Getting into university: From foundation to first year engineering

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With this poster proposal I present an ongoing longitudinal study with engineering students taking a (science) foundation course. The aim of the research is to explore the reasons why students decided to take the foundation course going beyond the rather obvious one, “because they did not have the necessary qualification for direct entry”. Secondly, I wish to explore students’ mathematical progression into first year engineering and ultimately the usefulness of the foundation course in that respect. I took a case study methodology to collect data in the form of interviews with students; analyses were qualitative. Initial findings indicate that students expressed a variety of reasons for taking the foundation course, and that students’ mathematical progression is not linear.

Keywords: Foundation course, engineering mathematics, progression, transition.

Introduction

Many universities have addressed students’ lack of mathematical preparedness for university study (e.g. Hawkes & Savage, 2000) by establishing mathematics drop-in centres or providing one-to-one support with specialist mathematics tutors. In the UK, a number of universities also offer a one-year foundation course (FC) as an alternative route into higher education, primarily aimed at students wanting to study a STEM subject. The (science) FC, offered at my home institution, consists of a number of modules, including mathematics, physics, computer programming, chemistry and biology. Depending on their destination degree (be it engineering, physics, computer science or one of the natural sciences) students take a combination of compulsory and optional modules. Mathematics and physics are by far the most heavily subscribed modules and compulsory for engineering students who form the largest group within the foundation cohort at my institution. While the FC is often seen as an option for students who have ‘missed’ (perhaps narrowly) their target grades at A-level, it is clear from student profiles that this does not represent the whole picture. Students come from a variety of backgrounds and hold a range of qualifications as well as work experience in engineering. Some students have been away from study for a long time; others reported health problems that have impacted on their progression into university. Thus I became interested in investigating the motivational factors that have led students to consider the FC. Since I am a lecturer of mathematics on the FC, I am also interested in the mathematical progression that students make. In Semester 1 of the mathematics module (from October to December) students study pre-university topics such as indices, logarithms and basic differentiation. In Semester 2 (February to May) students study first-year engineering mathematics topics such as matrices and complex numbers. I pose two research questions: (1) Why did students take the FC? (2) What is students’ mathematical experience when moving into their first year of engineering study?

Methodological considerations

This research is ongoing. So far two cohorts of students (those entering our university in 2014 and 2015) have been interviewed at the end of the FC; one cohort has been re-invited for interview at the end of the first year of their engineering course. Ten to eleven students were interviewed each
year. This is a small number when compared with the total cohort (>140). I, therefore, pursue a case
study methodology, and I take a longitudinal design with further interviews planned over the next
two years. Data analysis is qualitative with a focus on the reasons that students give for taking the
FC. A research perspective framed by activity theory (Engeström, 1999; Leontiev, 1981) is an
appropriate theoretical perspective since identifying the motive is closely linked to characterising
activity. Leontiev (1981) provided a framework in terms of the components activity-motive,
actions-goals and operation-condition. Actions-goals could be used to discuss students’ intermediate
goals, particularly mathematical goals, and actions taken in pursuit of these. Engeström's (1999)
framework is suitable for researching activity systems such as different student activity systems and
how these interact. Deciding which framework to use to theorise results is a crucial next step.
Investigating students’ mathematical progression will be explored in more detail in subsequent
years. So far I have analysed the material of some first year engineering mathematics courses to see
how well the foundation mathematics module might prepare students for engineering study. This
research was with students I had taught. Interview questions were communicated to students in
advance. Interviews were recorded and subsequently transcribed, followed by qualitative analyses.

Research findings and conclusions

While many students stated that they took the FC in order to gain entry to their chosen degree
specialism in science or engineering, some did so strategically, i.e. there is no need to re-apply
through UCAS, the UK body overseeing university applications, since passing the FC guarantees
entry. Some students cited an inherent interest in studying a STEM subject as the main motivation
for applying. Their focus was on the subject they wished to study and the FC provided a potential
entry route for them. A number of students thought that the FC would give them an advantage over
other students once they were in their first year of engineering. Thus students’ motives for taking
the FC were nuanced, going beyond “because they did not have the necessary qualification for
direct entry”. Most (not all) students interviewed reported having difficulties with the mathematics
content of the FC. Some students were overwhelmed by it. A number of students reported that they
struggled in Semester 1 when the mathematics was new and they were unaccustomed to studying.
The same students subsequently stated that Semester 2 was much easier (even though the
mathematics is harder). Oddly, some strong and mathematically confident students reported
struggling in their first year engineering mathematics module. This latter raises the question of the
appropriateness of the FC for engineering degree study. Further analysis is necessary and a focus in
the coming years. Hence results so far indicate that mathematical progression is anything but linear.

References

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Council.