



Robotically Refreshing!

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IBSC

Introduction

The challenge of building a competitive robot was set to enable middle school boys to 'Tinker'.

The process of Tinkering, or Making, allows participants to learn in a context which promotes ownership of their thinking and their actions.

Mistakes or failures during the process were viewed as positive learning experiences.

This multi-disciplined approach to learning encompasses Science, Technology, Engineering and Mathematics is the blueprint for the educational field of Maker Learning.

The Research Question

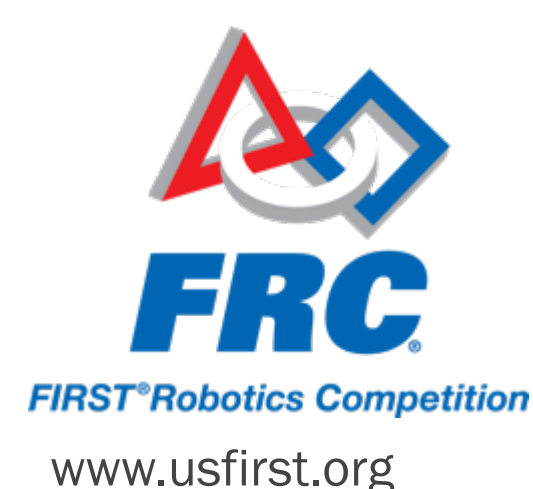
How does building a robot enhance middle school boys' decision making skills?

Research Context

Barker College is situated in Sydney, Australia. It is an Anglican school with 1980 students from Kindergarten to Grade 12. It is an all boys from Grades K - 9 and Grades 10 -12 are co-educational.

Participants

Nine middle school boys, aged 13-15, from Grade 8 and Grade 9. The students attended a Robotics holiday program in December 2014 in preparation for the FRC build season in January 2015.



The Research Action

This action focused on inquiry based practice. Tinkering emphasises decision making, critical thinking and problem solving as the roots of creativity, joy and innovation.

FIRST robotics competition (FRC) is an American based robotics program. In March 2015, the inaugural FRC Australian Regional will take place and in which the robot is to compete.

The rules of the competition determine the design of the robot. In a 6-week time period, participants build a robot of their own design. They are guided by industry mentors, learning an array of skills and using sophisticated software and hardware.

Data Collection

Field notes, personal log, surveys, record sheets, reflection questionnaire, video, photographs and interviews.

Data Analysis

It has helped me look at everyone's point of view evenly and equally as a possible solution, and also any way to improve each one

Date: Friday, 23 January 2015
Subject: What we learnt today and how we will use that newfound knowledge
To: team-4613@googlegroups.com

What we learned today:

That we all spend a lot of time chatting and not concentrating on our tasks and making mistakes or going slowly. I think this is because we don't have an easy way to find out what jobs need to be done and not everyone had something to do.

What I am going to do about it:
I will transcribe this table onto a whiteboard tomorrow morning. My theory is that as people come up with things that they want to do they add it to the list and assign it a priority.

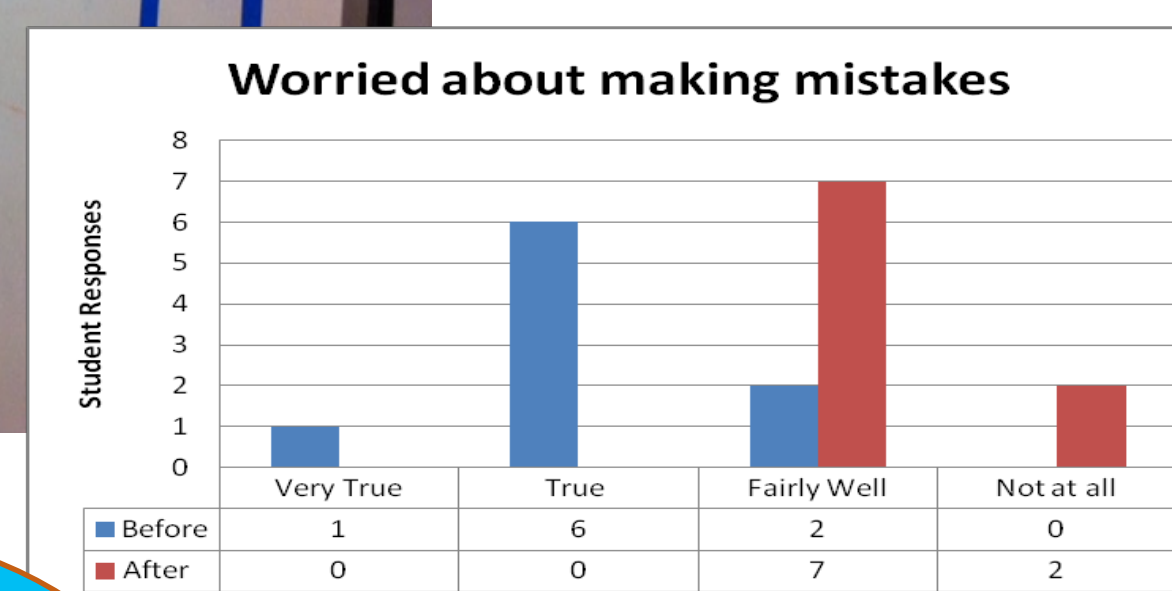
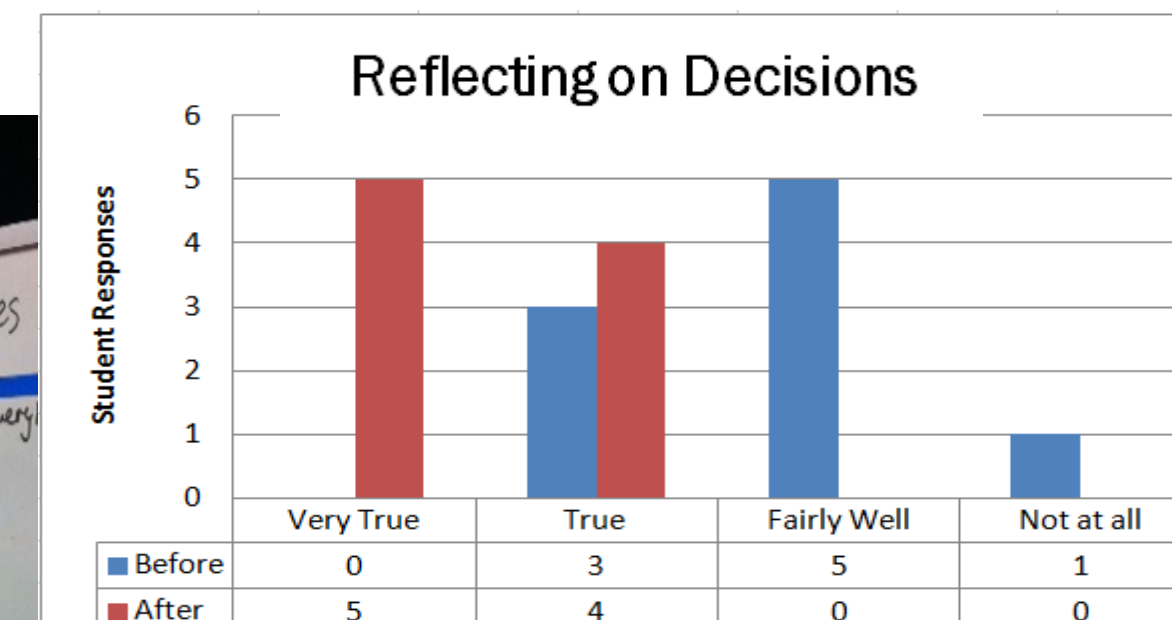
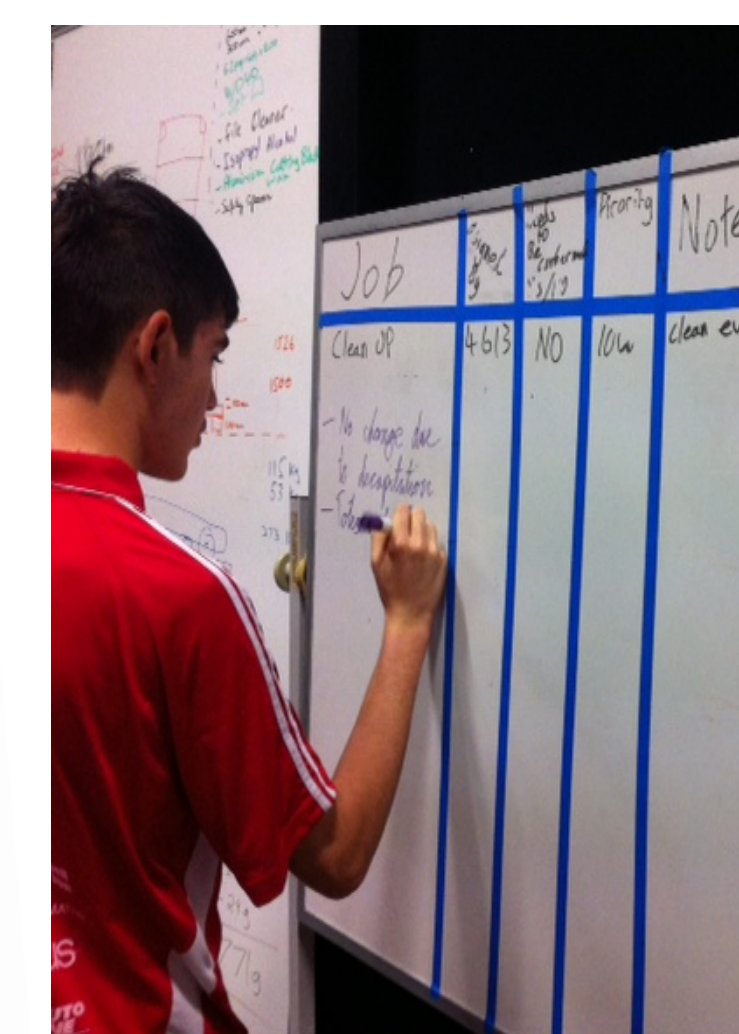
If the person who wrote the job up feels that the job needs to be checked they put their name in the appropriate column. There will be a column for other notes i.e. come see this person before you start.

When a person who has nothing to do looks at the board they make a sensible decision about what the most high priority job they have the skill to do. I.e. If there is a very high priority job that goes along the lines of code in the sensor I would not do it as I have no skill at coding instead I would choose the next most important thing I could do.

Once the person has selected the job they are going to do they would put their initials next to that job in the appropriate column. Once they have done that job they would put a tick in the done column. They would then (if they needed to) check with the person that it is done correctly. Once this is all completed you repeat the process.

The other thing we need to do is get things checked before we cut/drill/pop rivet. We are making way to many simple mistakes. This is wasting material and time.

Oliver

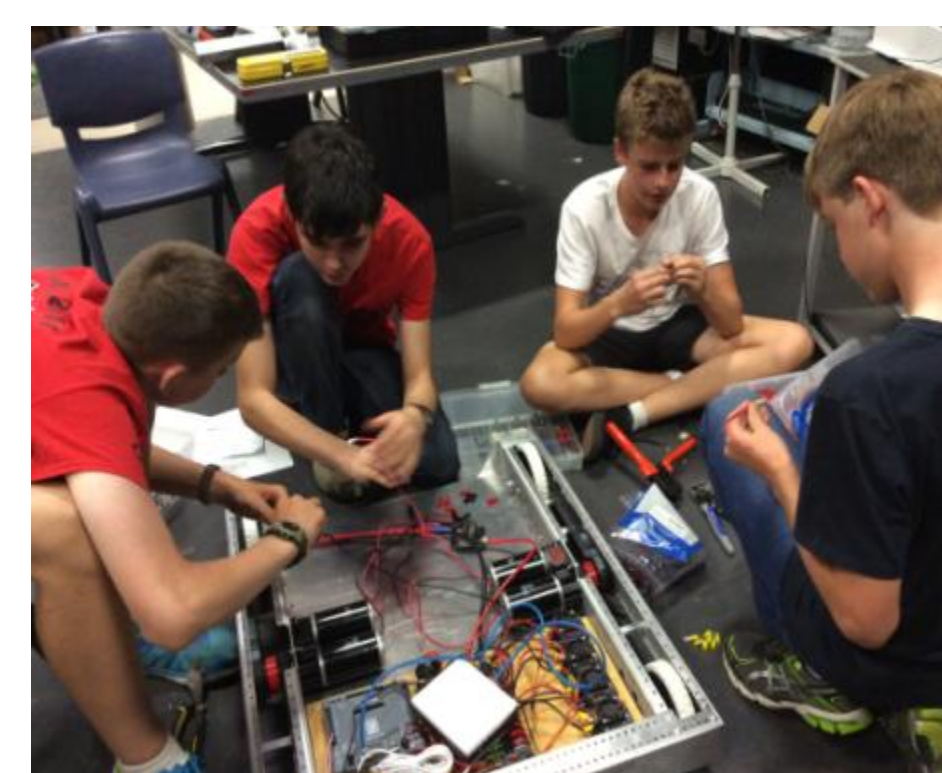


"Robotics has made me think/ weigh up my decisions a lot more... makes me think about whether the way I'm doing something is the best way"

"Through robotics I have learnt to be critical of my own ideas. 'Measure twice, cut once!!!, My decision making is more calculated.'

Key Findings and Discussion

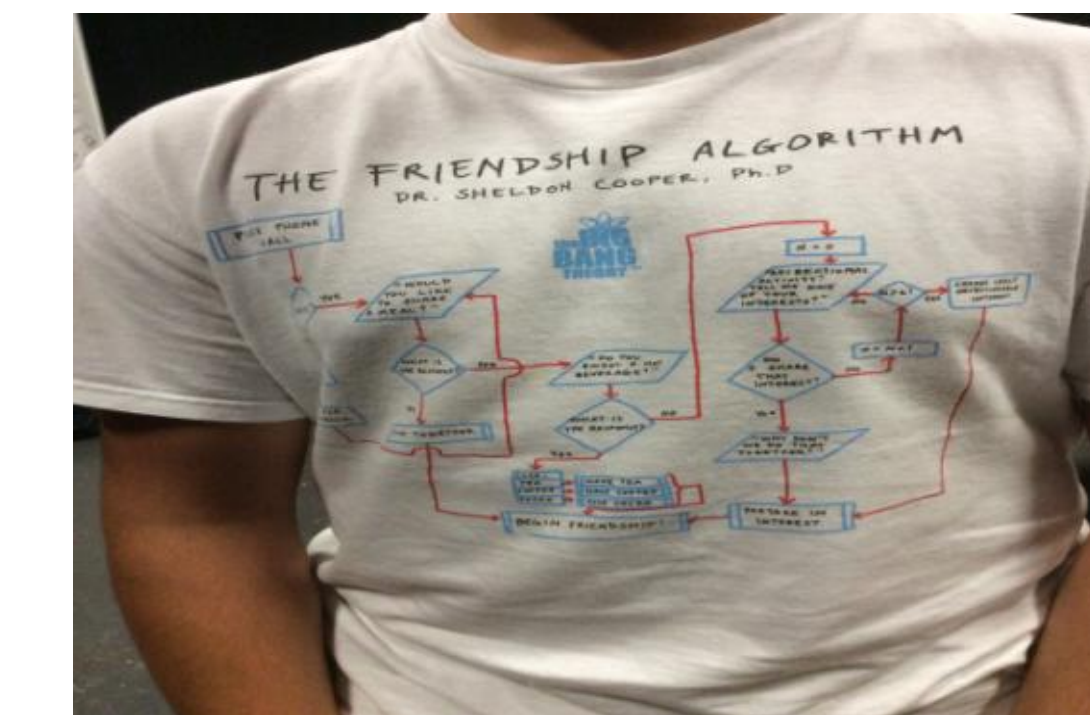
- Participants shifted their focus from the product to valuing the experience and the process
- Level of on-task behaviour was initially 50% task oriented improved to 100%
- Participants took less time to make better decisions
- 78% reduction in fear of failure and worry about making mistakes
- 100% increase in acquisition of language
- 60% increase in effectiveness of decision making skills
- 90% of students recorded an increase in their critical thinking skills and creativity



Conclusions

The participants became more effective and increased their efficiency when making decisions.

Recognition that poor decision making wasted valuable time, reducing productive.



Goal orientated tasks were identified, defined quickly and the participants increased their discussions in regards to the quality of the outcome required.

The development of objective thinking was directly linked to the participants increased understanding of their own self-efficacy and perseverance.



The participants recognised and valued their autonomy.

Maker learning practices develop participants' meta-cognitive thinking routines. These practices prioritise learning to learn by encouraging reflective assessment and evaluation of one's own thinking methods, in order to gain deeper understanding.

Inquiry based learning is a successful method to produce life-long learners and is a valuable teaching tool to equip boys for the challenges of learning in 21st century.

Key Readings

- Dean Kamen. 2002. *First*. [ONLINE] Available at: <http://www.usfirst.org/>. [Accessed 07 May 15].
- Gura, M. & King K.P. (2007). *Classroom Robotics: Case Stories Of 21st Century Instruction For Millennial Students* (1st ed.). USA: Information Age Publishing.
- Martinez, S.L. & Stager, G., (2013). *Invent to Learn, Making, Tinkering, and Engineering in the classroom*. 1st ed. Torrance, CA : Constructing Modern Knowledge Press.
- Switzer, A. (2009). *Assessing changes in high school students' environmental decision-making skills: some methodological contributions*. PhD. University of Michigan.

Further Information

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

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