Team Collaboration in Maker Learning

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Introduction

In Technology and Applied Studies, students are predominantly challenged to design and make solutions to given design briefs. In many design industries, designers work in collaborative teams but they focus on specialist tasks within those teams.

Through this research project, I set out to investigate how effectively boys could collaborate in multi skilled teams when challenged to solve a complex design problem. Boys with different skills and subject backgrounds teamed up and competed in a design challenge. They were tasked to design and make a working model wind turbine.

In running the design challenge I took much advice from Stager and Martinez 'Invent to Learn: Making, Tinkering and Engineering in the Classroom' with the boys using the "Think, Make, Improve" model for problem solving and design.

The Research Question

How can designing and making prototypes in specialised skill-set teams enable Grade 9 boys to be more autonomous makers?

Research Context

Shore (Sydney Church of England Grammar School) is a large day and boarding school for boys in North Sydney, NSW Australia. The teaching staff of the school are engaged in examining how to enrich student learning and engagement using structured thinking and questioning routines. The staff have also engaged in developing PBL programs.

Participants

The Shore TAS faculty runs elective courses in Design and Technology, Industrial Technology and Graphics Technology. This presented an opportunity to run a collaborative design project across these three subjects. The design project involved students working in teams of 6-7 students (2-3 Design and Tech students, 2-3 Industrial Tech Students and 2-3 Graphics Tech students).

The Research Action

Design teams were presented with the scenario that they had to use wind power to survive on an outback farm with no available energy grid. Their brief was to design and make a working wind turbine that would provide enough energy to power LED lights and small voltage water pumps. The boys were guided to a small degree by their teachers but the emphasis was on them being autonomous and learning through cycles of Thinking, Making and Improving. The project took place over 6 x 50 min periods.

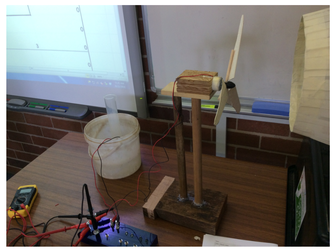
Data Collection

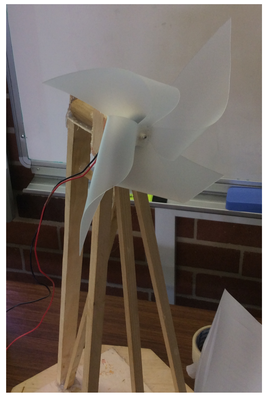
- Pre and Post action surveys to gain insight into the students perceptions and preferences regarding collaboration and group work, strengths, weaknesses, successes and failures in TAS and in the project itself.
- Boys wrote journals during the course of the project, commenting on their progress and planning for subsequent lessons. They also commented on their feelings about fellow team members.
- Two design teams were filmed extensively as they worked and observations were taken from the recordings.

Data Analysis

The survey responses, journal writing and video observations were examined. Boys responses and evidence from their activity highlighted many examples of autonomy and what it means to be an "autonomous maker". Data were grouped into common themes regarding:

- creativity
- collaboration and teamwork
- designing and making skills
- successful design realisation





Key Findings and Discussion

- Boys highlighted the need for creativity to be part of the making process. If they are being told what to do each step of the way and are not given freedom to explore ideas and design solutions then they are not really working autonomously.

- Creativity was also demonstrated in the choice of design process that boys followed.

"making projects like these were very rewarding and I was able to use my own creativity."

- Boys realised the importance of effective collaboration in their teams and they quickly organised themselves into allocated tasks. However they were critical of the effectiveness of their collaboration and of team members who didn't communicate.

"I enjoyed everyone splitting up into their strongest sections and then coming back into a group to put the final design back together."

"We found out that TH made his own propeller which worked really well. I think our teamwork wasn't very good across the whole project because I had no idea that TH came up with his own design while everyone else was working on the design which ended up failing."

- Evidently, collaboration was not helpful or effective for some students. TH (mentioned above) worked in isolation from his team for most of the project and he managed to produce a propeller that won the competition for his team.

- Boys largely relied on trial and error to develop their designs and make the turbines. However they became aware that research plays an important part in the design cycle.

"...have more specific roles and plan what we will do with research instead of just trial and error"

Conclusions

In adopting a Maker Learning approach, and applying it to this project, some successes and shortcomings have been identified.

- Although many of the students were unable to realise successful, working wind turbines, the learning that occurred when students cycled through thinking, making, and improving their prototypes was more important than simply arriving at a finished working one. Furthermore, the "Teaching Mantra: Less Us, More Them", firmly supports the research question. If the students have autonomy then the teacher will "grant more authority, responsibility and agency to the learner" (Martinez and Stager, 2013)

- Collaboration is not effective for all learners. Some personalities work better alone.

- A major shortcoming of this project was the time allocated for the research action. With 20 lessons instead of just 6, students would be able to plan, research, collaborate, make and evaluate more effectively and realise quality practical outcomes. This was clear in the feedback from research participants.

"More time to reduce stress and therefore clearer thinking happens."

Key Readings

Alber, R. (2014, April 13) *Deeper learning: a collaborative classroom is key*. [Web Log post]. http://www.edutopia.org/blog/deeper-learning-collaboration-key-rebecca-alber

Boss, S. (2012). *Bringing innovation to school: empowering students to thrive in a changing world*. Bloomington, IN: Solution Tree Press.

Libow Martinez, S. and Stager, G. (2013). *Invent to learn: making, tinkering and engineering in the classroom*. Torrance, CA: Constructing Modern Knowledge Press.

Ritchart, R., Church, M. and Morrison, K. (2011). *Making thinking visible: how to promote engagement, understanding and independence for all learners*. San Francisco, CA: Jossey-Bass

Further Information

This poster and further information is available at http://www.theibsc.org/.

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