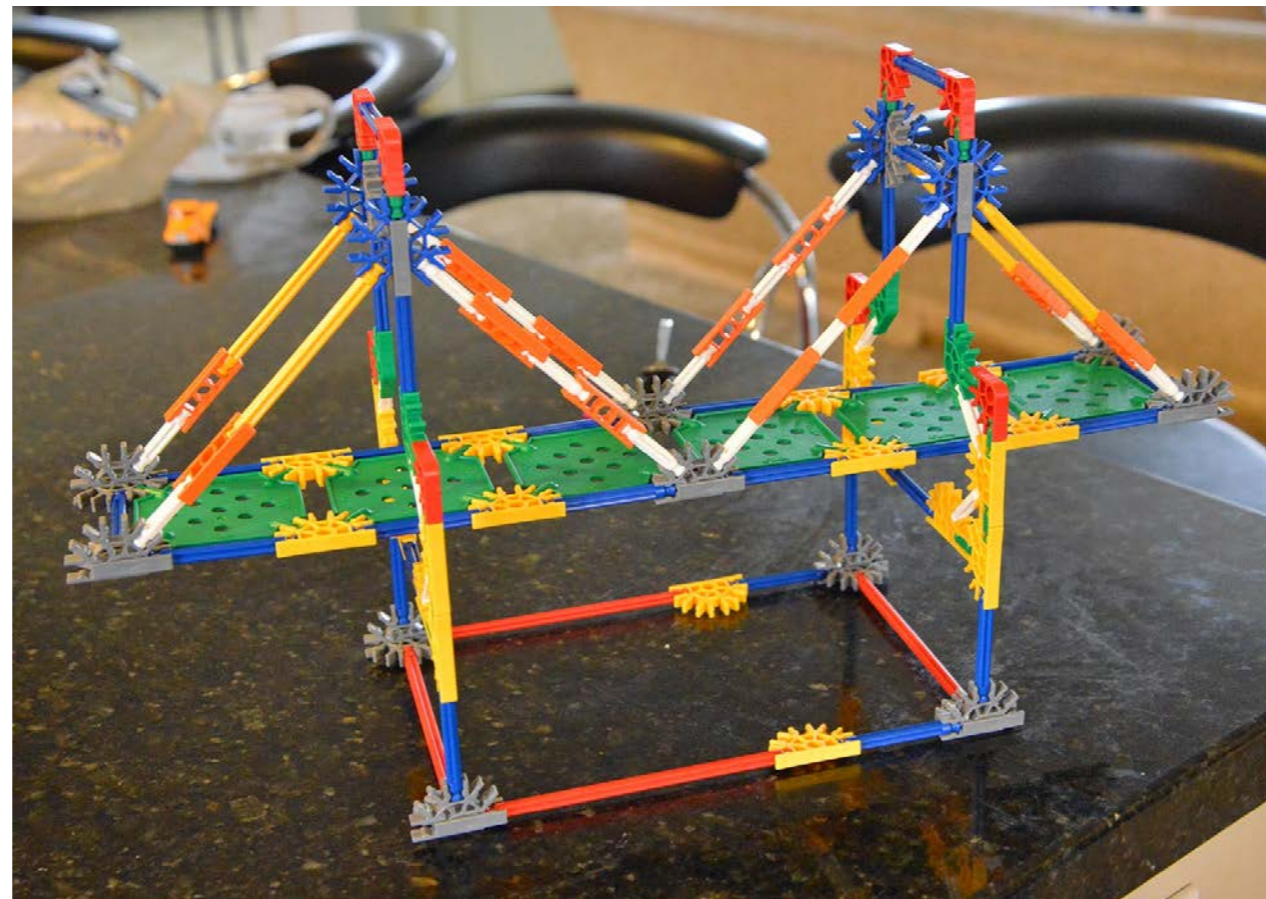


“The effectiveness of an integrated ‘Project Based’ curriculum on student attitude”

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RESEARCH QUESTIONS

- *1. How does the learning experience of an integrated STEM 'Project Based Learning (PBL)' task contribute to changing student attitude towards mathematics and science?*
- *2. What aspects of the STEM PBL task contribute to changes in student attitude towards mathematics and science?*



LITERATURE

- A student's attitude significantly influences their motivation to learn and ultimately determines their success or failure (Anderson and Maninger, 2007).
- Current trends show students are
 - less engaged in STEM subjects at school,
 - less engaged in STEM -related activities out of school
 - can develop resentment to STEM -related activities. (Vedder-Weiss & Fortus, 2010)
- A clear feature of the research is the decline in attitudes towards STEM from age 11 onwards
- The lack of motivation for science learning might not be inevitable but rather related to the way science is taught. (Breakwell & Beardsell, 1992)
- The current curricula and pedagogy in Australia fails to engage students in STEM fields. (Tytler et al, 2008)

LITERATURE

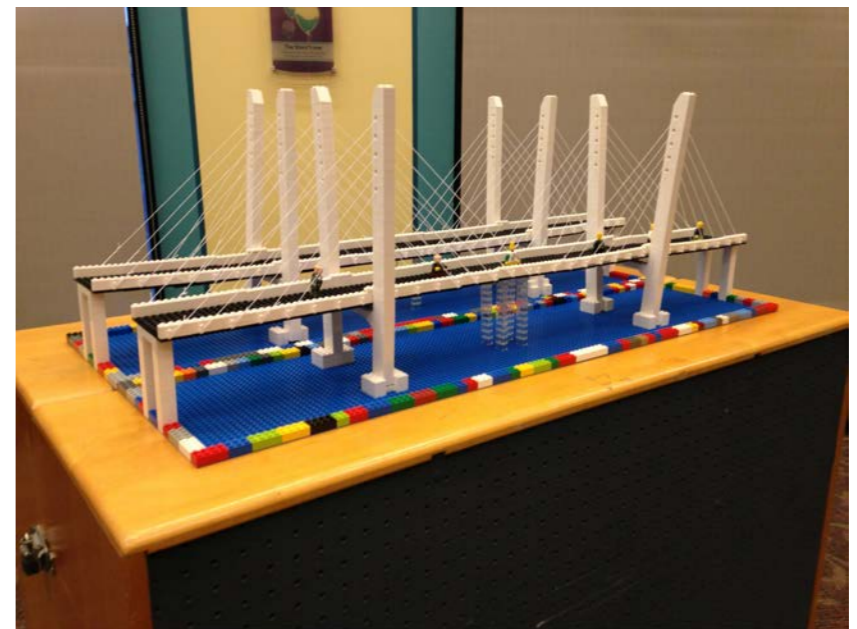
- The most common pattern in education is to teach subjects separately. (McNeill, 1990)
- Little attention is given to the interrelationships between subjects. (McNeill, 1990)
- The goal of curriculum integration stems from an understanding that real world problems are not separated into isolated disciplines. (Czaerniak, Weber, Sandmann & Ahern, 1999)
- Researchers and educators agree that curriculum integration can provide more meaningful learning experiences for students. (Capraro & Slough, 2008)
- Not only is learning thought to be enhanced, but it is considered to be more relevant to students. (Herschbach, 2009)
- An approach that uses integrated project based learning units provides students with the opportunity to learn through constructing their own knowledge by completing hands on, real life tasks.

LITERATURE

- Students in STEM PBL classrooms explore project activities and construct knowledge with teachers facilitating and guiding the learning process. (Barron et al, 1998)
- Integrating STEM subjects helps students connect relevant skills to the use of the skills in real world applications by providing valuable learning contexts. (Brophy, Klein, Portsmor & Rogers, 2008)
- The integration of STEM subjects offers students one of the best opportunities to experience learning in a real-world situation, rather than learning piece by piece. (Tsupros, Kohler & Hallinen, 2009)
- There is a limited amount of research that examines the skills, beliefs, knowledge bases and experiences necessary for effective integrated instruction, especially with STEM. (Fykholm and Glasson, 2005)

METHODOLOGY

- † Research was Quantitative with students completing a Likert Scale survey.
- † Surveyed student attitude to science and maths before and after undertaking a STEM PBL unit.
- † 27 grade 6 students.
- † No prior involvement in STEM.



DATA COLLECTION

- The data collection was of three forms.
- Questionnaire – of all students pre and post project based sessions
- Research Journal – a researcher reflective journal documenting reflections on aspects of the design task where I noticed an increase or decrease in students' attitude.
- Interviews – of a staff member (class teacher) and of a selected focus group of students.

MAJOR CHALLENGE

- ENGINEERING A BRIDGE



THE TASK

- THE YEAR IS 2025 AND YOU AND YOUR TEAM RUN A SMALL BUT SUCCESSFUL ENGINEERING AND ARCHITECTURAL COMPANY.
- THE LOCAL GOVERNMENT HAS PUT OUT A TENDER FOR A BRIDGE TO BE CONSTRUCTED BETWEEN POINT LONSDALE AND POINT NEPEAN, LINKING THE TWO SIDES OF THE BAY.
- YOU AND YOUR TEAM FEEL YOU ARE UP TO THE TASK.

THE COMPLICATIONS

- THE PORT OF MELBOURNE AND GEELONG ARE EXTREMELY BUSY PORTS AND THIS NEEDS TO CONTINUE.
- MANY OF THESE SHIPS ARE OVER 60M HIGH AND THIS NEEDS TO BE CONSIDERED IN YOUR DESIGN.
- ALTHOUGH THE BAY IS QUITE SHALLOW IS DOES HAVE SOME DEEPER SECTIONS IN THE MIDDLE OF THE CHANNEL.

WEEK BY WEEK

- WEEK 1 - INTRO TO PROJECT - GROUPS - EXPLORE BRIDGES.
- WEEK 2 - FORCES LAB - EXPLORE KNEX
- WEEK 3 - EXPLORE BRIDGE DESIGN
- WEEK 4 - EXPLORE BRIDGE DESIGN
- WEEK 5 - EXPLORE BRIDGE DESIGNS
- WEEK 6 - PROJECT
- WEEK 7 - PROJECT
- WEEK 8 - PROJECT
- WEEK 9 - PROJECT
- WEEK 10 - PRESENTATION

REQUIREMENTS

- AS A TEAM YOU NEED TO COMPLETE THE FOLLOWING.
 - A LETTER OUTLINING YOUR DESIGN TO CONSTRUCT THE BRIDGE AND WHY.
 - DRAWINGS OF YOUR DESIGNS FROM THE SIDE AND ABOVE
- A POWERPOINT PRESENTATION TO INFORM THE SELECTION COMMITTEE OF YOUR INTENTIONS.
 - A SPREADSHEET OF COSTINGS TO BUILD THE BRIDGE.
- A MODEL OF YOUR BRIDGE THAT SPANS 50CM IS STRUCTURALLY SOUND AND CAN SUPPORT THE WEIGHT OF A TRAIN.

Survey

	Strongly Disagree	Disagree	Neither Agree or Disagree	Agree	Strongly Agree
Maths is a subject that I find challenging.					
I would consider choosing a career in the future that uses maths.					
Maths is difficult					
I am a student who enjoys maths.					
I do well in most subjects but I cannot do a good job in maths					
I am sure I could complete harder work in maths.					
I get good grades in maths.					
I enjoy being challenged in maths.					
I am good at maths.					
I look forward to maths sessions.					
I am confident when I do science.					
In the future I would like to be a scientist.					
Science is difficult					
I am a student who enjoys science.					
I do well in most subjects but I cannot do a good job in science					
I am sure I could complete harder work in science.					
I get good grades in science.					
I enjoy being challenged in science.					
I am good at science.					

	Pre-test mean	Post-test mean	Difference
Maths is a subject that I find challenging.	2.42	2.24	-0.18
I would consider choosing a career in the future that uses maths.	3.25	3.36	0.11
Maths is difficult	2.08	2.16	0.08
I am a student who enjoys maths.	3.88	4.04	0.17
I do well in most subjects but I cannot do a good job in maths	2.25	1.88	-0.37
I am sure I could complete harder work in maths.	3.33	3.40	0.07
I get good grades in maths.	3.63	3.88	0.26
I enjoy being challenged in maths.	3.96	4.24	0.28
I am good at maths.	3.83	4.28	0.45
I look forward to maths sessions.	3.92	4.08	0.16
I am confident when I do science.	3.96	4.12	0.16
In the future I would like to be a scientist.	2.38	2.32	-0.06
Science is difficult	1.83	1.92	0.09
I am a student who enjoys science.	4.08	4.40	0.32
I do well in most subjects but I cannot do a good job in science	2.00	1.84	-0.16
I am sure I could complete harder work in science.	3.54	3.40	-0.14
I get good grades in science.	3.88	3.88	0.00
I enjoy being challenged in science.	4.00	3.92	-0.08
I am good at science.	3.79	4.00	0.21
I look forward to science.	4.21	4.36	0.15

FINDINGS

Area	Items Measured	Improvement in attitude	No Change in attitude	Decrease in attitude	% Improvement
Mathematics	10	9	0	1	90%
Science	10	5	1	4	50%
Total	20	14	1	5	70%

FINDINGS

Item	Items Measured	Improvement in attitude	No Change	Decrease in attitude	% Increase
Self-concept in mathematics and science.	12	8	1	3	66%
Learning mathematics and science in school	6	5	0	1	83%
Future participation in mathematics and science.	2	1	0	1	50%

STUDENT FEEDBACK

- What aspects of the current STEM PBL task did you like best?
- *The project was fun and more intriguing and it helped me learn a little bit more because I was doing it myself. I think that helped instead of being taught how to do it instead of figuring it out for myself.*
- Do you think that mathematics and science can be taught together?
- *With the science, it was all combined as well because with the mathematics there's the measuring and that kind of thing. Then with the science there's the engineering part of it. I think it was all rolled into one then he did teach us a little bit of science by itself and a little bit of mathematics as well.'*

TEACHER FEEDBACK

The classroom teacher commented that the PBL task was particularly popular with high achieving students and led to an increase in their engagement in maths. However, the teacher felt that it did not appear to have had the same impact on all students. The classroom teacher did comment that students were now more aware of the interrelationships that exist between the different subjects.

- *On a recent science excursion I found their level of investigation and justification skills to have improved. Making links and being able to go out against their friends, or working group in order to go with what they think rather than accepting other students' viewpoints as their own. This is a significant improvement. I have also found the level of science related conversation to have increased in the classroom. Students are happily sharing documentaries watched, solar boat findings etc.'*

SUMMARY

- STEM PBL is an engaging curriculum that generally enhances student attitude towards mathematics and science.
- Students responded to the situated learning provided by the real life challenge of working as an engineer.
- Students enjoyed the hands on elements of the STEM PBL task in which they had to build several different types of bridges.
- Student attitude towards mathematics improved more than that of science.
- Students enjoy learning science but do not have a very good opinion of their ability to do science.
- The cooperative learning aspect of the STEM PBL task was not enjoyed by all involved and in some cases may have contributed to less of an improvement.