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
- Robotics has made me think/ weigh up my decisions a lot more. I think about whether the any action I take is the best way
- Through robotics I have learnt to be critical of my own work, make my decisions twice, cut once!!
- My critical of my own ideas. ‘Measure twice, cut once!!!’
- ‘Through robotics I have learnt to be critical of my own work, make my decisions twice, cut once!!!’

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

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

Further Information
This poster and further information is available at http://www.theibsc.org/.
Researcher’s Email: sarah_cormio@barker.nsw.edu.au