Raising Awareness of Engineering as a Career Choice for Elementary and Secondary Students: A Collaborative Approach

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Background to the Project

Engineer for a Year
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What?
- The Engineer for a Year program is designed to help address the barriers to children’s engagement in Science, Technology, Engineering, and Mathematics (STEM) subjects.

Who?
- The target populations are youth in Grades 4-12, teachers, and Queen’s University students from engineering and education. The 2013-14 pilot will include four teachers and their classes, and one district school board curriculum consultant with a group of teachers undertaking professional development in STEM related subjects.

Why?
- Through supportive and collaborative mentoring relationships, the Engineer for a Year program is designed to personalize engineering making the profession accessible to young people through increased knowledge and confidence in STEM as a career choice.
Review of the Literature

• Enrollment in STEM career programs, such as engineering, is in decline while the anticipated demand for these skills is on the rise (Archer et al., 2012; Long et al., 2010; Let’s Talk Science, 2010; Riegle-Crumb, Moore, & Ramos-Wada, 2011; Prism Economics & Analysis, 2012)

• Youths’ attitudes towards engineering are more favourable when they have a more accurate conception of the engineering profession (Karatas, Micklos, & Bodner, 2008; Lyons & Carolina, 2011)

• The ideal context for success includes a teacher who understands the engineering design and problem-solving process (Becker & Park, 2011; Herschbach, 2011; Mativo, 2011)

• Further research is needed to explore the impact of K-12 intervention programs
This study explored how the Queen’s University Faculty of Engineering and Applied Science (FEAS) Educational Outreach “Engineer for a Year” program undertaken during 2013-14, raised awareness of engineering as a career choice for elementary and secondary aged students.
In particular...

This mixed method case study sought to understand:

- How did the Engineer for a Year program affect children’s perceptions of engineering-related subjects and associated careers?
- What were the teachers’ perceptions of how the Engineer for a Year program supports their teaching practice?
- How did the Engineer for a Year program facilitate collaborative curriculum implementation between FEAS engineering students and K-12 teachers?
Data Collection

Two observations per class were undertaken of teacher and student engineer classroom collaborations. A total of four observations were undertaken across the two participating classes. Classroom observations focused exclusively upon interactions between teacher and engineering student.

Interviews were undertaken with participant teachers and engineering students. Purposeful sampling was used to select four participants for interview based upon findings of observational data.

All elementary and secondary students from the participating classes were invited to undertake a drawing exercise to assess their perceptions of STEM subjects and associated career choices. 16 students out of 36 participated.
Findings: Observation Data

- Site visits
- Teacher as translator/interpreter
- Curriculum concepts brought to life
- Collaboration essential
- Teacher networking
Findings: Interview Data from Teachers

**Collaboration:**
“Engineer for a Year reinforced the value of collaborations in schools for sure” (John)
“It supported me as being a new teacher I sometimes feel that I am putting the information out there and I can’t always tell if it is being absorbed” (Hugh)

**Teacher as Interpreter:**
“Though the engineering student was technically very competent, it was so important that I ensured the content was right for my students” (John)

**Expanding Student Knowledge:**
“It was awesome for the students to see that a PhD and researcher is a human being…” (Hugh)
Findings: Drawing Exercise Data, School One

Objects
- Signs of thinking
- Technology
- Civil structures
- Blueprints
- Math symbols
- Furniture
- Books
- Other machines
- Fictional machines
- Writing objects
- Measuring tools
- Building tools
- Computers
- Other people

Inferences of Actions
- No Action Inferred
- Explaining/Teaching
- Experimenting/Testing/Creating Knowledge
- Designing/Inventing/Creating products
- Operating machinery
- Making/Fixing/Working with hands

Percent of (n = 7) participants
Findings: Drawing Exercise Data, School One

**Appearance**
- Labourers clothing: 0%
- Glasses: 40%
- Female: 20%
- Male: 80%
- Skin Colour (None): 60%
- Human: 100%

**Location**
- Indoors: 60%
- Inconclusive: 40%
Findings: Drawing Exercise Data, School One
Findings: Drawing Exercise Data, School Two

Objects
- Construction vehicles
- Passenger vehicles
- Signs of thinking
- Technology
- Civil structures
- Blueprints
- Math symbols
- Furniture
- Books
- Other machines
- Fictional machines
- Writing objects
- Measuring tools
- Building tools
- Computers
- Other people

Inferences of Actions
- Observing
- Experimenting/Testing/Creating Knowledge
- Designing/Inventing/Creating products
- Operating machinery
- Making/Fixing/Working with hands

Percent of (n = 9) participants
Findings: Drawing Exercise Data, School Two

Appearance

- Hard hat
- Crazy hair
- Lab coat
- Labourers clothing
- Glasses
- Female
- Male
- Skin Colour (None)
- Human

Location

- Outdoors
- Inconclusive
- Indoors

Percent of (n = 9) participants
Findings: Drawing Exercise Data, School Two
Implications

- Project participants need clear objectives
- Available resources should be specified to all parties
- Drawing exercise should be undertaken at commencement and culmination of project
- Engineering student requires pedagogical support ~ suggest involvement of experienced B.Ed. Candidates
- Teachers need cover to take time out for visits to engineering faculty
- Range of possible projects should be suggested to teacher ~ teacher has limited time to create projects
- Matching engineering student to teacher is crucial
Any Questions...?

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