Making mathematics meaningful: an investigation into middle years students engagement with problem based learning

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Tension

- “[M]athematics … is perceived to be ‘hard’, ‘boring’ and ‘useless’” (Brown, Brown, & Biddy, 2008)

- “Students formulate and solve problems when they use mathematics to represent unfamiliar or meaningful situations” (ACARA, 2011).
Knowledge Producing Schools

- Project based learning
- Students formulate and solve a problem or issue in their local community
- Students not only ‘consume’ knowledge but also produce new knowledge that benefits others (Bigum & Rowan, 2009)
- Students “produce some kind of product … that can be externally validated and which thus forms a bridge between school and not-school.” (McGrath & Rowan, 2012, p.69)
Authentic pedagogy

- Students’ “accomplishments ... are significant, worthwhile and meaningful” (p. 1).

- Classroom instruction requires higher-order thinking, substantive conversations, deep knowledge and connections to the world beyond the classroom.

- Task or problem must be connected to the real world and be for an audience beyond the school (Newman et al. 1995).
This study

- **Research question**
  - How did the students use mathematics meaningfully to make a difference in their local community?

- **Participants**
  - 27 students Years 5 to 9 regional school and teacher
  - External experts (community youth development officer, YAS project manager, researcher/mathematician)

- **Data**
  - My journal observations and reflections
  - Audiotaped interviews - students and external experts
  - Copies and photographs of student work
  - Videos of some sessions

- **Analysis - working mathematically moments**
  - problem negotiation, formulation, solving, communication
Their problem

- To create a teenage safe space
  - that was family friendly
  - included multicultural artwork that represented the community
  - had a landscaping and design element.

- To encourage a wide range of people to use the park as a meeting place

- To make an actual difference in their local community.
Problem negotiation

- Initial task was location of the Youth Activity Space
- Council’s aim was a skate park
- But students did not feel safe in either adjoining park
- Surveyed everyone from year 5 – 12 in the two schools
- Develop a survey
Problem formulation

- The CYDO: “[T]hey are the experts in what young people want. … Young people had identified what they wanted in the space … a space inclusive of all young people … Council wanted a recreation space … young people wanted more than that - the social aspect. … I think it just came out.”
Survey

2. Which of the following helped you choose the location for the Nambour Youth Activity Space (if any)?
   - [ ] I like the current location
   - [ ] It’s easier to get to
   - [ ] It’s closer to town
   - [ ] It’s closer to amenities e.g. public toilets
   - [ ] It’s a safer space
   - [ ] It’s a family friendly space
   - [ ] Privacy
   - [ ] More opportunities for youth activities

5. How would you use the Nambour Youth Activity Space?
   - [ ] Skateboarding
   - [ ] Bike riding
   - [ ] Scooting
   - [ ] Entertainment
   - [ ] Meeting and hanging out with friends and family
   - [ ] Picnic / BBQ / eating
   - [ ] Sport and recreation activities

6. Other than a skate park, what else would you like included in the Nambour Youth Activity Space?
   - [ ] Art wall or spaces
   - [ ] Children’s play area
   - [ ] Drink fountains
   - [ ] Fitness equipment
   - [ ] Grassed areas and gardens
   - [ ] Picnic / BBQ / eating area
   - [ ] Public toilets
   - [ ] Shade / Shelter areas
   - [ ] Stage for entertainment
   - [ ] Tables and seating
Solution

What students would use the skate park for.

*Figure 2.* The graph shows how the students would use the Nambour Youth Activity Space.
Demographic group

- Compared the demographics of their sample with the data from the ABS website
  - Graphically
  - Using percentages

- “I worked on the demographic analysis. One of the things I learnt was how to work with percentages. How to calculate them from just ordinary numbers.” (high achieving Year 9 student)

- They need to consider the percentages in the context they are working in (White & Mitchelmore, 2005).
Communicating

- Report to Council

*Project beyond Limits report*
Nambour Youth Activity Space
Youth community engagement 2012

Completed by Nambour State High School and Nambour State School
Community outcome

- Students’ preferred site chosen
- The Council project manager’s reaction: “The kids got it over the line. Things were very fiery in Council with the Business Alliance. … It was the kids report and graphs that got the decision over the line.”
Students’ learning outcome

- Opportunities for correction of misconceptions with mean, median and mode
- Deeper understanding of percentages in context
- Saw first hand
  - the meaningful useful of mathematics
  - The importance of being able to use mathematics to communicate findings
- Opportunities for further learning
Students’ final words

“During PBL I have learnt many skills like, how to work in a team with many people from different age groups. This has helped learn how to use other people’s skills. It is also very good and I learnt many things on the computer, such as graphing and how to analyse certain questions like in the report that we did and it’s a very fun experience and I’ve learnt many things.” year 8

“I enjoyed PBL because we actually got to do something useful in the community instead of just doing maths sitting in the classroom. We could actually go out there and design a skate park or something awesome.” year 6