Enhancing student motivation and performance: Tools that develop and support informed choice

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Three classes from Qatar Academy (grades 1, 5 and 9) participated in an action research investigation, "What is the effect of choice on students' motivation and performance?" A three group pre-treatment and post-treatment test design yielded data for motivation and performance. Motivation was measured using a Likert scale survey, performance was measured using a common rubric. Pre-treatment, all classes were assessed on a task where they had limited choice of content or in how they presented their knowledge. The treatment was guiding students through the cognitive process of making informed choices on content and presentation. This was achieved through reflective evaluations linked to a developing understanding of their personal learning styles and to the learner profile. Students then used this guided approach to choose how to present their knowledge for another project and were again assessed at its completion. Post-treatment, paired T-data analysis indicated that across the sample, student motivation and performance significantly increased.

INTRODUCTION

We are three teachers at Qatar Academy, an International Baccalaureate school based on the Qatar Foundation campus in Doha's Education City. Our experience spans the spectrum of early, primary and middle years.

The student body is predominantly Arabic-speaking, most of which is composed of Qatari nationals, with English as their second language. Our school actively embraces, encourages and continually strives to promote better teaching practice for greater motivation and success in our students through a twenty-first century approach to teaching and learning. Most recently the whole school focus has been towards differentiation, literacy and technology integration. An issue that we have noted is that, through these initiatives, students across the school are given many choices but those choices are often controlled by the teacher, which erodes the students' ownership of their learning and may affect their motivation and performance.

We feel that this is an area that needs addressing because as IB students, our students are expected to be self-motivated learners. Our school mission states that our students are expected to be, "independent critical thinkers, lifelong learners, responsible citizens, [who] gain entrance to elite universities and colleges". Bearing this in mind, we were interested in nurturing our students in an environment that would encourage them to "enjoy doing the kind of work for which [they are] best suited" (Hill, n.d.). Our hope was that by providing students with guidance and tools for making informed choices, their ownership of learning, motivation and performance would improve, while also enhancing our own teaching practice, aligned to our whole school focus and mission statement.

SAMPLE AND SETTING

The 65 participants this study were taken from three of our classes across the school: grade 1, 6–8 years old (Early Years), grade 5, 10–11 years old (Primary Years) and grade 9, 15–16 years old (Middle Years). All classes had an approximately even distribution of boys and girls. Grade 5 students were all Arabic-speaking and mostly Qatari; grades 1 and 9 were mainly Qatari (ESL), with a small portion of students from a variety of nationalities from around the world with English as their mother tongue.

REVIEW OF LITERATURE

An early researcher on success in education stated that, "Everyone enjoys doing the kind of work for which he is best suited" (Hill, n.d.). This sentiment was echoed far more recently by Powell and Kusuma-Powell (2011) who have suggested that student choice related to their personal learning styles leads to products that are "rich in conceptual understanding". They state, "We know the anxiety and stress of being compelled to work in one's least preferred production-style can actually serve as an obstacle to cognition. The medium does affect the message." This line of thought was also explored by Baum and Nichols (2009) when they suggested that providing choice was possibly a more powerful cognitive experience when students had an understanding of their personal learning styles and were sometimes allowed the option of aligning tasks to their learning-style strengths. Moran (n.d.) also found that "more choice equates to greater enjoyment, and presumably more engagement".

Kohn (1993) also connected choice to motivation when he asserted that students who were deprived of choice were also likely deprived of motivation. After reviewing a number of research projects examining the link between student success and high levels of motivation, he concluded, "There is no question about it: even if our only criterion is academic performance, choice works." Looking beyond academic performance and towards motivation, Stone and Madigan (2008) cited Becker who suggested that "a greater amount of choices available for the student promotes a greater sense of ownership and, consequently, higher levels of motivation and commitment".

However, despite the assertions above, there was also a body of research that concluded that offering choice may not always enhance performance and motivation. Patall, Cooper and Wynn (2010) suggest that "choice may not always be effective or that there are more effective strategies to support motivation". Furthermore, Kohn (1993), supported by Starnes and Paris (2000), cautioned that although choice was generally a desirable option, it also needed to be guided, "Nearly every essay on education by John Dewey, the father of progressive schooling, stresses the importance of adult guidance and derides the idea of 'leaving a child to his own unguided fancies'." In fact, Barry Schwartz (2009), referring to Iyenger and Lepper (2000) and Iyenger et al. (2004) pointed out that "too many options seemed to produce paralysis rather than liberation". He expanded upon this idea by stating, "If one overcomes paralysis and chooses, evidence suggests that the quality of performance deteriorates with increases in the number of options … it now seems clear that whereas choice is good, more choice is not necessarily better." When Moran (n.d.) asked students to reflect on their experience of choice in the classroom, most students indicated that 'they enjoyed the opportunities", however, "a small group said they preferred to be told what to do and when, as they had found it hard to manage themselves". She highlighted the fact that some students might prefer more extrinsic motivation in the form of teacher direction.

The goal of the action research described here was to enhance student motivation and performance. We were keen to explore what elements might make choice a more meaningful experience for our students. The literature, particularly the research of Baum and Nichols (2009) and Powell and Kusuma-Powell (2011) sparked our interest in researching the cognitive process of choice in order to provide students with not just *more* choice in content or presentation, but with teacher guidance, to develop their understanding of the process of making an informed choice. We were also interested in exploring if the same cognitive approach would be valid across all age groups of the IB programme. So, with a definition of "choice" encompassing the cognitive process of making choice, content choice and presentation choice, we asked: "What is the effect of choice on students' motivation and performance?"

RESEARCH DESIGN, INSTRUMENTATION AND DATA COLLECTION

We designed and implemented an action research investigation with the three groups of students using a pre-treatment and post-treatment test design for motivation and performance. We chose pre-treatment/post-treatment design for our projects as the survey was conducted on the same group of students. Before we implemented our "choice-cognition guidance" lessons, we established a baseline by having students complete a survey following a learning engagement in which they had limited opportunities for choice. We chose to use a single independent variable (choice) in order to isolate it as the contributing factor on motivation and performance.

Data were collected quantitatively and qualitatively throughout the research period. Quantitative tools were a Likert scale survey, delivered pre-treatment and post-treatment, to assess changes in motivation (Appendix 1), and a rubric common to all three classes (Appendix 3) to assess performance. We developed the survey during the research design phase of our action research. After a number of revisions, we agreed on the final version, which was adequately generic

so as to eliminate bias by removing any direct connections between student motivation with our study and/or our individual grade 1, 5 and 9 projects.

The rubric, also developed by the authors, was used to assess a project that had been recently completed where the students had controlled and limited choice over content and presentation options. The same format was used post-treatment to assess the project where the students were given choice under the conditions of the treatment. The rubric was broken into two parts, Process and Product, and each statement was listed under a learner profile heading. The pre-treatment and post-treatment scores for motivation and performance were evaluated using paired T-tests. Anecdotal observational records were also kept in order to provide triangulation for our quantitative measures of motivation and performance.

A "Learning My Way" assessment (see Appendix 2) was also administered at the beginning of the study. The authors developed this tool based on a survey that was presented during a whole school professional development (PD) session on differentiation (our school focus last year) delivered by Dr Susan Baum and Dr Hank Nicols from the State University of New York. Two versions were created in order to make it more age friendly. The range of responses was confined to a narrower band of responses for Early Years students. This assessment was not used to gather data but, rather, as a tool to act as a catalyst to get the students thinking about their personal learning styles and options of how to present. The intention was that students would make considered choices either to follow perceived strengths or explore methods they might not normally choose.

Limitations of the study were identified as it being conducted over a short time frame (eight weeks) and that it was a small sample of the entire school. In some cases, peer influence affected the choice process, and the research was only conducted on project-based learning.

We hypothesized that post-treatment, student motivation for presenting knowledge and the quality of product (performance) would increase. This hypothesis suggests a relationship between our two dependent variables, performance and motivation, and our independent variable, choice.

INTERVENTION

Across the sample, students reviewed prior levels of motivation (Likert scale) and performance (common rubric) based on the recently completed presentation where they had limited and controlled choice of content and presentation options. Early Years students were then introduced to six presentation categories (performance, multimedia, oral, artistic, written, and manipulative), while in the upper grades the students reviewed these categories.

The students reflected on their personal learning styles and interests (Learning My Way) and discussed different types of presentation options and how they might match or differ from their stated preferences in the Learning My Way assessment. A guided analysis of the common rubric based on learner profile attributes highlighted to the student that it was acceptable to express their knowledge and understanding in a variety of ways, including those outside of the their comfort zones. The rubric reinforced to the students that performance would not be determined purely on the quality of product but would also consider other learner profile attributes, thus not eroding motivation to innovate. For the next presentation task, all students were given the choice of content (within the boundaries of their current curriculum focus) as well as how they were going to present their knowledge and understanding. Students were encouraged to use the insights they had gained from the Learning My Way survey to assist them in their choice.

"Understanding the common performance rubric helped to create an environment where students felt they could take risks and try new things and that these efforts would be recognized."

Presentation choices were also discussed in context of the skills they required and students were encouraged to think about the motivation behind their choice, such as choosing because they knew they could do something well or instead trying something new. At this point, all students had the option of reconsidering their presentation choice after evaluating resources, skill levels and personal learning styles. They were encouraged to reflect, "What is my choice? Why did I make that choice? Is it the right choice for me? What is the consequence of this choice? Can I change my mind?" Some did and could give sound reasons for the change, related to the concepts that had been discussed. Others confirmed their choice, also giving pertinent reasons for why they felt their choice was right for them. However, a few

students did not exercise this level of considered choice, preferring instead to follow the choices of others.

RESULTS AND DISCUSSION

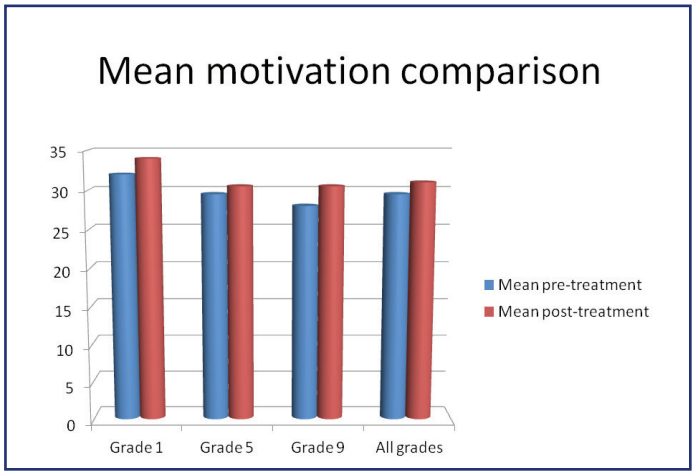

Figure 1: Paired T-testing analysis between pre-treatment and post-treatment results yielded statistically significant increases in student motivation. The y-axis represents the whole class mean score. See Appendix 4 for sample calculations and statistical significance.

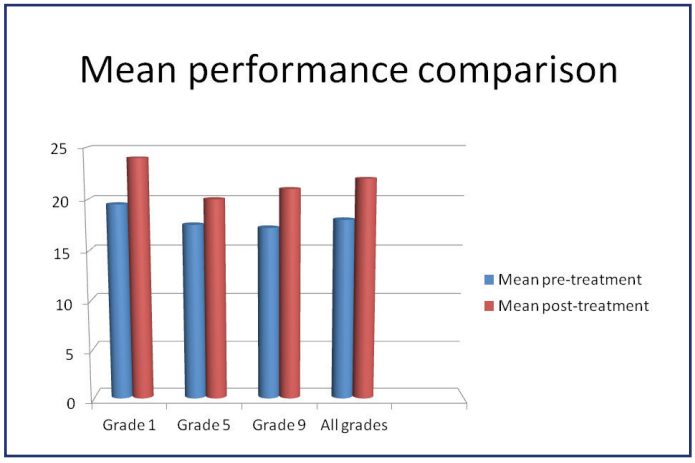

Figure 2: Paired T-testing analysis between pre-treatment and post-treatment results yielded statistically significant increases in student performance. The y-axis represents the whole class mean score. See Appendix 4 for sample calculations.

The results of this study showed that our hypothesis "Student motivation towards presenting knowledge and quality of product (performance) would increase" was correct. We observed statistically significant improvement in both student motivation and performance during the project.

After the Learning My Way assessment was administered, the students became interested in how they could use their personal learning styles and also develop skills in an area they might not normally choose. An interesting observation was that many students across the sample identified preferences for multimedia, manipulative or performance activities to demonstrate their knowledge. This is quite a contrast to the volume of written or oral options that are more commonly available to students in teacher-led activities.

Understanding the common performance rubric helped to create an environment where students felt they could take risks and try new things and that these efforts would be recognized. Students held many animated conversations with their peers, exploring options and sharing ideas, which led them to invest and take ownership of their initial project choice. Students reflected on their choice in relation to their personal learning style, interests, skills and personal objectives. This helped some students to confirm their choice but also led others to alter the choice of content and/or presentation option. The students felt secure about navigating their way to a choice where changes would not be penalized and they felt comfortable, enthusiastic and motivated. A safe learning environment was developed through teacher guidance and the students' familiarity with the learner profile embedded in the common performance rubric.

We observed that motivation was maintained through the students' engagement in new and exciting learning experiences. This further developed their sense of ownership and independence. This momentum was enhanced by the students' developing sense of purpose as they recognized that their product was not merely an exercise to acquire grades but an opportunity for optimally demonstrating their knowledge and understanding through considered choices. Heightened motivation was observed in a number of ways. First, there was evidence of "hard fun" where students worked during break times and dedicated extra time to their projects in their own time. Students also enlisted family members and friends in their learning experiences by teaching them the skills they had learned and by including them as participants in their projects. Second, feedback from colleagues interacting with students commented on their apparent raised levels of motivation. Students more keenly observed what their peers were attempting and emulated some of these ideas in the creation of their products because they were interested in them.

Students were actively engaged in showing off and discussing their projects within their private social networks, a domain distinctly

separate from the school learning management systems. A number of students independently stated that they felt empowered and enjoyed the opportunity to make their own choices. Equally, a number of students expressed that they felt successful and were very keen to present their final product, in some cases, ahead of deadline. There were some requests from students to repeat this form of project development in the same way, as they had enjoyed the experience so much and would like the opportunity to make different choices next time.

Generally, the teachers agreed that performance had improved. The quality of the final projects was higher than on previous occasions. Where projects showed little or no improvement, it could possibly be because the student had taken a risk and tried skills and strategies that were new to them but were unsuited to their personal learning styles. In their reflections, some students identified this as an inhibitor to their performance. Some stated that in the future, they would like to revisit the same learning experiences in order to improve on them, while others could state why they would not like to revisit them, relating their reasons to their personal learning styles and preferences. Some noted that by rewarding risk-taking in the common performance rubric, they felt that their efforts were both acknowledged and justified, even if the quality of their product was affected due to lesser skills in that manner of presentation. Overall, most of the students suggested that this had been an empowering and enjoyable experience and one that they would like to repeat.

PRODUCTS

During this research we identified and developed four distinct products:

- **Cognitive approach to lessons:** The students develop an understanding of learning styles (Learning My Way) and evaluate the choices for content and presentation based on learning styles as well as the consequences of these choices on the ability to express knowledge and understanding. After reflection, students have the opportunity to reconsider their choices for expression. Students are aware that both process and product will be acknowledged and assessed through elements of the learner profile (common performance rubric).
- **Learning My Way assessment:** The students' preferences toward the six different presentation categories are rated according to their responses. The results indicate a student's learning style preference.
- **Common performance rubric:** The rubric addresses both the quality of product as well as the process involved in the creation of the product by acknowledging the students' demonstration of the learner profile attributes. This assessment tool can be used vertically across the school.
- **Likert scale survey:** The scale measures student motivation. It presents students with a series of unbiased statements on which to rate themselves. The results can then be used to show different levels of motivation before and after treatment.

CONCLUSION

Based on the success of this project, we would like to integrate the tools we developed routinely, as they led to a profound positive effect on our students' ability to make informed choices when expressing their learning experiences, ideas, knowledge and understanding. The students felt empowered as their understanding of themselves as learners increased, and their confidence grew as they engaged with the learning opportunities, resulting in heightened motivation and performance. We plan to incorporate the cognitive approach to making choices into our grades and throughout the school.

We intend to administer the Learning My Way assessment at the beginning of our academic year and also to introduce these to our new team members. This is an invaluable tool that allows the students to develop a broader understanding of their learning styles and also allows the teachers to develop a deeper understanding of their students.

After receiving feedback from a number of sources, we recognize the value of the common performance rubric. We will review and refine it as an assessment tool that can be used in a number of areas within the PYP and MYP. We hope that through this tool we can develop a common assessment language across the whole school, contributing to consistency in school-wide assessment. We are already introducing this document to our teams and intend to share it with our wider school community.

Some questions have been raised because of this study. Would the students who have been exposed to this study internalize the process of choice and apply it without teacher guidance? As facilitators, how can we allocate more time to teaching process without detriment to content coverage? Such questions give rise to an opportunity for our further collaborative research across the school.

As reflective, constructivist educators, we have valued this experience as it has provided us with the opportunity for collaboration and

cross-curricular dialogue vertically through the school, and the opportunity to reflect on our students and on our teaching practices. As a result of this reflective process we have learned a great deal that has enhanced our teaching practice, in the same way that the reflective process enhanced the learning of our students, and we conclude that: "We do not learn by our experiences … we learn by reflecting on our experiences" (John Dewey, 1933).

ABOUT THE AUTHORS

Andreas Christodoulou, a project-based learning advocate from London, stumbled back into education in 1999 while working on the BBC Bitesize project in his capacity as Senior Database Manager at the BBC. He draws from his experiences in banking, publishing, logistics, broadcasting and new media to develop curriculum that mirrors realistic and purposeful scenarios that give rise to enduring learning experiences.

Even though Jill Duncan originally trained as a secondary English language teacher, she has been teaching grade 5 students for the past seven years. She has found being "mother" to 22 wonderful students a very rewarding experience.

Gail Nelmes has been working with children for the last 30 years, most recently as an elementary teacher for the past 12 years. She teaches 5–9 year olds because when she bursts into song or dance, they join in! She is from New Zealand and has also taught in Turkey and Qatar.

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APPENDIX 1: LIKERT SCALE

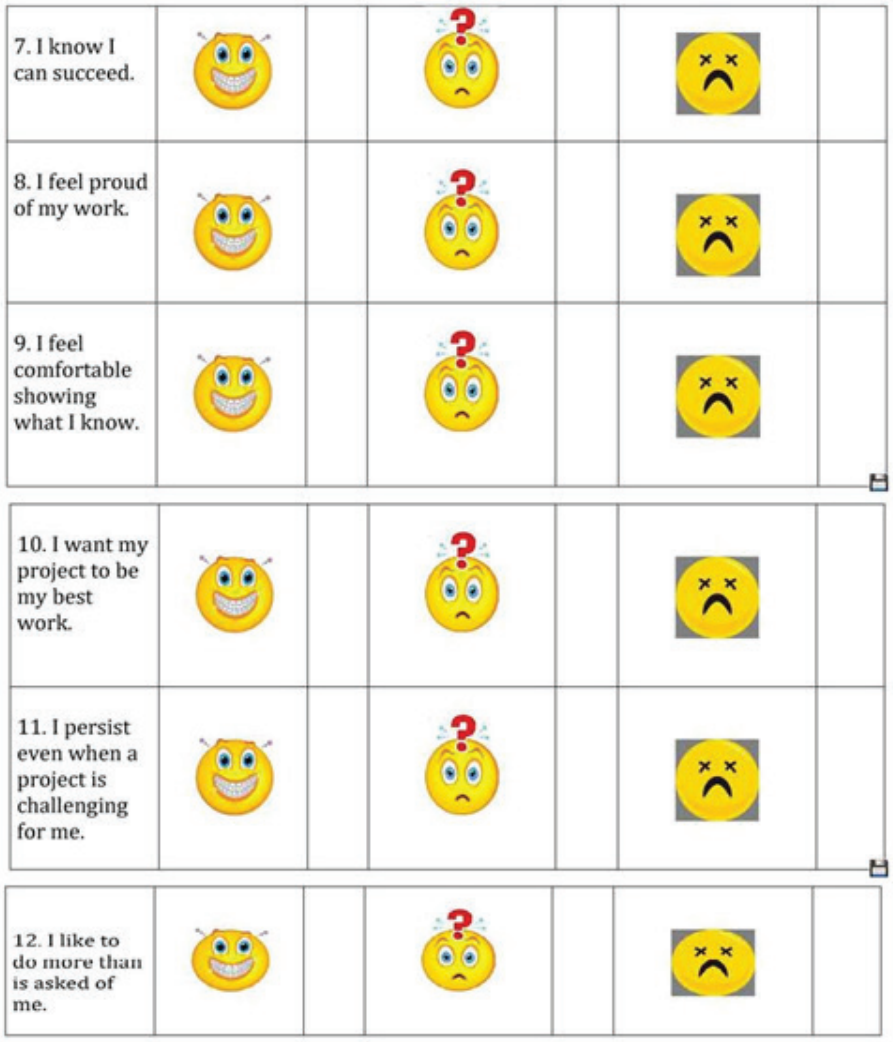
Motivation Scale

Name: Date: Grade:

Instructions:

Show how strongly you agree with the following statements by ticking next to the appropriate face.

1. I am motivated to do my work.			
2. It is easy to share what I have learned.			
3. Learning is easy for me.			
4. I like to come to class.			
5. I give my full attention.			
6. I keep working when I really enjoy what I am doing.			


7. I know I can succeed.
8. I feel proud of my work.
9. I feel comfortable showing what I know.
10. I want my project to be my best work.
11. I persist even when a project is challenging for me.
12. I like to do more than is asked of me.
Totals
Total
Total
Total
Weighted Totals
x 3
x 2
x 1
+
+
=

APPENDIX 2: "LEARNING MY WAY" ASSESSMENT

The Early Years version of this assessment is a 30-item, three-point cyclical survey. This was considered more appropriate for the Early Years students. The remainder of the sample used the more age-appropriate 30-item, five-point cyclical survey.

Early Years version

Name:_____ **Learning MY WAY**

How do I like to show what I have learned?

Instructions:
Circle the number that shows how interested you are in doing the following activities to share your knowledge.

	Not At All Interested	Interested	Very Interested
Example: Drawing with KidPix	**1**	**2**	**3**
1. acting out what I know	**1**	**2**	**3**
2. making a Power Point	**1**	**2**	**3**
3. talking about my experiences to the class	**1**	**2**	**3**
4. making a dough sculpture	**1**	**2**	**3**
5. writing a recount	**1**	**2**	**3**
6. making a model	**1**	**2**	**3**
7. performing music	**1**	**2**	**3**
8. making a movie	**1**	**2**	**3**
9. talking about what I know to another class	**1**	**2**	**3**
10. painting a picture	**1**	**2**	**3**
11. writing a poem	**1**	**2**	**3**
12. showing an experiment	**1**	**2**	**3**
13. acting out a story	**1**	**2**	**3**
14. making a Voice Thread	**1**	**2**	**3**
15. discussing my research with my family	**1**	**2**	**3**
16. painting a mural	**1**	**2**	**3**

17. writing a report	1	2	3
18. repairing a machine	1	2	3
19. playing a musical Instrument	1	2	3
20. filming a News Report	1	2	3
21. discussing ideas with a buddy	1	2	3
22. drawing pictures for a book	1	2	3
23. making a poster	1	2	3
24. building a project	1	2	3
25. acting in a play	1	2	3
26. selecting slides & music for a slide show	1	2	3
27. discussing what I have learned with a group	1	2	3
28. making a clay sculpture of a character	1	2	3
29. writing a description	1	2	3
30. building an invention	1	2	3

My Way... A Profile **How do I like to show the things that I have learned?**

Products						Total
Performance	1. _____	7. _____	13. _____	19. _____	25. _____	_____
Multi-media	2. _____	8. _____	14. _____	20. _____	26. _____	_____
Oral	3. _____	9. _____	15. _____	21. _____	27. _____	_____
Artistic	4. _____	10. _____	16. _____	22. _____	28. _____	_____
Written	5. _____	11. _____	17. _____	23. _____	29. _____	_____
Manipulative	6. _____	12. _____	18. _____	24. _____	30. _____	_____

Primary and Middle Years version

MY WAY
An Expression Style Inventory

Products provide students with a way to express what they have learned to an audience. This survey will help to determine the kinds of products YOU are interested in creating.

My name is: _____

Instructions:
Read each statement and circle the number that shows to what extent YOU are interested in creating that type of product. (Do not worry if you are unsure of how to make the product)

	Not At All Interested	Of Little Interest	Moderately Interested	Interested	Very Interested
Example: Writing song lyrics	1	2	3	4	5
1. acting out an event	1	2	3	4	5
2. designing a computer game	1	2	3	4	5
3. talking about my experiences	1	2	3	4	5
4. making a clay sculpture of a scene	1	2	3	4	5
5. writing an essay	1	2	3	4	5
6. constructing a working model	1	2	3	4	5
7. performing music	1	2	3	4	5
8. filming & editing a movie	1	2	3	4	5
9. talking about my project	1	2	3	4	5
10. painting a picture	1	2	3	4	5
11. writing stories	1	2	3	4	5
12. assembling a kit	1	2	3	4	5
13. acting out a story	1	2	3	4	5
14. designing an interactive computer project	1	2	3	4	5
15. discussing my research	1	2	3	4	5

16. painting a mural	1	2	3	4	5
17. writing a report	1	2	3	4	5
18. repairing a machine	1	2	3	4	5
19. playing a musical Instrument	1	2	3	4	5
20. filming & editing a video	1	2	3	4	5
21. discussing ideas	1	2	3	4	5
22. drawing pictures for a book	1	2	3	4	5
23. writing for a magazine	1	2	3	4	5
24. building a project	1	2	3	4	5
25. acting in a play	1	2	3	4	5
26. selecting slides & music for a slide show	1	2	3	4	5
27. discussing what I have learned	1	2	3	4	5
28. making a clay sculpture of a character	1	2	3	4	5
29. writing for a newspaper	1	2	3	4	5
30. building an invention	1	2	3	4	5

My Way… A Profile

Instructions: Write your score beside each number. Add each ROW to determine YOUR expression style profile.

Products						Total
Performance	1. _____	7. _____	13. _____	19. _____	25. _____	_____
Multi-media	2. _____	8. _____	14. _____	20. _____	26. _____	_____
Oral	3. _____	9. _____	15. _____	21. _____	27. _____	_____
Artistic	4. _____	10. _____	16. _____	22. _____	28. _____	_____
Written	5. _____	11. _____	17. _____	23. _____	29. _____	_____
Manipulative	6. _____	12. _____	18. _____	24. _____	30. _____	_____

APPENDIX 3: COMMON PERFORMANCE RUBRIC: SAME FORM USED FOR PRE-TREATMENT/POST-TREATMENT

Name:	Grade:	Project:

Rubric for Student Performance	Assessing common elements across grade 1, 5, 6, 7, 8, 9, 10: Scores: 1 = not at all, 2 = somewhat, 3 = proficient

PRE-TREATMENT Performance scores	Date:

Process	1	2	3
Inquirer: level of independence shown with project			
Knowledgeable: content shows deep understanding of topic			
Communicator: effectively communicates information / knowledge of subject			
Risk Taker: challenges self to explore new avenues / aspects within the project			
Reflective: organizes self effectively			
Principled: takes responsibility for own learning			
Product			
Thinker: content presented in a way that shows an understanding of how the presentation choice works			
Effort: project presented as 'professionally' as possible / appropriate for individual			
Product: quality of product			

1: (x 1)	2: (x 2)	3: (x 3)	Total: (Pre)

Comments:

APPENDIX 4: DATA ANALYSIS

Data analysis. Paired T-testing results: pre-treatment phase results versus post-treatment phase results. (Likert Motivation Scale: Common Performance Rubric). Data analysed using http://graphpad.com/quickscales/ttest1.cfm.

Grade 1: Likert Motivation Scale

Paired t test results

P value and statistical significance:

The two-tailed P value equals 0.0139

By conventional criteria, this difference is considered to be **statistically significant.**

Confidence interval:

The mean of Group One minus Group Two

Equals -1.67

95% confidence interval of this difference:

From -2.96 to -0.38

Intermediate values used in calculations:

t = 2.6947, df = 20, Standard error of difference = 0.618

Data Review:

Group	Group One.	Group Two.
Mean	32.71	34.38
SD	3.21	2.09
SEM	0.7	0.46
N	21	21

Grade 1: Common Performance Rubric

Paired t test results

P value and statistical significance:

The two-tailed P value equals 0.0004

By conventional criteria, this difference is considered to be **extremely statistically significant.**

Confidence interval:

The mean of Group One minus Group Two

Equals -4.81

95% confidence interval of this difference:

From -7.16 to -2.45

Intermediate values used in calculations:

t = 4.2604, df = 20, Standard error of difference = 1.129

Data Review:

Group	Group One.	Group Two.
Mean	19.95	24.76
SD	5.56	3.39
SEM	1.21	0.74
N	21	21

Grade 5: Likert Motivation Scale

Paired t test results

P value and statistical significance:

The two-tailed P value equals 0.4768

By conventional criteria, this difference is considered to be **not statistically significant.**

Confidence interval:

The mean of Group One minus Group Two

Equals -0.41

95% confidence interval of this difference: From -1.58 to 0.77

Intermediate values used in calculations:

t = 0.7245, df = 21, Standard error of difference = 0.565

Data Review:

Group	Group One.	Group Two.
Mean	30.27	30.68
SD	3.1	2.83
SEM	0.66	0.6
N	22	22

Grade 5: Common Performance Rubric

Paired t test results

P value and statistical significance:

The two-tailed P value equals 0.0004

By conventional criteria, this difference is considered to be **extremely statistically significant.**

Confidence interval:

The mean of Group One minus Group Two

Equals -2.36

95% confidence interval of this difference: From -3.54 to -1.19

Intermediate values used in calculations:

t = 4.1890, df = 21, Standard error of difference = 0.564

Data Review:

Group	Group One.	Group Two.
Mean	18.09	20.45
SD	3.58	3.74
SEM	0.76	0.8
N	22	22

Data analysis. Paired T-testing results: pre-treatment phase results versus post-treatment phase results. (Likert Motivation Scale: Common Performance Rubric). Data analysed using http://graphpad.com/quickscales/ttest1.cfm.

Grade 9+10: Likert Motivation Scale

Paired t test results

P value and statistical significance:

The two-tailed P value equals 0.0040

By conventional criteria, this difference is considered to be **very statistically significant.**

Confidence interval:

The mean of Group One minus Group Two

Equals -2.14

95% confidence interval of this difference:

From -3.51 to -0.76

Intermediate values used in calculations:

t = 3.2262; df = 21; Standard error of difference = 0.662

Data Review:

Group	Group One	Group Two
Mean	28.64	30.77
SD	4.27	3.15
SEM	0.91	0.67
N	22	22

Grade 9+10 Common Performance Rubric

Paired t test results

P value and statistical significance:

The two-tailed P value equals 0.0001

By conventional criteria, this difference is considered to be **extremely statistically significant.**

Confidence interval:

The mean of Group One minus Group Two

Equals -3.18

95% confidence interval of this difference:

From -4.57 to -1.79

Intermediate values used in calculations:

t = 4.7503; df = 21; standard error of difference = 0.670

Data Review:

Group	Group 1	Group 2
Mean	17.73	20.91
SD	2.69	3.93
SEM	0.57	0.84
N	22	22

All Students: Likert Motivation Scale

Paired t test results

P value and statistical significance:

The two-tailed P value equals 0.0003

By conventional criteria, this difference is considered to be **extremely statistically significant.**

Confidence interval:

The mean of Group One minus Group Two equals -1.40

95% confidence interval of this difference:

From -2.12 to -0.68

Intermediate values used in calculations:

t = 3.8658; df = 64; standard error of difference = 0.362

Data Review:

Group	Group One	Group Two
Mean	30.51	31.91
SD	3.9	3.2
SEM	0.48	0.4
N	65	65

All Students: Common Performance Rubric

Paired t test results

P value and statistical significance:

The two-tailed P value is less than 0.0001

By conventional criteria, this difference is considered to be **extremely statistically significant.**

Confidence interval:

The mean of Group One minus Group Two equals -3.43

95% confidence interval of this difference:

From -4.39 to -2.47

Intermediate values used in calculations:

t = 7.1569; df = 64; standard error of difference = 0.479

Data Review your data:

Group	Group One	Group Two
Mean	18.57	22
SD	4.15	4.12
SEM	0.51	0.51
N	65	65

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