is art, then nothing is art.

Scope

The groundwork for the discussion of the scope of the arts was laid in the introduction to the chapter. This section then, explores some of the same concepts in more detail. The discussion includes the following ideas:

- In terms of content, art can be literally about any idea or topic it is possible for an artist to conceive.
- The form and content of art is related to culture.
- Art fulfils an important emotional and psychological need.
- Art plays a powerful role in social commentary. This includes a case study of the role of Shakespeare's plays during the time of Stalin's rule in the USSR. This section reveals the powerful capacity that art has to reach people, to inspire them, to give them hope and even to threaten governments.

KNOWLEDGE QUESTION

Relevant knowledge question from the TOK subject guide:

- Can art change the way we interpret the world?

Perspectives

The different perspectives explored in this chapter include:

- artist vs audience
- different interpretations of a given work of art
- different opinions about what constitutes quality art
- different schools of art.

The different perspectives of the artist and the audience

KNOWLEDGE QUESTION

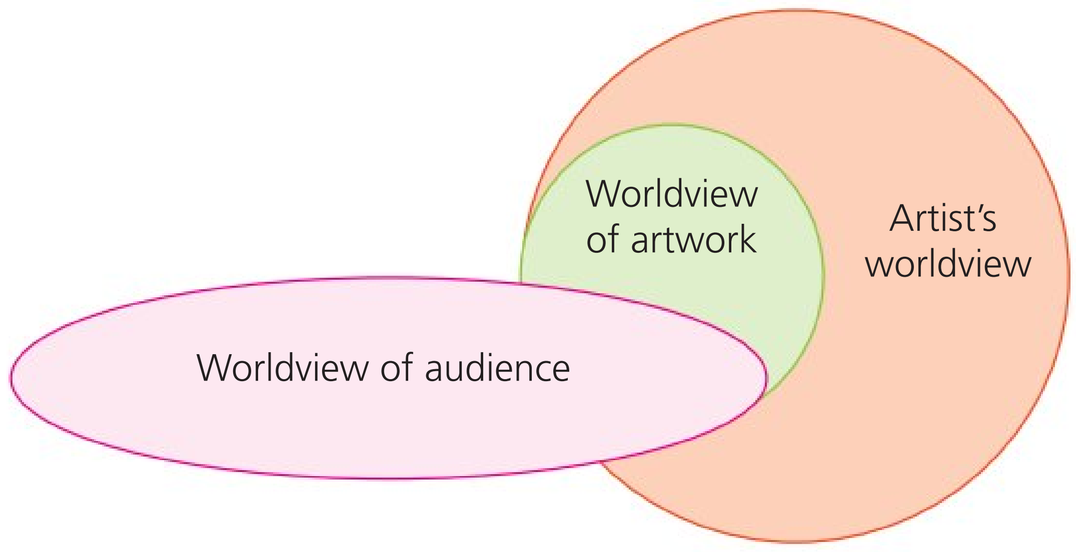
Relevant knowledge question from the TOK subject guide:

- Can a work of art have meaning of which the artist themselves is unaware?

The student book has several examples which demonstrate how the knowledge that the audience brings to a work of art shapes what it is possible for that audience to interpret. Two of these at least provide examples which show that the answer to the knowledge question above is 'yes'– at least some of the time. One example discusses the effect of a reader who is local to San Francisco interpreting the use of the word 'Frisco' differently from other readers – and very possibly from the poet himself. The example from *Henry IV Part 1* provides a conclusive example: Shakespeare cannot have known the term 'post-traumatic stress disorder', but he clearly knew how soldiers who had been through terrible battles suffered, and he was familiar with behaviours and symptoms that they exhibited. There are two examples in this section of the student book which ask students to explore the relationship between themselves and works of art, including visual art.

The opposite, of course, is also true: very often members of the audience for a particular piece of art are incapable of understanding something that the artist intended, because they do not know something from the social, cultural, historical or symbolic context of the work.

There is a diagram in the student book (page 416) which illustrates the relationship between artist and audience, as mediated through the artwork. The following diagram depicts a related idea: it suggests one way in which we might think of the relationship between the artist and the artwork and the audience, in terms of the meaning which can be encountered:

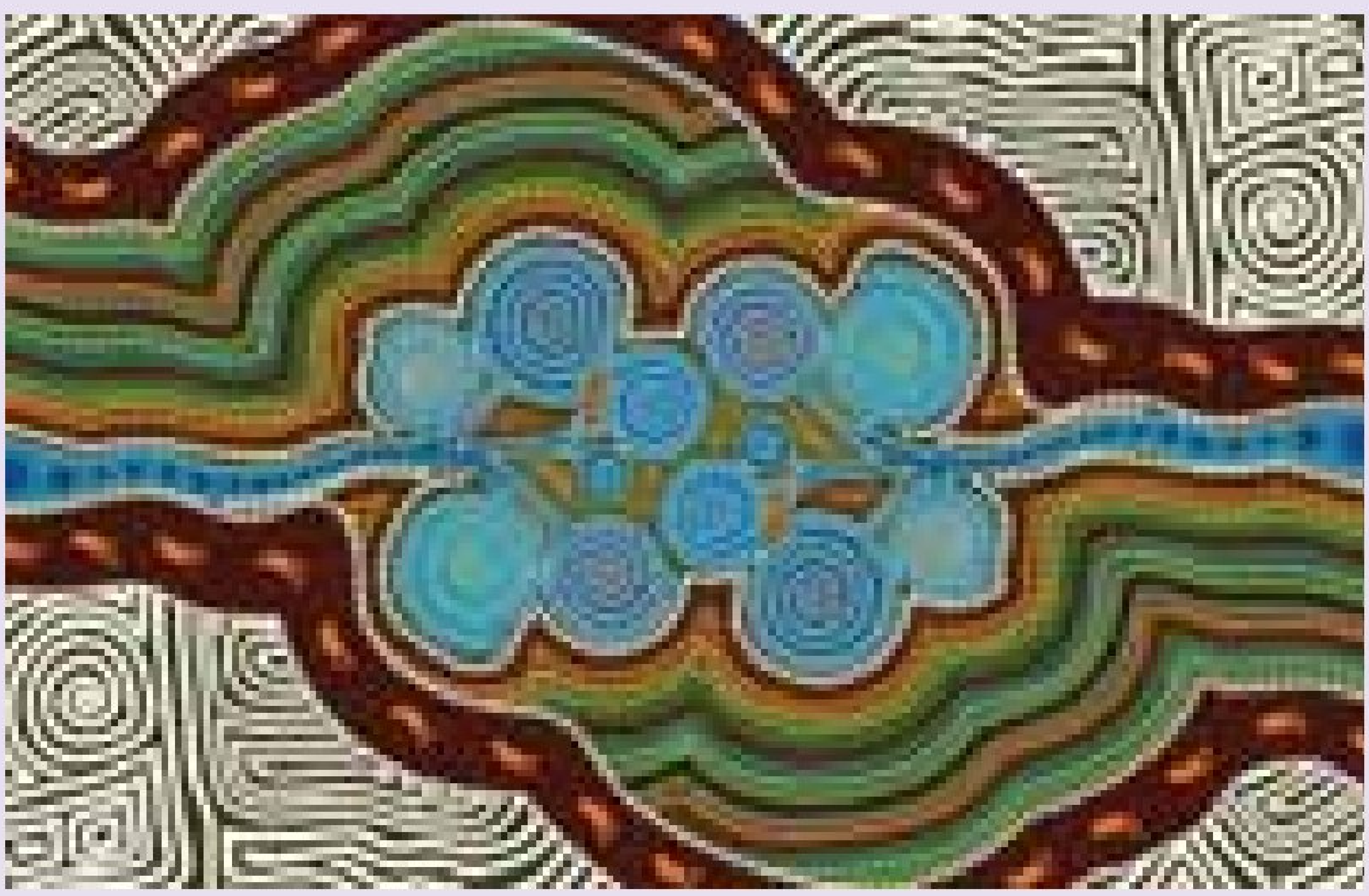


We can see in this diagram that the worldview of the artwork as created by the author lies entirely within the worldview of the artist. No artist can create a work which is somehow outside of their experience and understanding. The worldview of the audience, however, differs from the artist's worldview. These people are not the same person, and while they have likely had some of the same experiences and have developed some of the same knowledge, each will have knowledge and experience that the other does not have. The audience, therefore, brings to the interpretation of the artwork a different understanding from that of the artist. The audience will see some of what the artist saw in the work but may also see something different from what the artist understood.

Other ways to illustrate this interaction are certainly possible – maybe we could make an argument that, in the sense that others can see things in the artwork that the audience did not see, the worldview of the artwork does actually extend beyond the artist's worldview. You might wish to have students discuss the two diagrams and determine what they reveal about the knowledge-making process in the arts, and then design their own diagram to illustrate the same idea.

ACTIVITY

1 In order to explore the ways in which the knowledge and understanding of the artist are not accessible to all audiences, ask students to look at this painting and see if they can infer anything about it: where it comes from, for example, or what it might mean. They need to justify their response – this is how they will be trying to answer the question of how they know what the painting is about.



2 Next send the students to the website at the QR code. It discusses the use of symbolism in Australian Aboriginal art. The article is detailed and very informative about the kind of knowledge that would be necessary to understand artworks by Aboriginal people from different parts of the country. One point that it makes strongly is that the symbols are fluid. A viewer needs to know the language of the particular area and art style in order to fully appreciate the meaning of the paintings.
3 Students can follow up this activity by doing some research into symbols from other cultures. As always, they need to focus on the relevance of the activity in understanding how knowledge is constructed. In this case, it is less important to know what this painting (or symbols from other cultures) might mean than it is to understand that having sophisticated knowledge of symbols changes our understanding of what any given artwork means and how.

Perspectives on the meaning of artworks

The idea in the activity above – that knowing particular symbols can give us better insight into works of art – leads us to the next important way that differing perspectives function in the arts: the fact that art, because it must by its nature be interpreted, can mean different things to different people. Consider, for example, F Scott Fitzgerald's great tragedy, *The Great Gatsby*. A person with a strong sense of the romantic – not just in the sense of finding romantic love appealing, but in the sense of the mystery and nostalgia and longing for excitement – might find Jay Gatsby to be a tragic hero: a person who longed for something so powerfully that he sacrificed everything for one fantastic attempt to reach for that dream. Someone else, more realistically inclined, might find Jay Gatsby to be a classic tragic hero: his failure to understand that what he wanted, to turn back time, was literally impossible and so led inevitably to his downfall. One reader might focus on his love for Daisy Buchanan; another on his obsession. One reader might hold him accountable for his criminal activities and his failure to mature into a responsible adult, while another might acquit him of criminality, seeing, instead, his lack of realism as romantic other-worldliness. Any of these interpretations is viable given the facts of the text.

The questions, for a TOK student, would be about what evidence from the text could be used to justify these interpretations, and what influences from different readers' life experiences lead them to seeing the book from these different perspectives.

KNOWLEDGE QUESTION

Relevant knowledge question from the TOK subject guide:

- How does knowing more about the social, cultural or historical context of a work of art have an impact on our knowledge of the work itself?

The fact that the nature of the arts allows for different interpretations does not mean that it allows for all interpretations, without limit. Any reader who tried to interpret *The Great Gatsby*, for example, as a novel about the economic inequities leading to the French Revolution, would just be wrong. No facts from the details of that novel allow for such a reading. This leads us to an important point about artwork and interpretation: artworks do have facts. The facts of a novel are the words that the author used. The facts of a painting are the images, colours, shapes and relationships among objects that the painter chose. The facts of a musical composition are the notes and the instructions about volume, pace, repeats and so on. All interpretations must respect the facts. All facts must fit into any interpretation in order for that interpretation to be viable. No facts may be omitted or changed. (It is worth noting that it is true for all areas of knowledge that interpretation must respect facts!)

This point takes us back to the discussion of the right to an opinion in Chapter 1 of the student book (page 10). Individuals do have a right to an opinion about whether a work of art is to their taste or not – an idea we will explore in more depth below – but what a work of art means is not a matter of opinion, it is a matter of interpretation.

The following lesson plan can be used to help students explore the nature of interpretation of a work of art, and how focusing on the facts can deepen someone's understanding and appreciation of that artwork.

LESSON PLAN: THE ARTS – EKPHRASIS

Note: this idea came from Nancy Sullivan, long-time TOK teacher, examiner and workshop leader.

Introduction

This assignment investigates the transformation of one art form into another, as well as the intertextual relationships between the original artwork and the new poem. This assignment, therefore, provides an excellent opportunity to work with your Language A teacher, as both transformation and intertextuality are key components of that curriculum.

Students will choose a work of art (visual art probably works best, but other forms might be possible) and write an ekphrasis based on that work of art. This lesson will allow students to experience a work of art from two perspectives: from the perspective of an audience member interpreting a work of art and from the perspective of a poet writing a poem.

Framework section

Perspectives.

Aims

Students will:

- understand what elements of a work of art contribute to the effect that art has on an audience
- appreciate the challenge of conveying an idea or experience through an original work of art
- experience the effort of trying to convey emotional or aesthetic experience through words in a work of art.

The aims all have knowledge-related terms: 'understand', 'challenge of conveying', 'convey emotional or aesthetic experience'.

Objectives

Students will be able to:

- create a poem which expresses their understanding of the effect of a work of visual art
- explain the role of emotion, reason and imagination in interpreting a work of art
- reflect on the ramifications in terms of the knowledge inherent in a work of art of transforming that work of art into another form.

These objectives are specifically about the arts, in contrast to some earlier lesson plans which include broader objectives.

These knowledge questions come from the scope and methods and tools sections of the guide; however, they pertain to the question of perspectives as well. The first question asks about the perspective of the artist in contrast to the perspective of the audience, while the second question considers the arts from the perspective of the different mechanisms that we use to interpret them. This activity, therefore, can be a useful one in terms of understanding how the different elements of the knowledge framework function together in a complex system, rather than as independent components.

Knowledge question(s) from the TOK subject guide

- Does art provide knowledge of the artist or of ourselves?
- Does artistic creation rely more heavily on imagination than on other cognitive tools?

Relevant course concepts

Evidence, interpretation and perspectives.

Prior learning

These ways of knowing are not specified in the TOK curriculum; however, they fit under the general heading of methods and tools, particularly with regard to the means by which individuals develop knowledge.

- Students should have already considered the question of what defines a work of art and differentiates it from other expressions of knowledge.
- Students must also have at least a basic understanding of the definition and characteristics of the relevant course concepts.
- Students need some basic knowledge about how emotion, reason, sense perception and imagination function to help individuals develop their knowledge.

Required resources

- Materials for introducing students to ekphrasis, including a number of examples.
- Access to sources of images of artworks (primarily paintings, but other art forms can also be used). Museum websites are one such good source.
- Student access to word processing for creating their ekphrasis.
- Reflection questions (some suggested here).
- For the follow-up activity, some means of publishing the finished ekphrases: printing a hard copy or creating a PDF electronic copy are two possibilities.

The activities section provides some important information for the introduction, as well as links to professional ekphrases and samples of three good-quality ekphrases written by students.

Activities

1 Introduce students to the concept of ekphrasis. Ekphrasis is a very old form of poetry in which the poem is inspired by, and tries to recreate the experience of, a painting. A key point is that ekphrasis does involve *some* description of the original artwork, but the focus must be on interpreting and responding to the work (Goldhill).

Neither of these lists of ekphrases, unfortunately, include the original artwork on which the poems were based – or the poems themselves. You may wish to prepare a PowerPoint with the artwork and copies of the poems before you introduce the assignment.

2 Provide students with some examples of ekphrases. If you have done this assignment with your students in previous years, student work makes great examples. Use the first two QR codes on the left to access examples, including some very well-known ekphrases.

3 These two collections include a wide array of artwork and styles of poems, as well as representing art from different time periods. There are also some student-written samples available on the Hodder website. Use the QR code on the left to access them. Other examples are available on the internet if you wish to search for more.

Generally speaking, students should all use different artwork. However, if some want to write about the same art, they should not discuss their artworks together, and they should not engage in peer review with each other.

4 Provide students with some suggestions about places to look for artwork that they might wish to use. Students may be most inspired by artwork they experience in person, if you can arrange a trip to a local art museum or gallery. However,

viewing art online or in books also works just fine. The QR code on the left here provides a list of online art museums, including some of the world's most famous.

5 Students choose a work of art about which they wish to write. They write an ekphrasis which endeavours to recreate the experience, for readers of the poem, of engaging with the painting. Students should have freedom of choice in terms of the form and length of their poems. Students will need to focus on the facts of the painting – the details – and some of the key details which attracted their attention and contributed to their personal response to the artwork need to appear in the ekphrastic poem. The poem, in other words, should draw the reader's attention to some detail or details in the painting that the reader might not otherwise have noticed.

6 Peer review and teacher feedback are advisable during the writing process, so that the finished poems are as polished and effective as possible.

7 Students should submit the finished poem with a copy of the original artwork and proper documentation for the work of art.

8 After the ekphrases are complete, students should answer some reflection questions in order to ensure that they understand the activity as a way of exploring the nature of art as a source of knowledge. Some possible reflection questions:
   a What did this assignment reveal to you about art as an area of knowledge? (In other words, what did this assignment help you understand about what we know when we study the arts?)
   b What did this assignment reveal to you about the role of sense perception, language, emotion and imagination in creating or gaining knowledge within the arts?
   c What else did you learn from this assignment that you have not had a chance to say in answering either of the first two questions?

9 Students should also reflect on answers to the two knowledge questions suggested for this activity, or others which you choose. This is best done in groups or pairs so that different perspectives on the questions are brought to the discussion.

Follow up

Share the students' work with each other and with a wider audience. Some ideas for doing this are to:

- publish the ekphrases in a booklet for distribution to all the students
- display the ekphrases at a public event such as a project fair, a TOK evening or a recruiting event
- display the ekphrases somewhere in the school, such as the library, where a binder of the poems can be set out along with a running display of the artwork in a video or PowerPoint presentation
- create a PDF of the ekphrases, including the artwork, for distribution to all the students.

Perspectives on the quality of artwork

KNOWLEDGE QUESTIONS

Relevant knowledge questions from the TOK subject guide:

- Who determines what art is valued, and on what criteria?
- Should your judgments about art be given the same weight as those of an expert?

As we discussed in the introduction to this chapter, although we need some basic definition as to what constitutes art, so that we can differentiate it from that which is not art, the question of whether something is quality art is a different, and more difficult, proposition. The student book presents three different perspectives on artistic judgments:

- individuals
- art experts
- society.

The key point is that these three entities can be seen often to engage with art for somewhat different reasons, and, therefore, they have different standards for what constitutes good art.

Personal judgments

When it comes to any individual's judgment of what constitutes good art, art which moves that person in some way, the judgment is entirely idiosyncratic. Opinion is the appropriate determining factor, and no one else can say that an individual's judgment is wrong. The individual judgment, however, does not apply to others, and no individual can reasonably expect his or her personal determination that some work of art is good art to set the standard for experts or for society. Just because you think a work of art is a work of genius does not mean that you can get it included in an art museum or ensure that it is remembered 200 years from now.

ACTIVITY

1. Have students bring in a work of art in any form which can be transported to the classroom easily to share with others. In small groups, students should justify to each other why they love that work of art.
2. For a slightly different version of the activity, ask students to bring in a work of art that they personally find to be effective, but which they realize is not widely seen as good art by other people. In the ensuing discussion, students can justify their personal attachment to the artwork, and they should discuss why it is that the work is not widely renowned in the culture at large.

To ensure that this is a TOK activity, students need to reflect on the means by which the student became the kind of person for whom the artwork has meaning, and they should consider what methods the artist used to create the response in the student as the audience for that artwork.

This activity could form the basis for choosing an artefact for the TOK exhibition.

Experts' judgments

We have seen the question of what constitutes an expert come up in other themes and areas of knowledge. Experts are people who have amassed such sufficient experience with some topic that their knowledge is wide and deep. They are able to notice things that non-experts miss, and they are able to recognize important implications of what they notice. Experts are knowledgeable enough to be able to tell lay people what is important and what is not, and they are the people who can use their knowledge to make the most accurate predictions possible from the evidence which is present in any given situation. Experts can teach the rest of us to see, appreciate and understand what they do. This does not mean that experts know everything that there is to know, nor that they are infallible. It does mean, however, that experts are the people with the best chance of being right. This is true in every area in which we try to amass knowledge.

Experts in the arts do not have to be able to make predictions in the way that natural and human scientists, politicians and even historians often do – predictions which may have a powerful impact on the quality and security of people's lives in the future. Art experts, however, do make predictions about which works of art will become 'classic' works of art, and which will, therefore, be passed from generation to generation, as part of the important cultural knowledge in a given society. Art experts have a lot to do with determining which works of art are displayed in museums and which are, therefore, the ones which are recommended to individuals to learn to appreciate.

ACTIVITY

1 To enable students to experience the value of experts' judgments in opening up a work of art to greater understanding to individuals, show them Russian painter Kazimir Malevich's abstract painting, Black Square (shown here on the right). Ask them to reflect on the painting individually to see if they can come up with any ideas about why experts consider this an important work of art – a painting with value to society. They must not do any research; they must rely on their own life experience and existing knowledge of art.

2 After students have spent some time considering this work of art and sharing their ideas about its significance, they can be directed to the Tate Museum website (use the QR code on the left), where several experts have commented on the significance of this painting.

3 After reading the experts' comments, students should talk about what they now know about the painting that they did not know before. They can discuss whether they like the painting better and why or why not, and they can discuss whether they appreciate the painting more and why or why not. They can also discuss the difference between liking a work of art and appreciating it.

Societal judgments

Experts do not have the only say about what works of art will become iconic, or traditional, in a culture, and which will, therefore, be passed from generation to generation. Art which becomes famous because it appeals to a great many people may also become part of a cultural tradition. A societal judgment is not a conscious or considered choice: societal acclaim is an effect of thousands or millions of individuals responding to the artwork personally. The student book includes several examples of artworks which have become enduring because of their widespread appeal. Several questions about the role of contemporary acclaim and enduring fame can help explore the role of societal judgments:

ACTIVITY

1. Think about the works of Shakespeare: they have endured with a reputation of greatness for 400 years. Which of these judgments do you think played a role in bringing that about: individual judgments, the judgment of experts and/or the judgment of society? Why are the works of Shakespeare given prominence in school curricula? How do the power structures in a society further Shakespeare's fame? Can you imagine the works of Shakespeare falling out of favour in the future? Why or why not?
2. Name a world-famous painting that is on display in a museum. That painting likely originally came to be on display in a museum because of the judgment of some expert or experts. Do you think that its continuing fame is the result of judgments by experts? What role do museum visitors who come to see the painting play in ensuring its continued fame?
3. Name a contemporary artist who is widely famous right now. Do you think that that artist and/or artwork will continue to be equally famous in the future? Can you imagine people in 400 years seeing or reading or listening to this artwork? Why or why not?
4. Why does a work of art gain international fame, as opposed to its being valued solely within the culture in which it was created? Are there works of art from cultures which are significantly different from your own which have garnered fame in your culture? Why or why not?
5. How does the judgment – local, cultural or international – that a work of art is a good or great work relate to knowledge?

TEACHING TIP

It can sometimes be difficult to help students understand the importance of expert and societal judgments. Our personal relationship to art gives us a powerful stake in defending our individual judgments of art and can make it difficult for people to see that we have much to gain from what experts can teach us. One way in which you can help students to understand that the mechanisms by which individuals come to value art and the mechanisms by which art becomes valued on a societal level are different, is to show them a series of pairs of artworks. Then ask them to vote for the one in each pair which has, or is most likely to achieve, the kind of acclaim that will ensure it is carried on to future generations. The chart on the next page provides some suggestions for the kinds of pairs you might use. The chart shows all of the artworks which are more likely to be perceived by a great many people as being good or great art in one column, and those which are more likely to have meaning only for some individuals in the second. However, if you are doing this activity in class, you will want to mix them up, so that there is no discernible pattern in your presentation of each type.

More likely to achieve widespread acclaim	More likely to be valued by an individual
Rembrandt: *Young Woman at Half-Open Door*	*Clown* painted on velvet
Ballet dance by Polina Semionova	*Ballet dance* by 4-year old student
'Smoke Gets in Your Eyes' by The Platters	'Ordinary People' by John Legend
'Fire and Ice' by Robert Frost	A limerick
The *Mona Lisa*	*After the Mona Lisa* by Devorah Sperber (made out of spools of thread)
Beethoven's *Moonlight Sonata*	*After Beethoven*, a sonata composed by a computer program called Emily Howell at the University of California at Santa Cruz

This activity is a good one for discussing the question of why having artistic features is insufficient for achieving lasting greatness in the arts.

Some of these pairs provide quite arguable choices: students often will defend the John Legend song, for example, because they are familiar with it. It is, however, already much less famous than it was when it was first released, while The Platters' song has already shown lasting power for 60 years. This pairing provides a good opportunity to discuss predictability in the arts.

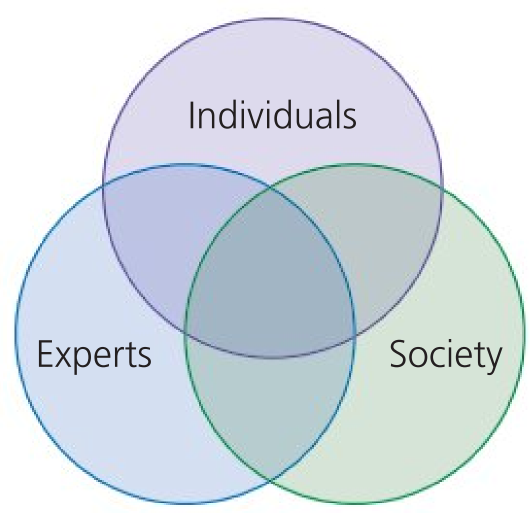
The pairing of Frost's poem and a limerick can also be an interesting one – especially if you choose an old limerick which has shown itself to have lasting power for a good many years.

The two versions of the *Mona Lisa* are also somewhat problematic: the original has been famous for 500 years, but the Sperber version has been exhibited in several different major museums, including the Brooklyn Museum in New York City. You can complicate this discussion further by including a 'painting' that scientists at the Georgia Institute of Technology created with an atomic force microscope on a surface less than one-third the width of a human hair – use the QR code on the left for a link to the website.

Many other pairings are possible, of course, depending on which ideas about art and the knowledge we gain from art you wish students to discuss.

■ Combining the three perspectives

One final important point to make, which is not made in the student book, is that these three perspectives on the interpretation of art are not entirely independent from each other – they all have some shared values, and so there are times when their perspectives overlap. The diagram suggests one way in which this overlap can be represented. The curved triangular space in the middle is the spot where all three of the perspectives overlap.



ACTIVITY

1 Have students discuss the features of each of the perspectives on what constitutes quality art.

2 What do each of the three entities care about and look for? What distinct differences are there among them? That is, what does each entity value that the others do not? What do they all have in common?
The answer to that last question is what would fit into the central triangle in the diagram on the previous page, which represents the shared values.

3 Finally, does this diagram accurately represent the relationship among individuals, experts and society in terms of what they value in art? Should there, for instance, be more overlap between some of the perspectives?

4 Students can then design a new diagram which better reflects their thinking about the values of each of the three perspectives.

Concepts related to this activity are culture, interpretation, perspective, values.

A final question which can be raised here is that of how the artist's perspective fits in. We have been looking at the interpretation of art, which differs from the creation of art, but the artist will have a perspective on what any given work of his or her art means. Getting access to that perspective, however, usually relies on our interpreting the artwork, as that is the mode of communication that the artist has chosen.

SAMPLE RESPONSE TO A KNOWLEDGE QUESTION

Should your judgments about art be given the same weight as those of an expert?

The answer to this question often depends on the purpose for which someone is judging the art. A layperson's judgment about, say, an abstract painting should not be given the same weight as the expert's judgment if the purpose is to determine if the work of art should go into a museum. An individual's judgment about any work of art should count more than an expert's judgment if the question is: 'Which works of art do you love?' An expert's judgment might influence what art an individual loves if the layperson chooses to use experts' judgments as a means of educating themselves about art and about what there is to appeal to the aesthetic in a given work of art. An expert cannot, however, tell an individual that they must not love a work of art because it is no good.

Regarding the question of whether or not a particular work of art is good in terms of its ability to reach and affect an audience, the expert, as an individual member of the audience, and the non-expert individual have equal power of judgment. When the point of engaging with a work of art is for personal response, then all judgments are equally valuable. When the point, however, is teaching others or determining which art, from among all the millions of possibilities, will be valued on a societal level, individual judgments do not weigh as much as those of experts. An exception to this is where the individual's judgment aligns with the judgment of a preponderance of people in a society, so that the artwork becomes enshrined in culture because of its wide-ranging appeal.

Note: As always, this sample response touches on only some aspects of the question. One additional consideration that might be addressed in responding to this question is the problem of whether or not there are things we should prefer. Some people might be said to have more refined tastes than others, in which case, it might be said that their private judgments are better than the private judgments of other individuals whose taste has not been developed to be sophisticated or refined.

Methods and tools

By this point in the chapter, we have already introduced most of the key ideas about the methods and tools by which we create and interpret art, although we do not say so overtly.

In terms of the methods and tools for creating art, the discussion here brings us back to a point made earlier in the chapter during the discussion of the scope of art: virtually everything can be used as a tool for the making of art.

ACTIVITY

Exploring the inspirations and methods of making art

You can use one or more of the following activities to help students explore the question of where ideas come from to inspire a work of art, and what can be used as a tool for creating a work of art.

1. Ask students to take a photograph using a digital camera (a cell phone works fine for this), and then ask them to manipulate that photo to create an effect that they like. There are many free online photo editors that students can use, and they may even have photo editors and filters on their phones. The following series of three photographs shows an original photo followed by two different manipulated versions. Students can then share their work with others, and they can discuss which images are the most appealing or interesting and why. They should also consider the role of modern technology in allowing artists to create art.

2. Broadcast an image so the whole class can see it, and have all students try to recreate the image by drawing it by hand. Allow them their choice of implement (pen, pencil, crayon) – whatever is available. They can then share their drawings and discuss the differences in style, interpretation and effect of the medium.
3. Assign students the task of creating a work of art which can be brought into class. They can choose the subject, but they must use materials which are not typically considered to be the materials of art, so no paint, ink, pencil, clay or paper. You can choose whatever other materials you would like to restrict. Students bring in their art and discuss the decision-making process they went through, as well as the effect of the unusual materials on the final product.

Methods and tools for interpreting art

In terms of interpreting art, this section ties together many of the ideas which have been previously discussed, including:

- the use of close observation and interpretation of details
- sharing of ideas among audience members and experts
- the role of people's backgrounds, cultural experience and knowledge in contributing to an ability to interpret art.

An activity toward the end of the section (see page 427 of the student book) demonstrates the difference between the knowledge an individual viewer might be able to derive from interpreting a work of art when working alone and the knowledge that another individual (with different knowledge of the world and of symbols) might get – or which the first individual might get by engaging in conversation with the second individual about this work of art. The students' experience in their Language A classes should be a valuable resource when investigating the interpretation of art for TOK.

Ethics

KNOWLEDGE QUESTION

Relevant knowledge question from the TOK subject guide:

- Is the production and enjoyment of art subject to ethical constraints?

The ethics of making art

The first part of the ethics discussion recaps two ideas which we have encountered elsewhere:

- any practice which interferes with the ability to achieve the aim of the subject area is unethical
- societal mores constrain what actions may be taken in the pursuit of knowledge.

Both of these principles are at work in the arts as an area of knowledge.

In the arts, the primary aim is the sharing of the artist's worldview with an audience, so anything which keeps that from happening is an ethical violation. Forgery and any effort to pass off as original work something which is not the product of an artist's mind (or that of a group of artists working together) are, therefore, unethical. The student book gives the example of tourists being sold paintings made by elephants, which are sold as the original creative work of the animal, but which are, in fact, the result of a trick by the handlers.

The question of how societal values constrain artists is an interesting one, because very often artists push the boundaries of what is acceptable in a social context. The first impressionist paintings, for example, were received with shock and dismay, because they violated all the accepted rules for creating paintings.

This painting, *Impression, Sunrise* by Claude Monet looks quite familiar to us today, and raises no powerful sense of shock or revulsion. However, when it was first painted in 1872, one art critic, Louis Leroy wrote 'Impression! Wallpaper in its embryonic state is more finished!' ('Impressionism: Early Criticism').

KNOWLEDGE QUESTION

Relevant knowledge question from the TOK subject guide:

- Do the arts have the power to challenge established moral values?

In recent decades, the push against traditional materials and styles has reached into the realm of using human bodies and animals as part of art, resulting in artworks which have shocked audiences and, on occasion, led to the arrest of the artist and the owner of the gallery or museum which exhibited the artwork. One example of an exhibit which has been widely visited around the world, but which has also generated a great deal of controversy (which is not mentioned in the student book) is *Bodies: the Exhibition*, a collection of actual human corpses which have been preserved and prepared so that the internal systems can be seen by visitors – muscles, veins, the nervous system and so on are all featured in different bodies.

One example of a controversy surrounding this exhibit which arose, was an uproar in Australia after a story was circulated among activists that the bodies used in the exhibit included those of Chinese prisoners. The chief executive of the exhibition denied this charge absolutely, saying that they had provided all the necessary documentation for the exhibit to enter the country legally, and that all the bodies were from donors who died of natural causes (Mao). This controversy was by no means the only one that the exhibit sparked; there have been opponents pretty much everywhere the exhibit has toured.

A good discussion can be had about this exhibit in terms of whether the figures are art or science or both, and whether the work that was done is ethical or not. Students could discuss, for example, the question of which of the two claims about the Australia exhibit is the more credible and why. The huge interest and very large numbers of people who have attended the exhibition in cities around the world seem to have provided a stamp of general social acceptance, despite some people's objections. You can learn more about the *Bodies* exhibit by using the QR code on the left. The organization has also prepared a free digital teaching resource, which you can request.

Cultural appropriation

The student book chapter also investigates the problem of cultural appropriation, which is related to the idea that the purpose of art is for an audience to engage with the experience of an artist. Cultural appropriation would seem to be problematic in this regard: the question is whether or not someone who does not fully and deeply understand the culture that generated the original art, and develops artworks which are derivative of the original art, is functioning within the ethical constraints of art as an area of knowledge. This is not a simple question. The student book explores the example of Iggy Azalea, a white rapper accused of appropriating the music of African American musicians, as well as the example of non-Indigenous musicians appropriating elements of Indigenous music in their work (see student book pages 430–1).

KNOWLEDGE QUESTION

Relevant knowledge question from the TOK subject guide:

- What moral responsibilities do we have regarding art that has been created or published by other people?

Art and the character of the artist

Another important area raised about ethical practice in the student book is the question of what we are to do about artists whose work has long been praised for its brilliance, but who have later been discovered to have behaved in morally questionable or downright unacceptable ways. The question is whether the character of the artist affects the value of the art. Can, we might ask, a bad person write a good book? The student book includes a series of questions surrounding the ethical dilemma with which we are faced when we consider the character of an artist and its potential reflection on the quality of their work. The student book cites an article which provides an excellent basis for exploring the complexities and difficulties of this ethical question. Use the QR code on the left here to access that article.

KNOWLEDGE QUESTION

Relevant knowledge question from the TOK subject guide:

- Can we separate the moral character of the artist from the value of the artwork?

The arts and the formation of ethical knowledge

The final section in the chapter takes up the question of how art can influence people's minds and behaviour.

KNOWLEDGE QUESTIONS

Relevant knowledge questions from the TOK subject guide:

- Do the arts play a role in the development of our personal value systems?
- How important is the study of literature in our individual ethical development?

This is an aspect of the arts with which students might be quite familiar, due to their experience with studying literature in their Language A classes. The student book provides several examples of artwork which is intended to shape people's ideas and urge them toward a more moral existence. Students can be asked to come up with many other examples. Just listing the examples, of course, is not enough: they should then discuss the ways in which the art attempts to achieve that goal, as well as the conditions necessary in the audience for the artist's intention to be realized.

Conclusion

We have now encountered a number of themes and areas of knowledge with far-reaching effects on people's lives: politics, history, the natural sciences and the arts, for example, can all be seen to reach to almost every corner of human experience. In contrast to those other areas, however, the arts generates and disseminates knowledge from a perspective which is not limited to trying to discover what is outside of ourselves, but rather from the perspective of what is inside us – what we do with the things and people that we encounter as we go through our lives. The arts, it can be argued, are the most personal, and the most personally affecting, of all the areas of knowledge. In this, they provide us with a kind of knowledge which is fundamentally different, both in origin and in effect, from all the other topics we study in TOK.

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CHAPTER 13 Assessment in Theory of Knowledge

Introduction

Theory of Knowledge is a wonderful subject, one that you will undoubtedly agree enriches your teaching practice, even if it is tough going. The freedom and breadth of the subject provide an environment where students and teacher both can explore a wide variety of issues, perspectives and approaches. However, this breadth comes with some downsides. Because the final answer in TOK is (almost) never as interesting (or as important) as the processes and analyses that lead you there, you may have already found that assessment can pose a challenge. What sort of activities should you be grading/marking? What are the best types of feedback for the subject? What form of feedback should you offer? How do you tell the difference between a good and a less good TOK response?

In this chapter we hope to provide some general ideas for framing your own thinking through these questions, some suggested activities to help make your in-class assessment useful and effective for better learning, and to provide a focused look at the two formal assessment elements of the course: the essay on a prescribed title and the TOK exhibition.

We certainly do not want to suggest in any way that your own instincts about teaching your students need to change significantly now that you have found yourself inside a TOK classroom. You have your own methods and these need to serve as the foundations for your TOK teacher journey. Being a good TOK teacher is just another subset of being a good teacher. Focus on good teaching habits and these will naturally benefit your TOK teaching.

As an introduction to the chapter, perhaps we should think about the scope and nature of TOK and how this might relate to the nature and methods of the assessment. TOK is a unique subject and this will have certain consequences for our assessment and our expectations for what good assessment will look like. A few important points about TOK are outlined here.

- **TOK is open-ended**: This means that rarely are the questions we ask in TOK going to be black or white, yes or no, true or false. As they develop their own arguments, one of the most frequent questions students will ask their TOK teacher is, 'Can I say …' followed by a perfectly reasonable point focused on knowledge. The answer to this is nearly always, 'Of course you can, if it fits with the argument you're making!' This opens the door for any number of different responses to any questions asked. In the TOK-sphere there are a number of formulaic, step-by-step processes which are touted to provide excellent TOK essays and exhibition write-ups. Please take these with a grain of salt and encourage your students to do likewise. Because the course is so open-ended, you will undoubtedly find as many good ways to respond to a TOK question as there are good TOK students. One-size does *not* fit all, thankfully.
- **TOK is not a course driven by subject-based content**: Teachers often fret because they feel they do not have the subject-specific content knowledge in all the subjects. As we have said before, the students will likely be the content experts in most of the disciplines you explore in your class. This means that most of the work you set for your students will not be *knowledge*-based assessments. The subject-specific knowledge should be drawn from their own classes and used in a TOK way in your class – *that* will be the focus of your assessments. Questions perhaps about the main elements of the scientific method, or understanding quizzes based on reading material of course would be relevant, but most of the analysis will need to move beyond just comprehension and provide opportunities to create and articulate personal arguments.

- **TOK is inherently trans-disciplinary and comparative**: This means that there are almost an infinite number of different ways that ideas and concepts can be compared, differentiated, used or analysed. This means that it is possible that *everyone* can be the smartest person in the room. Again, this is a strength of the course, and we wouldn't have it any other way.
- **TOK is difficult for everyone in the room (teachers included)**: TOK is something that the students have never really encountered, so they will undoubtedly struggle, finding themselves somewhat adrift at times. TOK teachers also may have never encountered anything like the subject in their own training and now suddenly find themselves in front of a roomful of eager, though slightly befuddled students having to 'teach' it.

All of this means that giving a definitive assessment of student work is a real challenge. In many school environments, the grades students receive during the year are made up of school-based skills and criteria, whereas in other environments the final IB assessment and criteria are used to evaluate students. At the same time, these facts suggest that the TOK teacher has quite a degree of freedom in relation to how they 'assess' their students. First and foremost, we should not be thinking of the course as a preparation for some final assessment. The true value of the course is found in the day-to-day teaching. The assessment is really another opportunity for the students to demonstrate their new skills and dispositions, and it is these new skills and dispositions that will provide long-term benefits, not the core points that they receive.

This is not to say that we think that the final TOK assessment is not important. Of course it is, and it is vitally important that students and teachers think critically and carefully about the nature of the final assessments and strategize about how to best approach them and make every attempt to calibrate them to the expectations of the senior examiners of the course. Preparing our students for their final assessments is, of course, an important aspect of our roles and we would be negligent if students were not properly prepared. This will be the focus of the latter half of this chapter.

So, what is 'best practice' in terms of evaluation of our students' abilities?

In-class assessment

Formative, not summative

Our advice is to focus your assessment strategy, and the students' understanding of what they are working towards, squarely on skills, not outcomes. Your students should think a 'good' essay is one which develops a convincing, clear and well-justified argument.

Given that we are aiming for long-term benefits (extending even beyond the end of their IBDP), our approach towards assessment should always be aimed at formative assessment rather than summative. Formative assessments include all the strategies, monitoring and interventions designed to further a student's understanding and abilities, and are closely tied to actual instruction or teaching. Summative assessment is generally offered at the end of a process and would also include any static judgment of the student's work at a moment in time against some criteria.

In the practice of teaching, of course, there is a place for summative assessment and indeed, giving static grades against the criteria is a good way for students to know 'where they are' in relation to some objective standards. In some contexts, a certain amount of summative assessment will be required, too. However, in terms of motivation to improve, there is evidence that receiving a grade/mark actually stifles improvement (Butler). Ruth Butler's research suggests that effective formative feedback did more to improve student progress and motivation than did either summative feedback alone (static grades or marks)

Offering quality formative feedback is more likely to aid student improvement than static summative judgments

or summative feedback accompanied by formative feedback. We have all seen it: you spend hours marking, giving specific and detailed feedback, only to see the students ignore those comments and flip straight to the grade at the back.

It is up to us, then, to do two things when it comes to assessment. First, we must provide exercises and activities which give students the opportunity to develop those skills and dispositions that are important and those that will help them do well in the exams. Second, we must provide feedback on students' work that will support that goal as well. It seems that putting a grade or a number on their work actually makes students less interested in progress, even if you also include feedback on how to improve.

Feedback advice and ideas

We are not going to tell you the best way to give feedback – these are general skills in which you will likely already have a wealth of experience, but we will offer some important advice. The activities here draw heavily on the official assessment criteria for the essay and the exhibition. In some contexts, there may be other local or school criteria used throughout the course in addition to the official IB criteria. The activities can be altered as needed. The point in each case will be to shift the conversation from grades to skills and your local or school criteria will (hopefully) also be based on skills.

RESOURCES

Even the best of us could use some inspiration and ideas when it comes to classroom interventions as we prepare our students for the future. Here are some resources that we have found helpful.

- ✔ **John Hattie and his 'Visible Learning' research**: John Hattie from the University of Melbourne has conducted meta analyses of over 1600 other meta analyses of 277 different interventions that teachers and schools provide and has ranked them according to how effective they are in terms of student achievement (Hattie).
- ✔ **Project Zero: Visible Thinking**: Coming out of Harvard's Graduate School of Education, the researchers at Project Zero have been exploring learning, thinking and creativity since 1967. The Visible Thinking project seeks to develop routines and activities for classroom use which *show* students' thinking processes and provide opportunities for teachers to intervene in this process. The second QR code links to 'Thinking Routines'.

- ✔ ***Intellectual Character: What It Is, Why It Matters, and How to Get It*** by Ron Richhart: Richhart explores the concepts of intellectual character in terms of the dispositions of a good student. Much of what he identifies is clearly visible in TOK classrooms. Use the first QR code on the left to read about Richhart.
- ✔ ***Cheating Lessons*** by James Lang: Lang argues that academic dishonesty is most often a (poorly chosen) strategy by students who are responding to infrequent, high-stakes assessments focused on performance and outcomes. He argues that better assessment strategies put in place by teachers will both create disincentives to cheat ***and*** lead to better learning. He suggests that frequent, low-stakes assessments focused on ***mastery*** of the content and skills promotes better learning. (For further details, see 'Works cited' at the end of this chapter.)

The activities on the next few pages are designed to prioritize formative feedback and to focus the students' attention on progress not outcomes. These activities are designed to encourage reflection at the level of the skills highlighted through the assessment criteria, not to focus their attention on your judgment of outcome.

ACTIVITY

1. Set an essay or longer writing assignment and take in the students' work.
2. Make a copy of that work, so students have access to a *clean* copy.
3. Read and comment on your own copy of their work.
4. Make a static summative judgment (a letter grade or numerical mark) on a separate sheet or in your grade book (depending on your local context, you might need this for progress reports).
5. Return the students' *clean* copies and give each student a copy of the relevant assessment criteria. Make sure that enough time has elapsed so that they are approaching their work relatively fresh. Usually a week is sufficient.
6. There are a number of different routes to take now in terms of how you offer them feedback or encourage them to develop their own feedback and targets. Here we offer just one approach.
   Ask the students to read their own work and highlight where they think they have met specific elements of the criteria well, where they think they could do better and where they have genuine questions about whether they have met the criteria well or not.
7. After they have recorded their own reflections and comments, give back your own copy with your comments (but *not* your final summative grade!).
8. Meet with the students individually and discuss where there they think they did well, and where *they think* they need to improve. It is during this discussion that you can guide them into an understanding of where they might target their improvement. Let *them* guide the discussion, asking prompting questions like those below. Try to use specific references to the assessment criteria throughout this discussion. The goal here is to shift the discussion away from a summative mark, and onto their own skills and their own understanding of the assessment criteria.
   a. On second reading do you think your argument was clear? What about it made it clear and what about it made it less clear?

b What elements of the assessment criteria do you feel you need to understand better?
c What do you think you did well?
d Where did you show 'sustained focus'? Do you think your focus may have wavered anywhere?
e How effective do you think your use of examples were?
f What did your evaluation of other points of view add to the overall effectiveness of your argument?
g Important: What do you want to work on to improve your writing in the next assignment? Note this target down and try to remind them of it in the next assignment.

9 Optional step: Ask students to use the criteria to give themselves a grade and to justify that grade. You may find that they have already reflected on their own work and the assessment criteria enough to move forward without a grade. Some students might not even want a grade at this point. If they do want a mark, you might just ask, 'If you think you want a grade, choose one and let me know what it is' or, 'Why don't we agree on a level rather than a grade?'

Here too you can say, 'Hm, I think that you might have been too generous there, for these reasons' or, 'Actually I think this section might be better than you've given yourself credit for.' Most students will *under*estimate the quality of their work.

If you think that their grade or level is *reasonable*, tell them that they can have it! The idea is that the discussion you had with them is far more important to you and to their process towards improvement than the grade. Of course, letting them choose their own grade needs to be taken with a grain of salt; your own context may make this unfeasible, but you might be surprised at how reasonable the students can be when it comes to this exercise. Managing the discussion well will usually result in the student choosing a grade that you are happy with. Whatever the case, they generally will pick up on the idea that the mark is not the important bit, the reflection and the skills in the assessment are.

ACTIVITY

1 Ask the students to create a running list with two main categories:
- Things which generally raise examiner's marks that I should do.
- Things which generally lower examiner's marks that I should avoid.

2 This list can be a display in your classroom using Post-it notes, or it could be a page in their folder or an online shared document. You might even develop a worksheet where the assessment criteria for the essay and exhibition are broken up into discrete sections, and advice on how those elements of the criteria might be shown is given for each. An example is available by using the QR code on the left.

ACTIVITY

For shorter assignments (perhaps practice analysis for the exhibition), after students have completed their work, ask them to read through it again and annotate the work themselves, highlighting where they think they met the criteria well or have questions about whether or not they did. They must provide annotations (either in the margins or coded onto another piece of paper) – highlighting passages is not enough.

Your feedback then is a direct response to the comments and annotations that they offer – nothing more. If they are not reflecting on their own work, then your feedback will be quite sparse! The better they are at reflecting on their work and asking questions about it, the better the feedback they will receive.

ACTIVITY

After a unit or section has been completed (or anytime, really), ask the students to bring in a real object or objects that they think can be used to illustrate the main points they identified in that section or one or more of the IA prompts that related to the material covered. A number of activities are possible:

1. Have a couple of students present their objects to others, justifying their choice.
2. Other students are tasked with trying to work out how the object is related to the unit.
3. Students practise writing about that object in relation to one of the 35 IA prompts offered in the TOK subject guide.

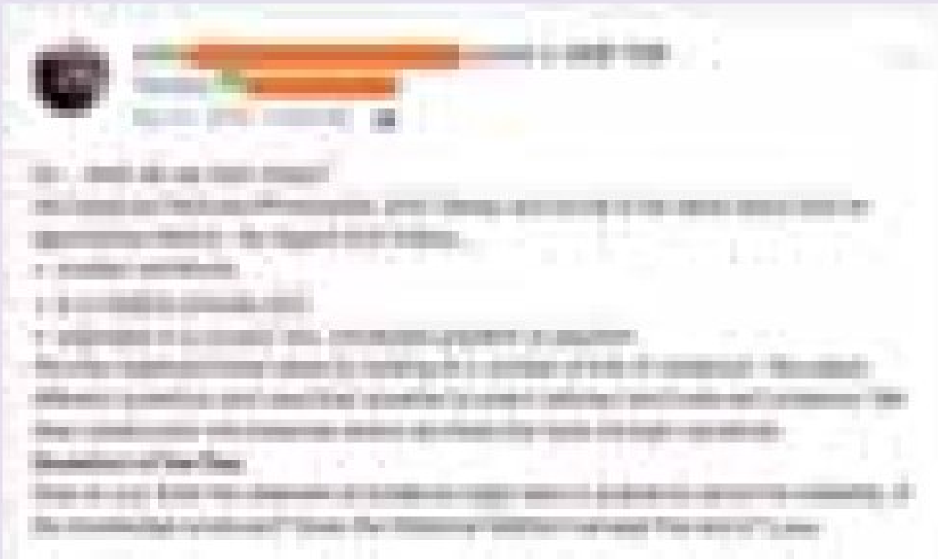
As this activity is quite open and low stakes, it does not warrant a summative mark. If you do offer feedback, do so in relation to skills highlighted in the assessment criteria in an effort to help students understand the sorts of things which tend to make their work stronger.

ACTIVITY

This is an ongoing (little and often, low stakes, focused on mastery) assessment titled: ‘So, what did we learn today?’, in which students respond to short prompts from the teacher. At the end of the lesson, the teacher very briefly summarizes the learning, not the task, and asks a question designed to push that learning in a new direction with a ‘Question of the day’. Do not set a word count. This task is easy with certain online learning platforms like Edmodo, Google Classrooms or OneNote, but could be developed in all sorts of ways. You might then offer a quick reply to the student’s comment to continue the conversation.

Here is an example from the ‘Lesson plan: The role of selection in history’ (page 252) in Chapter 11 of this book. Notice that even without a minimum word count the response is reasonably full. Over the course of a few weeks, students amass quite a bit of writing, so when you start setting the first ‘long’ essays (800–1000 words maybe), you can remind them of all the writing they have already done without even noticing.

Here is an example of a response along with the teacher's reply.



The teacher summarizes the learning as they want students to extend their thinking, not merely review the activity.

The 'Question of the Day' then pushes that learning in a new direction.

The student links the learning to the activity herself.

She takes it upon herself to develop evaluation and develops her own further questions.

Her response is focused on the question set (reliability and the historical method) which is good. She might need more evidence to improve, but that wasn't the task.

The teacher's response is designed to keep the conversation going, indicating to the student where she might have developed the response further.
It was not important here to get overly critical or explicity set targets for the future. These are meant to be *conversations*, not 'assessments'.

Course aims and assessment objectives

Finally, in relation to in-class assessment, we would like to point out that the TOK assessments are still opportunities for teachers to develop activities which promote the aims and objectives of the course. Just because the students have shifted into assessment mode, does not mean that we cannot provide a framework or structure to help them learn new skills or further embed learned skills.

We have included the aims and objectives here and highlighted in blue text the skills that a well-planned assessment process might further develop.

Aims

The aims of the TOK course are:

- to encourage students to reflect on the central question, 'How do we know that?' and to recognize the value of asking that question
- to expose students to ambiguity, uncertainty and questions with multiple plausible answers
- to equip students to effectively navigate and make sense of the world, and help prepare them to encounter novel and complex situations
- to encourage students to be more aware of their own perspectives and to reflect critically on their own beliefs and assumptions
- to engage students with multiple perspectives, foster open-mindedness and develop intercultural understanding

- to encourage students to make connections between academic disciplines by exploring underlying concepts and by identifying similarities and differences in the methods of inquiry used in different areas of knowledge
- to prompt students to consider the importance of values, responsibilities and ethical concerns relating to the production, acquisition, application and communication of knowledge.

Assessment objectives

Having completed the TOK course, students should be able to:

- demonstrate TOK thinking through the critical examination of knowledge questions
- identify and explore links between knowledge questions and the world around us
- identify and explore links between knowledge questions and areas of knowledge
- develop relevant, clear and coherent arguments
- use examples and evidence effectively to support a discussion
- demonstrate awareness and evaluation of different points of view
- consider the implications of arguments and conclusions.

The activities and suggestions outlined in this section have all been developed as opportunities to further embed these general TOK skills. The final outcome of these processes may well be a strong exhibition or essay, but teachers should also be aware of the learning outcomes available. Some of the students' best learning will happen when constructing their assessment products.

Formal assessment

As mentioned above, the official assessment in TOK is relatively light handed. There are no written exams, there is no specification full of content, no surprise questions with a five-minute reading time. A full one-third of the assessment is largely under the full control of the student and the rest is an essay, the title of which they receive six months before they have to submit.

Table 13.1 Summary of assessments

Essay	Exhibition
Student essay in response to one prescribed title (PT).	Student-curated exhibition of objects which illustrate issues related to a knowledge question.
Students choose one title to respond to out of a choice of six. Prescribed titles will often reference specific AOKs and students must refer to those AOKs.	Students choose one IA prompt out of a choice of 35. Students choose any three objects they wish to discuss in the context of the IA prompt.
Two-thirds of final TOK score. Essays receive a mark out of 10, which is then doubled to make a mark out of 20.	One-third of final TOK score. Exhibitions receive a mark out of 10.
Externally assessed by IB examiners.	Internally assessed by TOK teachers in the school, but externally moderated by IB moderators.
Up to 1600 words. Footnotes, references and title are not included in the word limit.	Up to 950 words total, including their commentary on each object. Footnotes, references and title are not included in the word limit.
Each essay is submitted to IB via IBIS.	A sample of school's work is requested by IB for moderation and uploaded via IBIS.

How are the assessments assessed?

Global impression marking

Both the essay and the exhibition are marked against 'global impression' marking. The assessment criteria for both can be found in the TOK subject guide on pages 47 and 48.

Global impression marking is the name given to the sort of marking based on an examiner's overall view of the work.

In some IB subjects or components, the assessment criteria come in groups where each group evaluates a different skill, and each is worth a few of the total points available. The extended essay, for instance, has five different criteria that are used to assess different skills.

TOK is different, in that all the appropriate TOK skills are woven together into a series of 'level descriptors'. The idea is that the examiner (in the case of the exhibition, this will be you) will be able to judge in general terms whether that piece of work is of a really high quality, in the medium range or in the low range. Both the essay and the exhibition in TOK use five levels, with five being best. One of those levels will be a 'best-fit' even though there might be some inconsistency across all the different skills. In practice, examiners generally start at the lowest level and work up, looking for reasons to shift the student's work into the next level. If an examiner cannot find evidence for the next highest level, then they stop and that level contains the score the student receives. Then the examiner makes a judgment about whether the student's work is nearly the next level or barely into this level, which then provides the mark out of 10. The essay's mark is doubled to count for up to 20 marks out of a total of 30 for TOK.

To fit best in the top level, the work should demonstrate genuine ability in a range of skills. More excellence across a range raises the level, less excellence across the range dampens the mark. This means that the student's work does not have to be perfect in every way!

There probably is no such thing as a perfect essay or exhibition, but the global impression marking tool allows examiners to weigh minor problems against an otherwise very strong piece of work and still award high marks. The student's job is to give examiners all the reasons they can for the examiner to see that overall excellence and award the top marks.

Examiners, standardization and moderation

The examining and moderating for TOK are all completed online using an online assessment program. All essays and exhibition write-ups are delivered to the IB electronically, then delivered to the individual examiners. Examiners then mark them using the online interface.

TOK examiners do all their work online, without knowing who they are examining or moderating

Your students' essays are randomly distributed across eligible examiners. Your moderation sample for the exhibition is moderated by a single moderator, but the moderator won't know which student belongs to what school. Both essays and exhibition write-ups should be entirely anonymous; blind assessment provides another layer of reliability.

TOK examiners are just TOK classroom teachers like you (this is a requirement for the job); they simply also have signed up to be examiner. To do so, they need to have passed a rigorous process by which they first read a number of essays to standardize themselves, meaning they calibrate their expectations and application of the criteria to that of the senior examining team. They then must 'qualify' by blind marking test essays: if they mark within the tolerance factor (usually one mark either direction) then the examiner passes and moves on to live scripts. Hidden amongst those scripts are 'seeds' which, unknown to the examiner, have already been marked by the senior team. Provided that the examiner continues to mark those seeds within tolerance, the examiner is allowed to continue. If the examiner starts to fall outside of tolerance, they will not be given further scripts and what they have marked may be re-marked by other examiners.

Moderators for the exhibition are standardized and qualify in the same way as essay examiners. Moderators, however, do moderate the whole school's sample, although the schools are randomly distributed to the moderators so they do not know what schools they are moderating until after their marks are recorded and they begin the process of feeding back to schools. If you receive no feedback on your moderation, it is because your marks were upheld: no feedback needed.

Moderation is done through a process called 'dynamic sampling'. This means that first teachers send in a sample usually of five, eight or ten, depending on the size of the cohort. Then a small sample will be given to the moderator. If the moderator agrees that the teacher has applied the assessment criteria properly, then the rest of the school's marks will be upheld. If, however, the moderator feels that the teacher has been too generous or not generous enough, then the rest of the samples from those the school sent will be given to the moderator and they will moderate. Again, this process is anonymized so the moderator only knows what is immediately before them; they do not know whether some, all, or none of a school's sample has needed moderation. Once the moderator has seen all the samples from a school, a 'moderation factor' is determined and applied to the whole school's cohort. Sometimes that factor means that marks might change depending on where they are in the range of marks available (lower scores might be raised for instance, while those in the middle stay). This process of moderation is common across exam boards and is consistent with industry standards. Here the 'disagreement' does, however, mean that the teachers' marks are altered, and this can be an uncomfortable process. The aim is never to chastise teachers, however; the idea is that a single standard of assessment must be applied fairly across all 100 000 plus TOK students. Do not get caught up in whether you 'agree' or 'disagree'; think of this as a process of 'calibration'. You want to calibrate yourself to the standard and you want to apply the criteria in a standardized way. Keep up to date with the subject reports, the teacher support material and the materials provided at workshops to get and stay calibrated.

ACTIVITY

After you have developed some confidence in your TOK teaching, sign up to be a TOK examiner or moderator. The regulations require that you have been teaching TOK for some years. Check the experience requirements for TOK by using the QR code in the margin.

There are three good reasons to be an examiner.

- It is excellent professional development. Learning about how the process works from the *inside* gives you a much stronger sense of just how the assessment criteria work and how they are applied to real essays and exhibitions. It provides a level of confidence when discussing the criteria with students and colleagues. It also puts you in a position to be charitable to those examiners who are examining and moderating your own students' work.
- You can also use your experience and insight to help your students develop the skills for which they can receive higher marks.
- Finally, we need to support the IB and the IB assessment process. As teachers who (hopefully) believe in the value of the course, we ought to support the course by engaging actively with the whole process. IB examiners are all working IB teachers just like you.

Academic honesty

Teachers and schools are responsible for ensuring that the students are aware of the importance of academic honesty and how they can maintain it. This includes both making sure the students know how to identify useful resources and know how to effectively cite those sources. They must know how to effectively and honestly collaborate and how to accept and act on the advice of their teachers. Teachers should try to create a process that guides the students effectively, but at the same time ensures that the work is authentic. Academic dishonesty is more often than not a strategy employed by students who feel overly anxious about their work or might be under huge amounts of stress due to time constraints. In an environment with effective benchmarks, deadlines and helpful feedback processes, students are less likely to feel the need to cut corners. See your IBDP coordinator for more information about your own school's policies and the IB's academic honesty regulations.

TEACHING TIP

When it is time for students to turn in drafts and final essays, run them through a plagiarism checker, which should compare your students' essays with other material on the web. Turnitin.com is a useful tool. It compares the students' essays with material on the web, highlighting comparisons where the student may have lifted material, and gives you a percentage of how much of the student's essay has been found on the web. Teachers then need to go through the results and identify anything which may have been lifted dishonestly. If plagiarism is found by the IB, this will have severe consequences, including losing out on the full Diploma award. It is better for the school to ferret out any problems than the IB.

Note the following:

- The IB does have its own plagiarism checking procedures which it runs on all student-submitted work.
- The percentages need to be manually checked because material that is properly cited and referenced will still be picked up in a comparison.
- The wording of the actual *title* will be picked up as other TOK students upload their own essays to the plagiarism checkers.

General guidance

- Remember that TOK is less about the assessment and more about helping students become critical, responsible and reliable constructors of knowledge.
- Remember that sometimes you might need to work hard to *calibrate* your expectations for the essay and the exhibition to the standard of the senior examining team (just like essay examiners have to standardize to the senior examining team).
- There are only three official documents or sources of information for TOK and a careful engagement with these will answer most of the practical questions around the logistics of the course that teachers have. There is a wealth of other sources (social media groups, websites, colleagues at workshops and conferences) but rumours and disinformation spread through these like wildfire. The three official sources, in order of importance are:
  - the subject guide
  - the subject reports
  - the teacher support material.

RESOURCES

- ✔ At the end of every session, the senior examining team will write a report about how the session went. Generally, they will identify good and bad points, hoping that teachers will emulate the good things and avoid the bad things in the future. The subject reports for past sessions are available, and although the subject guide has changed, the assessment advice for the essay and for general TOK skills will still be helpful to you. These will appear on MyIB about four or five months after the assessment session and really are required reading for teachers.
- ✔ Further discussions aimed at a student audience about how to prepare for the essay and the exhibition are included in *Theory of Knowledge for the IB Diploma: Skills for Success 2nd edition* by John Sprague, published by Hodder Education. While written for students, teachers will undoubtedly also find it useful.

The TOK essay

The TOK essay is an excellent opportunity for students to construct and present their own TOK ideas in the context of the titles set by the IB. Earlier, we discussed the aims and objectives of the course and we want to remind teachers that the processes you put in place can either support the wider learning objectives or not.

For example, if an aim of the course is 'to encourage students to reflect on the central question', how will your process provide guidance so they can learn how best to do that? Perhaps you want to use your assessment process to further embed skills related to the objective 'develop relevant, clear and coherent arguments'. One of the key opportunities here is to give students the freedom to make their own choices, take responsibility and earn the success we hope they will achieve. We want students to develop the essay that they can develop, not write an essay that pleases us. The TOK essay is one of the places where students can demonstrate their creativity, adventurousness and confidence. Whatever process you develop, try to weave these opportunities into it.

You might like to phrase the opportunity that the essay presents in terms of the attributes of the IB learner profile: risk-takers, thinkers, reflective, communicators, knowledgeable, balanced, open-minded, etc.

The TOK essay is worth 20 points of the total 30 available for the TOK final score, meaning it is weighted twice as heavily as the exhibition. Examiners will mark the essay against the criteria, assign a mark of out 10, but then that mark is doubled. This doubled mark is then added to the points awarded for the exhibition and a total mark of 30 is assigned to the student. So, if a student receives a 6/10 on the essay from the examiner, the IB considers that a 12/20 and then the marks from the exhibition are added. If the student then received a 7 on the exhibition then the total score would be 19/30 ((6 × 2) + 7 = 19).

TEACHING TIP

Many students choose to develop a response to their chosen prescribed title that pushes the boundaries of the idea of 'essay'. Students sometimes want to write in dialogue or in the form of a fictional narrative, for instance. Generally speaking, the idea is that if students can obviously and explicitly meet the elements of the assessment criteria, then they can choose any form they wish; an argument, after all, is distinct from the form of narrative. In practice, however, this does not really pan out. It takes a hugely gifted writer to develop a response to a prescribed title in the form of a Socratic dialogue. Often in these cases, students get caught up in the form of the writing and sacrifice clarity, precision and relevance of argument. Our advice, and this might fly in the face of what we have said about student ownership, responsibility and risk-taking, is to use the TOK essay to show excellence in the essay genre, leaving the dialogues, poems, fictional narratives or stage scripts for the lower-stakes format of the classroom.

While risk-taking is an important attribute for IB students, taking the right risks during their assessment is an important skill to learn

The prescribed titles are released about five months before the date they need to be uploaded to the IB, which gives schools plenty of time to develop a process which will support the students in the writing of the essay.

■ The three interactions

The TOK subject guide (page 44) outlines three 'interactions' which teachers are expected to manage with each student. This is, on the one hand, to help give the process structure with effective interventions, rather than just 'letting the students get on with it', and on the other, to set clear guidelines in place to help teachers avoid giving the students too much support. This is a common dilemma in assessment: we teachers need to provide opportunities for responsibility and authenticity, but at the same time guide students so that their best efforts can come out. The three required interactions are listed below:

1 Discuss the list of prescribed titles with the student.

2 Discuss the student's initial exploration of their selected title (for example, an essay plan).

3 Comment on one draft of the student's essay.

Although you must adhere to this schedule and have each of these three interactions with each of your students, below we have suggested a slightly expanded five-stage process, incorporating these three interactions, to allow students to fully develop and communicate their ideas.

1 Brainstorming each title.

2 Developing an argument.

3 Crafting the argument into an essay.

4 Reflecting on a full draft.

5 Finalizing the essay.

What follows is a short exploration of each of these stages.

Stage 1: Brainstorming each title

Collusion is a genuine worry in schools and teachers need to develop exercises which can show students responsible collaboration. The lesson plan below presents a framework for a collaborative brainstorm, which can be used as a first step in the process to help students understand key ideas, unpack challenging concepts and develop their initial ideas in a mutually supportive and collaborative environment. Brainstorming is not new to teachers and there are a million different ways to do this. We offer our version as a useful way to start the essay process, but also to support the wider learning objectives of the course.

LESSON PLAN: COLLABORATIVE BRAINSTORMING

Introduction

This activity is designed to provide ideas and break open the prescribed titles which can seem utterly opaque at first glance. The activity is also entirely student run: it is far too easy to impose our own ideas on what we think the students should be doing in their essays. We as teachers need to be aware of a few things, however:

- It is not our essay. Our role is to provide opportunities to develop students' own essays and their own authentic approaches to the topic.
- They might think you are the 'expert' so they might dutifully put in whatever you say, so be conscious of your influence.
- Their work needs to be authentic, and this should start from the very beginning.
- Through this activity we can help students develop control, ownership, responsibility, pride and genuine achievement.

Consider the general aims and objectives of the course and the learner profile and the IB approaches to learning.

Of course, you have a part to play here through the guiding questions that you will be dropping in throughout the lesson. The idea is that the class is having a discussion and you are part of that discussion, but you must be aware of your influence. A good practice is to have a brainstorm, just like this one, with colleagues in your TOK department or others in the local community. This will help you understand the titles and provide you a bit of an advantage in your classroom discussions, which you can use to contribute.

Note: This activity should not be the first time you have thought about these titles!

Students will chair their own discussions. The chair must manage the discussion, making sure that all voices are heard, that the important elements of the discussion guide are met. A good chair will ask probing and interrogative questions.

From the teacher's perspective, please remember the following:

- There is no need for the brainstorm to be perfect.
- The students' discussion will not capture all the things that you think are really important. You might have to live with that, but …
- Students will catch ideas that you had not thought of!
- Students will not need to be as sophisticated at this stage as they will need to be later, so uncritical thinking is okay.
- You can help bring the ideas into better focus at later stages through discussion and feedback.

Teachers less comfortable in low-guidance activities may find some of this difficult.

Aims

Students will:

- understand the key elements of the prescribed title (PT)
- effectively collaborate with others.

Objectives

Students will be able to:

- discuss various elements of the PTs
- create a record of the discussion which can be shared with all students.

Required resources

The scribe needs to be a pretty good typist. You might choose this role, which gives you some guidance on how to articulate ideas.

- A chairperson.
- A scribe (this might be you): someone who can record the highlights of the conversation in a way that will be distributable later.

Activities

The chairperson uses the following framework to initiate discussion. A scribe uses this framework to record ideas to be distributed later. A blank electronic form can be found using the QR code on the left.

Command words

- What *precisely* are the command terms? They are usually something like 'To what extent …' or, 'Discuss …'.
- In some cases, the students won't have an explicit command term.

Key concepts

Students *do not* have to include dictionary definitions when exploring key concepts!

Here students identify what concepts are important in the title. Often the success of the essay depends on the students carefully unpacking key concepts.

Guiding questions/embedded knowledge questions

Be careful not to let students get caught up in answering any KQ that is NOT directly related to the PT. Any treatment of these sub-KQs *must* be part of an explicit response to the PT.

Some PTs imply other knowledge questions (KQs). For instance, one recent question asked students to discuss the following claim: 'Present knowledge is wholly dependent on past knowledge.' Here there are important KQs embedded in the claim, which can be used as 'stepping-stones' to a full response to the title, for example, 'In what ways might present knowledge be dependent on past knowledge?' or, 'How do the methods of <AOK> build upon the past knowledge of experts in the field'? There are countless others but identifying some might provide an opening that students can use to pry open the title.

Useful AOKs to explore (in addition to AOKs prescribed by the PT itself)

Very often the *first* connections are not the best. Getting them out into the harsh light of day for evaluation early is good.

When given the choice to choose an area of knowledge to use in their response, students should look for choices that are interesting, informative and perhaps unique. Here students can identify possible AOKs that will be appropriate to the title.

Knowledge framework elements

The knowledge framework element might be a good way for students to put constraints on their analysis, rather than just streaming their ideas as they come.

Here students might identify elements of the knowledge framework which can illuminate the prescribed title. If the question is asking students to consider the claim 'Robust knowledge requires both consensus and disagreement', they might choose to explore this in terms of competing perspectives within or across AOKs, or perhaps through focusing on the methods of the AOKs, or even whether the scope of the AOKs allow for disagreement.

Connections to core theme (role of individual knower)

The new core theme should never be far from your thinking. How does the individual knower's perspective illuminate the tensions and dilemmas in the title?

Opportunities for analysis

This is where much of the brainstorming naturally leads. The scribe should be noting down broadly the ideas that come up. 'Maybe you could argue that …' signals material that could be recorded here.

Pitfalls

This is a good place for teachers to make their thoughts known by way of guidance for what *not* to do.

It is always a good idea to take time to think about what a student could do if they wanted it all to go horribly wrong.

Follow up

Teachers must guarantee that the notes get distributed. You might also remind students after they have made their choice of which title to answer to revisit the brainstorm.

Stage 2: Developing an argument

The second and third stages are important to see in relation to one another because they should be treated as distinct. Identifying and making decisions about what to put in the final argument is a distinct task and requires different guidelines and skills than presenting ideas in the form of an essay. Breaking these stages up will help teachers differentiate their interventions and being aware of these stages will, ideally, help slow the students down and get them to apply different skills (thinking and presenting/writing) at the appropriate times.

You might have several conversations with students like the following:

Student: 'Miss, what should I put into my introduction?'

Teacher: 'Good question. What is your argument?'

Student: 'I don't know yet.'

Teacher: 'Then how can you decide the best way to introduce your argument?!'

TEACHING TIP

Breaking up stages two and three this way is an idealized case. Students do not have forever to get writing and many of the decisions they need to make will be made in the writing of the final essay. Still, characterizing these stages as distinct will help students target their efforts and provide opportunities for you to differentiate the thinking skills required to achieve these aims.

The skills and processes needed to identify ideas and choose which to analyse are different from the skills needed when deciding how to present ideas in the form of an essay. To discover ideas and solidify an approach is key to this stage. Students will undoubtedly use writing as part of the process as they try to understand and articulate what they are thinking, but try not to let them mistake the writing they do at this stage for the writing that will be included in their final essay. Anything you can do to slow down the process of essay construction is helpful.

Your interventions at this stage are relatively open, but, as always, need to be constrained by general worries about your own influence versus student authenticity and responsibility. This is assessment, so we need to let the students do their best, not what we think they should do to meet the expectations of the anonymous examiner. You should never tell them what to do, or what to write, or how to write it. Often, simply having a discussion with them, where you are a participant, will provide the right level of guidance if they are struggling.

A useful piece of advice to remind your students of at this stage is 'curate your ideas, don't "stream" them'.

The following activities might prove fruitful at this stage in helping students to develop an argument.

ACTIVITY

Students will naturally want to fire up their word processor and start typing madly away. Harness that by giving them an argument frame to do this in. You can add more or less guidance to the writing frame depending on the students' or your own needs. There are also not too many constraints on your feedback at this stage. Remind the students to take this seriously so that you can provide good feedback.

The following headings might be helpful:

- What are your initial intuitions about how to answer the prescribed title?
- What elements of the knowledge framework might be relevant to a response to this question?
- What examples will you use to illustrate your points?
- Can you articulate (write out) those examples and the discussion you will use?
- If someone were to disagree with your argument, what would their position be? What examples might they use?
- How would you respond to someone who disagreed with you in this way?
- So what? Who cares? Why do you think this is an important question to ask in the first place?
- What implications of your argument do you think are important to discuss?
- What are the main points that your argument will develop (no need to use examples here)?
- Can you offer a one-sentence response (with no fluff, examples or details) which is a direct response to the prescribed title?

ACTIVITY

After the students have spent some time on their own essays, pair them up with students who are doing a different essay title and ask them to share their general ideas and approaches as 'critical friends'.

ACTIVITY

1 After the students have developed their ideas a bit, ask them to find an expert in the disciplines they are discussing and to share their ideas about that discipline with the expert. The goal will be for the expert to help the student gauge whether the examples being used, and the claims being made, are factually correct.

2 Does the student's handling of the content show some level of sophisticated understanding of the material?

TOK TRAP

Students are often drawn to disciplines in which they have no practice, knowledge or understanding, perhaps because they are not aware of any nuance or complexity. Their ideas on the topic have the appearance (to them) of being obvious and clear. Often this is not the case. The activity above is a way of identifying any misunderstanding of the subject-specific content.

ACTIVITY

Challenge the students to write out five or six statements or individual claims on note cards which amount to a skeletal response to the prescribed title. Placing them in order and reading them aloud should show them whether they connect and whether they comprise a response to the prescribed title.

Stage 3: Crafting the argument into an essay

The theme of this stage is: 'Think about what you are presenting, do not present what you happen to be thinking.'

This stage is devoted to crafting an essay which presents the ideas the student has decided on. Here is where you can help them think about what makes an effective introduction and conclusion. You might help them use the notecard activity above to identify distinct stages of their argument and help them with the sequencing of their ideas. You will also want them to be working closely with the assessment criteria, making sure they are crafting an essay that will give an examiner every opportunity to push the essay into the higher levels of the assessment criteria. If students want to highlight the implications of their argument they might consider saying, 'One implication of this point is …', or if they want to present a counter-argument, they might say, 'One counter-argument to my position would be …'. Again, now might not be the time for students to be overly subtle or complex.

If we could offer one piece of advice it would be to put clarity at the top of the students' to-do list. Examiners should never have to wonder what the student is talking about. Effective signposting throughout the essay is crucial here; students need to be peeking up above the battlements of their argument to remind their readers just what they are doing at each stage. Essays which require re-reading and dissecting in order for a reader (or an examiner) to understand the basic points being made are essays which are rarely 'clear' or 'coherent'.

TEACHING TIP

There is much debate about what the overall tone or purpose of a student's essay should be. It might take a discursive approach, which would outline a variety of positions and approaches one might take. An evaluative approach, in contrast, would offer a more pointed approach, one that takes a stand on a position.

Examiners can score either form highly. However, we like to think of it in terms of opportunities for students to demonstrate sophisticated thinking skills and do more than simply highlight or 'describe the TOK landscape'. We already know that any number of arguments in relation to a prescribed title could be made and a good TOK student will be sensitive to those different approaches and be able to offer sophisticated descriptions of them.

One recent prescribed title asked students to explore the following question with reference to two AOKs: 'Are disputes over knowledge claims within a discipline always resolvable?' All good responses would need to describe what the issues around those disputes were, showing awareness of the intricacies of the various positions within the disputes and causes of them. But the title asks a pretty pointed question and deserves a pointed response.

A better approach in this case – one that shows more sophisticated thinking skills – might be to actually take a stance in relation to those positions and develop an argument which both shows sensitivity and understanding of those approaches and is nevertheless able to make a decision in relation to the prescribed title.

Whereas discursive essays often are limited to descriptions of positions, evaluative essays are focused on the evaluation of those positions and aim at a particular outcome. The wording of most prescribed titles suggests an evaluative approach:

- 'To what extent' suggests a particular extent is required.
- 'Do you agree' suggests some statement about whether the student agrees.
- Closed questions (e.g, 'Are disputes resolvable?') suggest a position (but with good justification and awareness of counter positions).

'Discuss' is a command word often used in PTs and may open the door for more discursive style responses. They often are related to some claim or statement and take the form 'Discuss this claim in relation to two AOKs', or some variation.

Even in this case, our advice is to encourage students to find a clear tension in the 'discussion', a tension that needs solving. We suggest thinking of 'discuss' in the context of TOK not in the way you might use 'discuss' if you said to a friend, 'Let's meet up and discuss that movie over a coffee', but rather in the way that your head teacher or principal might use 'discuss' if they were to say, 'We need to discuss how we are going to manage this student'. In the latter case there is a clear question that needs answering, a tension that needs resolving. Even in prescribed titles that ask students to 'discuss', then, they should find an issue that needs solving and wrap their analysis around that issue, with an eye to solving it.

Some students genuinely struggle with taking a position or defending a clear position, and teachers should consider this when advising them on what sort of approach would be wise. A very clear, well-signposted and well-illustrated discursive essay is likely to outscore a one-sided, convoluted, unclear or poorly supported evaluative essay.

Finally, it is perfectly fine for students to use the first person in a TOK essay. It might even be more appropriate than a third-person approach, given that the essay is a presentation of the student's own position on the prescribed title. We recognize that conventions in other disciplines (in history, for example) require the third person, but those are conventions in those subjects. In TOK, the first person 'I' is entirely appropriate.

■ Stage 4: Reflecting on a full draft

The theme of this stage is: 'How can we develop this draft to make it better?'

The 'draft' should be considered as the 'student's best effort' and treated as if this is the version that will be sent to the IB. You should give them the responsibility of ownership at this stage then, and keep to it: all your feedback should be about taking the essay as it stands and turning it into the best version that it can be. Students should not be encouraged to rewrite, redraft or change their title at this stage! This prohibition is premised on the process being relatively ideal, however. There are always exceptions or extenuating circumstances which mean that the process was so severely hampered (by sickness, bereavement, trauma, political turmoil, teacher negligence, etc) that the students were unable to give their honest or best effort at this stage. These, of course, can be managed within the school and it seems fair to allow them another attempt. In the general, idealized case, however, you as the teacher are now stuck with what the student has produced.

There are genuine constraints on what teachers can do at this point in terms of feedback. The TOK subject guide's constraints at this interaction is as follows:

> After this, the student is permitted to present one full draft of the essay to the teacher. The teacher should provide oral or written advice on how the work could be improved. This advice may take the form of written comments of a global nature, but teachers are not permitted to mark or edit this draft. While the student may seek further advice from the teacher, for example, on the appropriateness of a particular example or on the clarity of a section of writing, no further written advice on drafts is permitted. The next version handed to the teacher must be the final version for submission.
>
> (TOK subject guide, pages 44–5)

As is clearly pointed out, teachers should not 'mark' this draft, meaning the student should not be receiving any mark out of 10. You are not in the role of assigning the essay marks, that it is the job of the examiner. Your role as a teacher is to help the student take whatever it is that they have produced at this stage and make it better. And this is regardless of the mark you would give it. Suppose a student hands in a draft which you think might be worth 9/10. The student might see this and think 'job done' and not make any attempt to improve. This means that the student has missed out on a valuable learning opportunity about the process of essay writing – reflecting on strengths and weaknesses and improving. This skill is what is needed for life-long success so is still an important part of the process. The other reason is that an examiner might simply disagree and think it is worth 6/10, meaning your student might have missed opportunities to get better marks.

In many contexts where predicted grades are used for university admission, students have a lot riding on their overall and final points score, so they will lean on teachers quite heavily to assign them a grade. Stand strong. Research suggests that having a mark actually inhibits progress!

How you give feedback here is important. You may not copyedit the essay; minor grammatical, punctuation or spelling mistakes which do not detract from the reader's understanding will not affect the examiner's mark. You may offer oral and written feedback, but this should be of a 'global' nature and preserve the student's own responsibility and authenticity. Here you can discuss the student's work in relation to the assessment criteria – because the assessment criteria is 'holistic' or a 'global impression', you can comment on the 'global impression' of the essay and the skills it presents.

Our suggestion is not to get too worked up about your comments here or make yourself anxious. Just use your intuition and instincts, remembering the basic goal of preserving the essay's authenticity and giving the student the responsibility over the essay. The activities below might be useful guides.

ACTIVITY

1. Ask the students to *earn* your feedback by first providing their own. After some length of time provide them with a clean copy of their essays and the assessment criteria. Follow the steps in the 'negotiate your mark' activity (pages 285–6) – but this time *definitely don't* give a final mark. They may want to place their essay in a level – let them use the assessment instrument to do this.
2. Rather than agreeing or disagreeing, ask questions about what they need to do to push the essay into the next higher band. You might also use a writing frame here, breaking up the assessment criteria into distinct skills and outcomes, then asking the student to comment on their success in each element.

   An example writing frame can be found using the QR code in the margin.

ACTIVITY

Now that the essay has been produced, see if the students can reverse engineer the sequence of ideas, by shifting the prose from the essay back into a sequence of notecard-size claims.

1. What is the single point being made in each paragraph?
2. Line up all the note cards and read them in order. Do they constitute a logical progression? Taken as a whole, do they add up to a reasonable response?

ACTIVITY

Students choose a partner who has written on a different title. Students then read the essays aloud to one another. The partner listens for comprehension, clarity and awkward phrasing. The reader may find that they do not understand their own points when reading them aloud!

Stage 5: Finalizing the essay

Teachers are not permitted to offer any further written or global feedback. Many students will return and ask you to read it again, or to read a section, and you really should not be doing this. Teachers need to encourage students to take risks and commit to decisions, rather than asking for constant support. Students are rarely satisfied by this, but it is important to maintain authenticity. There is also the important point that students must at some point cut the essay free, tick this off the long to-do list of the IBDP student and get on with the business of working towards their final subject exams.

You may find yourself having lots of conversations like the following:

Student: 'Please can you have a look at this section again?'

Teacher: 'Did you understand and make decisions based on my comments?'

Student: 'Yes.'

Teacher: 'Brilliant. That's good practice and just what I hoped you do!'

Student: 'But can you read it again?'

Teacher: 'No.'

Student: 'What if I just read you a section?'

Teacher: 'Nope, won't do it!'

Student: 'Please? I don't know if I did it right.'

Teacher: 'Okay, why don't you tell me about the choices you made based on my feedback?'

Student describes what choices they made, or strategies employed, rather than reading their new section.

Teacher: *Provided it's all a reasonable response to your comments, you might say:* 'Brilliant, that sounds like a good strategy to improve your essay. Good effort!'

Planning and progress form (PPF)

The PPF is the paperwork element of the essay, and neither teachers nor students need worry too much about this. The examiners never see it. It is largely a tool to help with any academic dishonesty issues. If there is a concern over the authenticity of the student's work, the coordinator could be asked to send the form in, but if it appears from the PPF that the student was actually developing their ideas responsibility, then this is evidence against any dishonesty.

For each interaction, students are expected to record their progress on the PPF, and this need not amount to more than a discussion of where their ideas are at each stage, what strategies they are thinking about and what advice they have received. Teachers then add their own comments, validating the authenticity of the process. In cases where students suddenly change their essay or their approach late in the process (perhaps after the draft, for example), you might need to remind them that you won't be able to vouch for their work. This requirement is necessary given the TOK help websites and other essay writing services which make a lot of money preying on anxious TOK students.

The TOK exhibition

The TOK exhibition is worth 10 of the overall 30 points of the TOK final score and it is internally assessed and externally moderated, so technically speaking you are an IB examiner when you are marking your own students' exhibitions. Congratulations!

Whereas the prescribed titles for the essay will focus on the areas of knowledge, the exhibition represents an opportunity for students to explore the core theme of Knowledge and the Knower and the optional themes that they studied in their lessons. This does not mean that they will be prohibited from discussing AOK-related materials in their exhibition. The students will have a huge amount of choice in this element and as long as they meet the basic requirements of the assessment, they will be fine.

The nature of the exhibition is described in the TOK subject guide as an opportunity for the students to 'explore how TOK manifests in the world around us'. This is achieved by students identifying and then analysing objects 'in the world around us' in the context of one of the 35 IA prompts listed in the guide (pages 40–41). The students must choose three objects and use them to unpack and to answer the IA prompt they have chosen. The objects are not the TOK, the prompts are. Each prompt is a high-level knowledge question and the students will show their TOK skills by developing answers to this knowledge question.

As stated in the TOK subject guide (page 40), students are required to produce a single file containing:

- a title clearly indicating their selected IA prompt
- images of their three objects
- a typed commentary on each object that identifies each object and its specific real-world context, justifies its inclusion in the exhibition and links to the IA prompt (maximum 950 words)
- appropriate citations and references.

The teachers mark these exhibitions using the exhibition assessment instrument, which can be found in the TOK subject guide (page 47). A sample of these files, along with the teacher's marks, is then uploaded to the IB and the teacher's marks will be moderated (see the section earlier for an explanation of this process).

The subject guide states that the TOK exhibition process consists of three key steps:

- Step 1: Selecting an IA prompt and three objects.
- Step 2: Producing a single file containing the TOK exhibition.
- Step 3: Showcasing the exhibition to an audience.

We will focus on the first two steps.

Step 1: Selecting an IA prompt and three objects

Cognitively, there are two main sets of skills the exhibition expects the students to access as they complete Step 1. We do not suggest that these two elements are structural in any way, meaning we do not think it is necessarily a good idea for students to structure their responses along these two lines. We offer them here as a way of 'unpacking' the activity, thinking critically about it and then better structuring our advice to you.

- Identifying, articulating and discussing the TOK issues related to the IA prompt.
- Using objects to illustrate and exemplify the TOK issues the student chooses to discuss.

The first issue is not unique to the exhibition – it relates to the general skills that you will have been helping the students develop throughout their course up to now. This is the 'TOK bit' of the assignment and it is absolutely necessary if the student wishes to succeed. Because this element is general to the course as a whole, we won't be discussing it in detail here. You might use any of the activities in the teacher's book or student's book to develop these skills. You might even use activities, suitably altered, used in the section earlier, discussing how to develop ideas for the essay. In this context, the presentation of those ideas is in the form of an exhibition, but the TOK thinking is all still relevant.

The second element, however, is unique to the exhibition and requires more thinking. It will likely be new to most of us, and most of our students.

Seeing an object in this way requires an interesting cognitive leap, one that may prove challenging to some students: thinking of objects as examples of or as illustrations of knowledge issues. We will explore this issue in more depth in relation to Step 2.

The IA prompts

Each of the IA prompts is a higher-level knowledge question. Students do not need to show excellence in formulating knowledge questions during their assessment because it has been done for them. They do need to maintain a TOK analysis, but as long as their commentary offers a focused, direct and explicit response to the title they should be delivering clear TOK responses.

First and foremost, students should simply choose a prompt that interests them regardless of whether you have covered anything like it in class. Alternatively, they might choose a prompt that relates to something they have done in class or reminds them of some exercise they have done. They might also think about what they have studied in other classes, and what they have written their extended essay on. If they are constructing knowledge in their extended essay, then it is likely that they can apply that experience and knowledge to this assignment as well. IBDP students are busy so should look to economize their efforts as often as possible. It will be up to the teacher to guarantee that the students are not simply repurposing old material. Each element of their IB Diploma must represent new work, but this doesn't mean that the work they have done in their subject IAs or their EE or even in their CAS programme cannot be used as content for new analysis in the TOK classroom.

Students might also find that they are interested in a particular element of the knowledge framework and want to explore that element in more depth. In an effort to create links between the elements of the framework and exhibition, we have categorized the 35 questions into the sections they seem to best fit into.

An excellent way to encourage familiarity with each of the questions would be to ask the students to put the prompts into the four categories themselves. Discussions around these interpretations will further embed understanding of both the prompts and the elements of the framework.

ACTIVITY

1 Ask students to consider the 35 IA prompts and place them under the categories of the knowledge framework: Scope, Perspective, Methods and tools and Ethics.
2 Students should compare their categorizations with a partner and discuss any similarities and differences, using specific examples from AOKs and the optional themes as evidence and examples.
3 In what ways do their understandings of the prompts and knowledge framework elements differ? Where are their ideas similar?

Knowledge framework element	IA prompts (some of the prompts have been included under more than one element)
Scope	1 What counts as knowledge? 2 Are some types of knowledge more useful than others? 9 Are some types of knowledge less open to interpretation than others? 17 Why do we seek knowledge? 18 Are some things unknowable? 21 What is the relationship between knowledge and culture? 25 How can we distinguish between knowledge, belief and opinion? 26 Does our knowledge depend on our interactions with other knowers? 28 To what extent is objectivity possible in the production or acquisition of knowledge? 29 Who owns knowledge?

Cont …

Perspective	4 On what grounds might we doubt a claim? 5 What counts as good evidence for a claim? 6 How does the way that we organize or classify knowledge affect what we know? 7 What are the implications of having, or not having, knowledge? 8 To what extent is certainty attainable? 9 Are some types of knowledge less open to interpretation than others? 11 Can new knowledge change established values or beliefs? 12 Is bias inevitable in the production of knowledge? 13 How can we know that current knowledge is an improvement upon past knowledge? 14 Does some knowledge belong only to particular communities of knowers? 19 What counts as a good justification for a claim? 20 What is the relationship between personal experience and knowledge? 21 What is the relationship between knowledge and culture? 22 What role do experts play in influencing our consumption or acquisition of knowledge? 24 How might the context in which knowledge is presented influence whether it is accepted or rejected? 28 To what extent is objectivity possible in the production or acquisition of knowledge? 29 Who owns knowledge? 31 How can we judge when evidence is adequate? 32 What makes a good explanation? 33 How is current knowledge shaped by its historical development? 34 In what ways do our values affect our acquisition of knowledge? 35 In what ways do values affect the production of knowledge?
Methods and tools	3 What features of knowledge have an impact on its reliability? 4 On what grounds might we doubt a claim? 5 What counts as good evidence for a claim? 8 To what extent is certainty attainable? 11 Can new knowledge change established values or beliefs? 13 How can we know that current knowledge is an improvement upon past knowledge? 15 What constraints are there on the pursuit of knowledge? 16 Should some knowledge not be sought on ethical grounds? 19 What counts as a good justification for a claim? 22 What role do experts play in influencing our consumption or acquisition of knowledge? 23 How important are material tools in the production or acquisition of knowledge? 26 Does our knowledge depend on our interactions with other knowers? 28 To what extent is objectivity possible in the production or acquisition of knowledge? 30 What role does imagination play in producing knowledge about the world?
Ethics (You might think of agency or knowledge in action here as well)	7 What are the implications of having, or not having, knowledge? 10 What challenges are raised by the dissemination and/or communication of knowledge? 11 Can new knowledge change established values or beliefs? 12 Is bias inevitable in the production of knowledge? 14 Does some knowledge belong only to particular communities of knowers? 15 What constraints are there on the pursuit of knowledge? 16 Should some knowledge not be sought on ethical grounds? 20 What is the relationship between personal experience and knowledge? 24 How might the context in which knowledge is presented influence whether it is accepted or rejected? 27 Does all knowledge impose ethical obligations on those who know it? 34 In what ways do our values affect our acquisition of knowledge? 35 In what ways do values affect the production of knowledge?

ACTIVITY

1. Develop a set of note cards with the various cognitive tools (you might use the old 'ways of knowing'), another set with the twelve course concepts (Chapter 1 in both this book and the student book and page 6 of the TOK subject guide) and another set of note cards with each of the 35 IA prompts.
2. Choose one card from each of the piles and challenge the students to develop links between these concepts, allowing them to choose the theme or AOK through which they do it.

The objects

The challenge of choosing three suitable objects will be something that takes a bit of care and thought. The assessment asks students to choose objects and place them into a new context provided by the knowledge issues framed by the IA prompt. So, the primary concern is for students to choose objects that provide opportunities for them to have interesting discussions about knowledge.

However, that students must choose three objects raises new opportunities and challenges. Strictly speaking, the assessment only requires that students develop links between each individual object and the one prompt under consideration. The prompt provides the unifying theme, but there need be no connections developed between the objects. This is highlighted by the element of the top-level assessment descriptor: 'links between each of the three objects and the selected IA prompt are clearly made and well-explained'. Many students will choose this approach and can still access the top levels of the assessment instrument if they do so.

For the purpose of the document you will upload to the IB, it goes without saying that images of the objects are what is needed, but this also applies for the actual exhibition (as discussed in Step 3). It is not plausible for students to bring some actual objects in to school, so an image of that object will suffice.

The IB is pretty open here about what sorts of things might constitute suitable 'objects'. Many of the objects chosen will be human-made objects – objects conceived, designed and constructed for a purpose – and which, in some sense, encapsulate human knowledge and are the products of knowers. We opened Chapter 2 of the student book with a reference to this idea as foreshadowing. Natural objects might also work here; the TOK subject guide actually makes reference to a 'baby' as an object. These natural objects' links to knowledge, however, are less obvious, so they must be placed into a knowledge context, that is, they must be analysed in a way that makes their connections to knowledge obvious. A baby, perhaps, might be an object through which the student discusses the specific knowledge of a pediatrician or the transfer of knowledge provided by early years educators.

Objects might also be virtual objects. The TOK subject guide suggests tweets might be such an example, but we might extend this to models (like the AS–AD model used in economics or the Periodic Table of the Elements from chemistry). Models are not found naturally in the world, they are conceived, designed and constructed for a particular purpose. Models are an ever-present feature of the TOK world, so their inclusion here is perfectly appropriate.

Mathematical equations are also 'objects' in the broadest sense; again, they are not found in the natural world in the same way bushes and babies are, so must be in some sense the product of human knowers (even if we subscribe to the idea that mathematics is discovered, rather than invented, as discussed in Chapter 8).

TOK TRAP

A very important point to keep in mind is that the students must not use the objects as an arbitrary sign or representation of something else. The objects are not meant to be metaphors or symbols for something else. A blank sheet of paper representing or 'symbolizing the need for imagination in the arts', for instance, is not a suitable object; one can imagine any object being discussed as a 'representation' or as 'symbolizing' any other thing.

Objects must in some sense be manifestations of some knowledge process. The baby referred to earlier, for example, might have been in hospital so is a sort of outward expression of the medical knowledge of a pediatrician or might (if it were a bit older) actually be in an early years learning programme, so is the outward expression or product of that learning environment. The baby does not just 'symbolize' or 'represent' learning.

Thinking back to models, they do more than just represent some feature of the world. They are the knowledge about the world. The Periodic Table, for instance, does 'represent' relationships among the elements, but it is more than an arbitrary sign simply pointing to some other phenomenon. The table itself contains the knowledge about those relationships; it was developed, tested and then used in the creation of new knowledge. Models are not the same thing as what they 'represent', just as 'maps are not the territory', but models and maps are how we conceive of the territory, they contain the knowledge. They are what makes the territory understandable and are not arbitrary signs of the territory. The word 'Switzerland' is an arbitrary sign representing a physical place and can be interchanged with 'La Suisse' or 'Die Schweiz' or '瑞士' depending on the context. But a map of that physical place is not arbitrary, it is the manifestation or product or outcome of our attempt to understand certain features of that physical place.

Objects should be specific and have a specific real-world context. An image of any 'microscope' is less effective than an image of 'the microscope in S4 where I learned about the structures of cells'. 'A mathematical equation' is less effective than 'Euler's identity'.

Objects should be personal. In keeping with the core theme, the exhibition provides students the opportunity to think about how they have constructed or accepted knowledge in their own lives. Specific and personal objects will result in an exhibition that no other student in the world could have created.

This choice of what makes an object is certainly one of the challenges of the exhibition. Our advice is not to get too worked up over whether something constitutes an object. The important element will be the analysis of the knowledge, not the specific choice of the object. If there are questions about whether the object is suitable for the discussion the student wishes to have, then perhaps it is best to avoid any philosophical subtleties and simply identify a more obvious object which opens up the same discussion.

TEACHING TIP

Starting from the very beginning of the course, use objects with which you can illustrate the TOK points you are aiming for. In those activities where you have used an object, you might then identify one of the IA prompts and ask the students to apply the learning of their lesson to create analytical links between the object and the IA prompts.

For example, in Chapter 10 of this book we used the *Diagnostic and Statistical Manual* as a way of exploring the historical development of our understanding of psychological and psychiatric disorders. IA prompts 13 (How can we know that current knowledge is an improvement upon past knowledge?), 21 (What is the relationship between knowledge and culture?) and 33 (How is current knowledge shaped by its historical development?) would be relevant to the discussion presented in that chapter. You might ask the students to develop a 300-word discussion of the DSM as an example of a response to one of those titles. Making this a matter of course throughout your teaching will prepare them well.

The exhibition is designed to provide an opportunity for students to reflect on either the core theme: 'Knowledge and the Knower' or the optional themes. The guide encourages students to ground the commentaries of the exhibition in the core or one of the optional themes. This can most effectively be done through identifying the 'specific context' of the object. Objects can be manifestations of all sorts of themes, but students should consider using the theme (core or optional) as the perspective through which they view the object. The microscope might be seen as an object of technology *or* an object of power structures; a religious text might be an object of a religious knowledge system, but might also be an object of personal authority and significance. Students should make clear their choice of theme in the write up of the commentary and maybe even in the heading of their commentary.

■ Step 2: Producing the file

The actual thing the students produce is a file containing three written commentaries, one for each of their three objects. There need not be any summarizing introduction or conclusion. The document containing the commentaries must make clear what the IA prompt is and must have an image of each of the objects.

An easy, no-nonsense solution would be to have a three-page document, with the IA prompt as the title on each, followed by an image of one of the objects, then a commentary of approximately 315 words on that object (950 words total, not counting references or IA prompt headings). Any required references might be included on a 'works cited' page at the back, with references in any recognized format. There is no need to make the document any fancier than that. No need for title pages. The moderators will be looking at it online, so the fewer pages the better – it means fewer clicks are needed to read it.

■ The written commentary

When it comes to the commentary, one of the things that will keep a student from progressing into the higher levels of the assessment is the inability to shift a description of an object into the knowledge that that object illustrates. We'll spend a bit of time here illustrating this shift with an example.

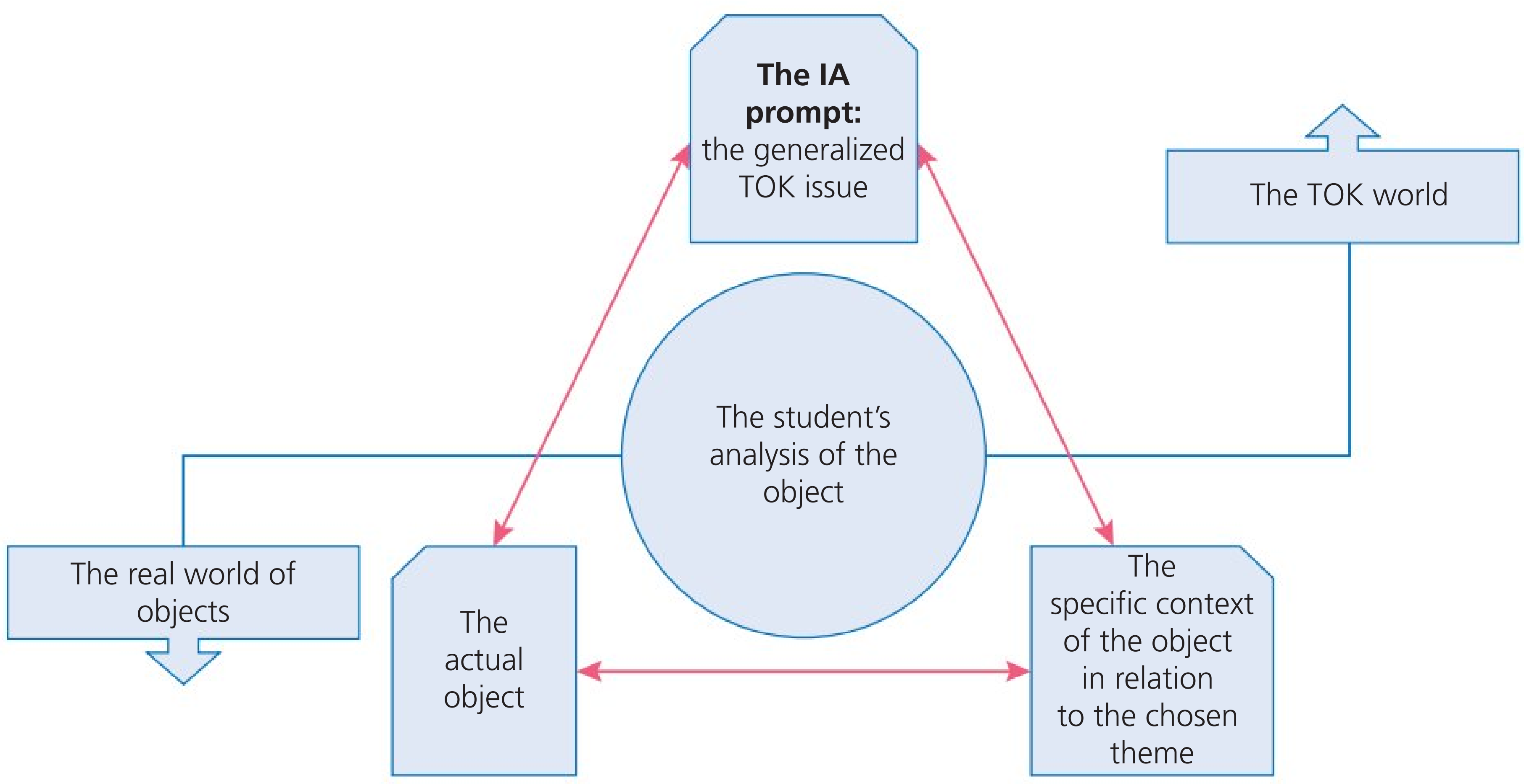
An example of a suitable object can be found at the website for The British Museum's famous exhibition 'A History of the World in 100 Objects' (more on that later!). Object 37 is a clay pipe in the shape of an otter, believed to have been used in rituals by the Hopewell Native Americans living in what is now called Ohio, USA (The British Museum, National Parks Service).

Were this object to be used in the TOK exhibition, the commentary of it would require some description, but students would need to shift quickly into a consideration of how it might be used in the context of one of the knowledge issues presented by the IA prompts.

In relation to the clay pipe, a student might choose to explore IA prompt 14, 'Does some knowledge belong only to particular communities of knowers?' Students might discuss the role of ritual in the transfer of knowledge, pointing out that the likeness of the otter and its use in ritual embedded the spiritual importance of the animal kingdom (and perhaps otters in particular) to individuals in that community of Native Americans. Not being part of that community, however, might mean that the knowledge transferred through their rituals is unavailable to someone living outside that culture, where the ritual has no meaning.

In the use of objects in the TOK exhibition, then, you might say that there are three elements working in conjunction in the student's analysis of the object:

- the IA prompt and the general TOK points
- the specific object
- the specific context of that object. The context should be provided by the theme through which the student has chosen to explore the object.



Students who can skilfully weave these elements together will do well. Students who struggle might find themselves unable to access the generalized or decontextualized issues relating to knowledge that the prompt is an invitation to discuss.

An inadequate treatment of the object and response to the IA prompt would be something like the following (at 121 words, this is less than half as long as an analysis of a single object would likely be):

> This object is a clay pipe used by shamans from the Hopewell community of Native Americans who lived during the first four centuries in what is now called Ohio, USA. The Hopewell were a group of farmers who built large ceremonial and burial mounds. This object was excavated from one of those mounds in a complex called the 'Mound City Group'. The clay pipe was probably used in rituals. Rituals were used by Native Americans as a way of worshipping the animal world, which is where they believed spirits lived. Rituals are a good way of transferring the shared knowledge and values of the community to individuals in that community. The pipe would have been an important part of the rituals.

ACTIVITY

What counsel would you offer this student if you were presented with this as a first draft of one of their commentaries?

This response suggests that the student understands the pipe, the culture from which it comes and, more generally, has something to say about the role of ritual in the transfer of knowledge. However, these strengths have limited effect because the student spends a lot of time describing the specific object and its specific context, without linking that into the TOK issues raised by the prompt. There is a plausible TOK point about the role of ritual in the transfer of knowledge between communities and individuals, but this point has not been developed in the context of the object: this is the explicit link missing. The final point about the pipe is perhaps the beginning of a link, but it is not fully developed. The primary weakness, however, is that the discussion does not address the IA prompt. We do not have any sense about what the student thinks about the issues surrounding knowledge being had by particular communities and not others.

The TOK subject guide gives the following advice about how to support students at this stage, guidance which is similar to that given in the context of the essay:

> Teachers are permitted to provide feedback on **one** draft of this work. They should provide oral or written advice on how the work could be improved, but should not edit the draft.
>
> (Subject guide, page 40)

For the student to improve, you would encourage them to make sure, first and foremost, that the analysis can be read as a direct and explicit answer to the IA prompt. The student has made some progress in that direction, but the material does not seem to have been conceived as a direct answer. You might ask the student to consider just how much description of the object is necessary and you might suggest that the comments about the nature of ritual would be a good way to develop such a link to the prompt. Finally, you might suggest that more time is spent making more explicit links between exactly what knowledge is being transferred and how this might belong only to the Hopewell cultures.

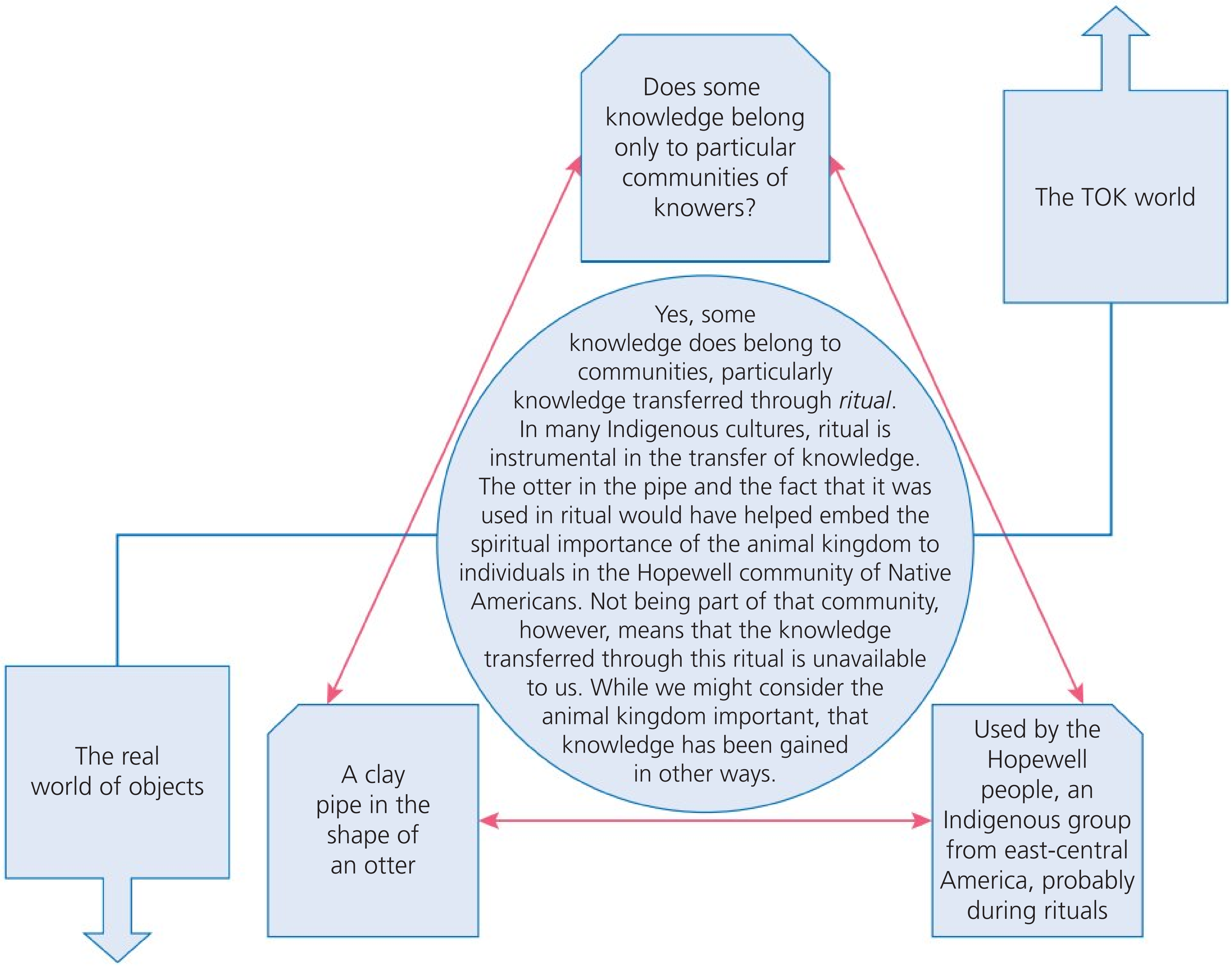
TEACHING TIP

One of the challenges for the students is to successfully weave the right sort of description of elements relating to the object and its real-world context, with a TOK application of those ideas to the IA prompt. These 'realms' of 'real-world' description and TOK analysis are indicated on the model by being above the horizontal line or below it.

The actual response of the student must be a direct response to the prompt, and if it is, then the student will have successfully delivered an adequate TOK response, but to do so they will have had to use facts about the objects and discussions of that their real-world contexts.

The following is not a 'perfect' or 'model' response or even necessarily a 'level 5' response, not least because it is still too short and underdeveloped. However, it is included here to give you a sense of what improvement looks like in comparison with the response above.

Using the example above we might map out the interaction of these elements like this.



We have placed the student response (a bare skeleton of a response, at less than 100 words it is about a third of the length offered by the overall 950-word limit) into the grid to illustrate the connections between the various elements. In this example the student has been able to draw from the specifics of both the object and its context, but has also been able to decontextualize somewhat into the TOK world of knowledge with a link to the optional theme of Knowledge and Indigenous Societies.

ACTIVITY

Do you think the second short extract is an improvement on the first attempt on page 310?

■ Curating the exhibition

There are some real opportunities for students to develop more convincing and more effective analyses in their commentaries. What the students will want to avoid for sure is using the different objects to say the same thing or make the same point. Whatever they do, they will need to develop different facets of the prompt. But how might they manage those different facets?

The top-level assessment descriptor also says, 'There is a strong justification of the particular contribution that each individual object makes to the exhibition'. The implications of the phrase 'particular contribution' are that each object brings to the discussion something unique, it provides a unique contribution that the other two do not.

Essentially therefore, the students are being asked to act as curators in their own mini-exhibition and this notion of curation might be a helpful one to use to guide the choices students make.

Curators (professional curators working at a museum or a web-based 'content curator') choose objects and present them in new contexts in order to create something new. Curators do not just put random objects in new contexts, they create a new context through the juxtaposition of objects, highlighting their differences and similarities. A good exhibition curator, therefore, will not simply provide different points with each contribution to the exhibition. Rather they will offer a narrative in relation to the context provided.

Our TOK students, then, have the opportunity to tell a unique story in relation to the prompt, one that can be deeply personal to the individual student, and which cannot have been offered by any other IB student in the world.

Students might then need to take a wider approach when thinking about their objects and what they wish to say with them. The need to be able to explain the 'particular contribution' of that object to their overall project suggests a number of things:

- Students must make choices, meaning that they need to identify more than three objects from which to choose. If you are using objects throughout your teaching, you might encourage students to start keeping track of objects that they bring to class from which to choose later on. (Of course, they do not need to include any but the three chosen in their final exhibition.)
- Students should be able to articulate how each object provides a unique and new voice to the conversation.
- Students should consider choosing different types of objects. One object might be like the clay pipe, but they might also consider documents, electronic objects, objects from distinct time periods or conceptual objects like models or formulae.
- Students might try to identify surprising objects by taking objects out of their familiar context and placing them in a context the examiner might not have expected.

ACTIVITY

In 2010, the BBC and the British Museum collaborated on a project presented by the British Museum's director Neil McGregor, in which the history of the world was told in 100 objects. The QR code in the margin provides links to the BBC website, where you can listen to a short podcast about each of the objects.

To get used to the idea of using objects to create new narratives in a wider context, you might listen to one or two of the podcasts. The questions below might serve as a starting point for discussions around curation:

1. Why these 100 objects? (The British Museum has about 8 million objects) (The British Museum).
2. In what ways have they been categorized and connected?
3. What is the effect of the way they have been categorized?
4. In what ways does the website use the objects to tell a story?

The website is not doing TOK, so you do not want to suggest that the website itself is a model for the TOK exhibition, but there are lots of useful connections you can make about how objects manifest knowledge and how the IA prompts might help illuminate new aspects of the objects.

Students need to create an electronic file to give to their teacher (PDFs or Word files are the easiest). The teacher will assess this document and then upload a sample to IB. It is important that the teacher assesses this document (rather than a physical in-school exhibition) so that the moderator can see precisely the same thing that the teacher assessed. Teachers are asked to mark and annotate the document, clearly indicating the strengths and weaknesses they found which added to their assessment judgment. To uphold the teachers' marks, moderators need to see clearly why the teachers have awarded the marks they have.

Step 3: Exhibition for an audience

A required element for the TOK exhibition is that there is some element of presentation. This could take a variety of forms, as outlined in the TOK subject guide (page 40), but the point is that students need to undergo some experience by which they discuss or present their thoughts about the objects and the prompt to an audience.

For TOK teachers who love and want to promote their subject, this is a great opportunity to show the wider school community the type of sophisticated thinking that goes into the TOK course. You might consider asking students in the years below the IBDP to come to see what this mystical TOK is all about. If you are in a 'dual pathways' school (where students have a choice between the IBDP or something else), you might link it to when students are making these choices. Parents always love being given a chance to see first-hand their children's academic work. Parents of students making dual pathway choices might also like to see what choosing the IBDP will entail. In other words, you and your IBDP coordinator might think carefully about how you can use the presentation element of exhibition to promote wider agendas in the implementation of the IBDP.

Top tips for TOK assessment

- Insist that one or more of the teachers on your TOK team are examiners or moderators.
- Make sure that your TOK teachers have recently been to TOK training. There they can collaborate with other teachers, gather materials and ask the questions they need answering.
- Never tell a student that 'this essay is an 8' (teachers do not make that decision). Do not disclose your exhibition scores – they might be heavily moderated, resulting in difficult conversations ('You said I was going to get an A!'). Again, focusing on the summative outcomes might stifle progress.
- Remind students and parents that the teachers do not mark the essay. Some teachers say, 'Our essays were marked down!' This is mistaken thinking – the examiners are the only ones to mark the essays. Therefore, if an examiner gives a lower mark, it is a matter of the teacher simply not agreeing, not that the examiner was actively 'moderating down'. This, of course, is not true for the exhibition. Here teachers need to be conservative (sensitive to their natural biases in favour of the students) and be clear and compelling in their justifications of the marks.
- Ensure that the students are reading, commenting and marking previously marked work made available to teachers through IB workshops. This will help them understand the assessment criteria.
- Ensure that there are adequate practice opportunities for the students to develop their ideas in writing and offer thorough feedback.
- Ensure that the predicted grades and university choice process is properly calibrated to the student. This will give students peace of mind in relation to their assessments. No student benefits from being over predicted, though, of course, they will benefit from being given high (and reasonable) expectations.

- Ensure that your teachers are using the TOK subject report. This, the TOK subject guide and the teacher support material are the official documents for TOK, and they contain lots of useful advice. Subject reports are released twice a year after each assessment session and will highlight trends (both good and bad).
- Make good use of the knowledge framework to frame the discussions for both the essay and the exhibition. This will help maintain a clear TOK approach.

Conclusion

In our experience, assessment provides excellent opportunities for genuine student learning and some of the best TOK learning will occur under the guise of assessment. Many schools devote more time to the assessments than is suggested by the TOK subject guide precisely because the students are eager to get it right and are earnest in their approach.

The best way to approach the TOK assessment is as another chapter in their TOK learning experience. The assessment is not 'the end of the day' for them – they will move on into the 'real' world and need to put into action the skills and dispositions towards knowledge that we have helped them develop.

Most past IB students seem to remember TOK better than they remember other elements of their IB experience, and not just the assessment. The whole course becomes one of those elements of their secondary education which might take years of further learning and life experience to understand. This, we think, is a good thing, even in those cases where they do not remember TOK fondly. It is not an easy subject – neither for the teacher or the student. In terms of promoting deep change and maturity in the students, however, TOK has a stronger long-term effect than any of the other subjects of the IB.

This last claim is purely anecdotal and the TOK teachers in us shudder at the overstatement. No human scientist worth their salary would accept such a claim. Nevertheless, we all think it is true. Don't we?

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Index

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