INTRODUCTION

Facilitating student engagement and motivation is particularly difficult within compulsory foundation units. This pilot study was undertaken in a first year calculus-level physics unit with a significant failure rate thought to relate to a lack of engagement. The study explored a possible solution: namely, encouraging students to take ownership of their learning by challenging them to explore its relevance to self and career.

The incentive for the study was to create new insights into the support and teaching approaches needed for students to succeed in this and similar foundation units. Influenced by the theoretical framework of ‘possible selves’ (Markus & Nurius, 1986), which advocates that people are influenced by their awareness of possible future selves, the study aimed to determine student self-efficacy and career premix in relation to their intended profession. A secondary aim was to determine the extent to which the students felt the unit was relevant to their future careers.

The research questions guiding the study were:
1. How do students characterise an engineer?
2. What differences do students perceive between themselves and their definition of an engineer?
3. In what ways do students think that the learning in this unit will contribute to their development as engineers?

METHOD

Participants: Fifty-nine first year students enrolled in Principles of Physics at Murdoch University in First Semester 2014.

Procedure: In the first week of the unit, students participated in a two-hour workshop that featured self-reflection, group work, and group discussion. The two workshop activities directly related to this study are given below.

Measures: Students provided individual written responses to the activities ‘Imagining their future career’ and ‘Two-minute paper’, detailed below. Working in discipline groups, they then created a collaborative drawing of someone in their profession.

Data: Data from the 43 students planning to be engineers was analysed using content analysis with a-priori codes developed from a related project (Bennett, 2012).

ACTIVITIES

Imagining Their Future Career (40 minutes)
Students complete the self-reflection worksheet and then discuss their responses with discipline peers prior to discussion with the class. Self-reflection questions include: 1. Name 3 characteristics of your chosen profession (e.g. engineer, scientist, teacher) 2. What differences are there (if any) between you and the above? 3. What do you see as a role of a…? (Insert your profession) 4. What will your personal role be? 5. How will the learning in the unit contribute to your development as a professional in your chosen field? 6. Imagine yourself in 15 years’ time. What will you be doing? What do you dream you have achieved as a professional over this time? Each group is given an A4 sheet of paper so they can create a visual representation and/or text to show what a professional in their chosen discipline looks like.

Two-Minute Paper (2 minutes)
This exercise is designed to find out whether students experienced threshold concepts. We acknowledge Dr Sally Male’s (UWA) role in developing the paper. The two questions are: 1. Have you learned anything transformative in this session? If so what? 2. Do you feel a need to think further about anything raised in this session? If so what and why?

RESULTS

Imagining Their Future Career: Student Comments

Top perceived characteristics of engineers
1. Personality (e.g., ‘problem-solver’, ‘confident’, ‘hard-working’, ‘open-minded’)
2. Technical knowledge (e.g., maths, physics)
3. Social and professional communication skills (e.g., ‘good listener’, ‘know how to talk’)
4. Values (e.g., ‘nature-lover’, ‘environmentally conscious’)
5. High Status (e.g., ‘powerful’, ‘well paid’)

Top perceived differences between self and engineer
1. Personality (e.g., ‘sometimes, I procrastinate’, ‘laziness’, ‘I’m very quiet and follow others’).
2. Technical knowledge (e.g., ‘I currently lack the knowledge needed for the job’, ‘I don’t really know much about engineering or electricity’).

Will the unit develop perceived differences between self and engineer?
Fourteen students perceived that the learning within the unit would contribute to the development of competencies they identified as differences between self and engineer.

Examples:
• ‘Learning to problem solve is good. Also, working in a team.’
• ‘Physics is a key component of all engineering and so this unit will have a huge impact on the development of such required skills’
• ‘This unit will help me understand the world I am living in which engineers need to know. It will also help me think professionally and help with my critical thinking skills’
• ‘Make my brain open wisely, so I can think more and logically. The most important one problem solving’
• ‘It will provide basic fundamental physics knowledge which I can build upon in later study’

DISCUSSION

Students described engineers in terms of personality characteristics, technical knowledge, social and professional communication skills, values and high status. They also perceived gaps between the attributes of engineers and their own personal attributes, some of which were positioned as personality-based rather than skill-related.

Some students understood that the unit would help them develop the technical knowledge and interpersonal skills required to be an engineer. However, others did not understand the relevance of the foundation unit to their future engineering work.

WHAT NEXT?

- Compare success in the unit for students who could, and could not imagine themselves as an engineer; and
- Continue with the original workshop, adding:
  • Pre and post unit personal identity scale; and
  • Pre and post unit sense of community scale.

REFERENCES


We welcome comments, questions and collaborators! For more information about the specific project contact Chris Creagh: chris@murdoch.edu.au
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