Shaping Higher Education with Students

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3.3
Learning about what research is and how researchers do it

Supporting the pursuit of and transition to postgraduate studies

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1. Introduction

This chapter is the result of conversations between the various authors about how to raise awareness among undergraduates about what research entails, and what support could be put in place to facilitate the development of those skills needed by researchers in mathematics and maths-related fields. We carry out a brief review of non-subject-specific research about transitioning to postgraduate education. We then suggest some strategies for engaging undergraduates, postgraduates and academics in a partnership intended to develop their subject-based research and enquiry skills, grounding their understanding about what research is and what researchers do from early on in their studies.
2. The current postgraduate transition landscape

Research suggests that the transition to postgraduate study deserves the same attention as that of the transition to undergraduate. In their project involving focus groups with 30 members of staff and 41 postgraduate students, and five in-depth individual interviews with postgraduate students (one PGCE, one MA, one MBA and two PhDs) at Greenwich University, Alsford and Smith (2013) found that postgraduate students want recognition that their study level is different and that their transitional needs are as valid as those of undergraduates. Indeed, there is a growing body of research into Masters and doctoral students’ that acknowledges that these students have particular transitional needs. Preparedness for postgraduate life and study, communication and socialisation skills, staff and student training – these various issues are now being acknowledged by research, with some institutions starting to improve their policy and practice around postgraduate transition (Alsford and Smith 2013).

Researchers have suggested that a lack of focus on the transitional needs of postgraduate students reflected an assumption that students were (a) somehow already prepared for postgraduate study since postgraduate-level study is simply ‘more of the same . . . taken to the next level’ (O’Donnell et al. 2009, 27) or (b) already experts in the realm of higher education and learning, and so would not even acknowledge moving on to the next level of study as being a transition issue (Tobbell et al. 2010). Indeed, it was only when working on his Masters project that Adam, one of the PhD students contributing to this chapter, formed a clearer idea about what his PhD research was going to be like. Many students who decide not to complete a Masters degree would graduate with no insight or experience about the research process, and therefore unprepared for a workplace that requires them to confidently tackle and solve problems.

3. Making the transition: the student experience

Through interviews and focus groups, Symons (2001) found that students had a desire for more information about the course they were going to be studying and wanted to know what would be expected of them in terms of academic requirement. Approaching a taught undergraduate degree versus a research degree requires
significant changes on the part of the students in terms of how they
deal with the subject. At undergraduate level, one accumulates a
solid foundation of discrete knowledge, mainly through the under-
standing and reproduction of lecture notes. Adam recalls his under-
graduate years when he was given a problem to work on, which most
of the time was already broken down into ‘bits and pieces’ for him.
Understanding the statement of a theorem, being able to reproduce
its proof and applying it were skills and knowledge Adam developed
through regularly assigned homework, which tended to focus on
the techniques and applications of maths results introduced in the
lectures. These skills were invaluable for Adam in carrying out his
PhD research. However, Adam came to realise that he was missing
the big picture, of how the different maths topics he had studied fit-
ted together in the maths landscape that he is now – through much
of his own individual and lengthy pursuit – aware of. In his view,
undergraduates would benefit from being able to see maths as a uni-
fied field of interconnected knowledge, rather than a collection of
disjointed subtopics.

Both Sebastian and Pedro, PhD students in Engineering, reflect
on their undergraduate experience and how it contributed to and
supported their development as engineers. Pedro works with optimi-
sation under uncertainty, which has applications in many fields,
for example modelling and design of processes. He believes that the
knowledge and skills he developed through studying pure mathem-
atics for the first two years of his engineering degree developed his
enquiring mind, paying attention to details and asking lots of ‘what
if’ questions. These skills and knowledge empowered him not only to
understand the ‘theory behind the models out there’ but also ‘to go
inside’ those models and adapt them for the problem at hand. In his
view, current engineering undergraduates would benefit from being
made aware that understanding the principles behind how models
work can enable them to modify, adapt and customise the models ‘to
work for them’.

Sebastian thinks that undergraduates’ learning could be made
more exciting. In his opinion, undergraduate engineers find it difficult to
engage with mathematics. They find it ‘dry’ and as a result are not really
motivated to know more than the final equation that is needed for the
application of a model. For this reason, Sebastian suggests that under-
graduates could be shown what research entails: engaging creatively
with the ‘dry maths’ to create and improve the models.
4. The importance of doing research

In this chapter we propose that engaging students in research and inquiry could and should be supported from early on in their undergraduate studies. In their report for the Higher Education Academy, Healey and Jenkins (2009) argue that all undergraduates students in all higher education institutions should come as close as possible to the experience of academic staff in carrying out disciplinary research. Indeed, the UCL Connected Curriculum aims to ensure that all students are able to learn through participating in research and enquiry at all levels of their programme of study. Moreover, Hathaway et al. (2002) found that those undergraduates involved in research were more likely to pursue graduate education and postgraduate research activity than students who did not participate in undergraduate research.

Through exposure to disciplinary research, all students will benefit from asking the right questions in the right way, conducting experiments, and collating and evaluating information. In the UK, most undergraduate students experience research as part of their final-year dissertation. For their dissertation, students choose a topic of interest to them, and such interest is mainly shared with the supervisor and the second marker, with no further dissemination of the outcomes of their work. Adam recounted his near struggle at the beginning of his postgraduate degree with reading maths papers. These papers tend to be quite technical and difficult to understand. But once understanding was achieved, Adam found that he needed to develop a habit of sitting back and trying to see the bigger picture, rising above the maths propositions, lemmas, theorems, etc., and understanding where the ideas fit in the maths landscape. Adam’s view is that this skill should and could be learned early on, at undergraduate level, through collaboration with peers and researchers.

Although academic mathematicians are well aware of the role of intuition in mathematics (Burton 2004), they may not address it explicitly in their teaching beyond linking it with problem-solving. Just as Burton (1999) pleaded with anyone who has responsibility for the learning of mathematics to model their own intuitive processes, to create the conditions in which learners are encouraged to value and explore their own and colleagues’ intuitions, Adam too thinks that ‘intuition needs to be explicitly taught’. He tries to develop intuition in the tutorials he teaches to undergraduates, as intuition could then be used and developed further in acquiring new knowledge.
5. Recommendation

We thus propose a collaboration between staff and students at undergraduate and postgraduate levels aimed at raising awareness among undergraduates about what research is and what researchers do. Undergraduates could be brought into the world of research by enabling them to learn in ways that parallel and reflect how academic staff and postgraduates research and learn their discipline.

References

Burton, L. 1999. Why is intuition so important to mathematicians but missing from mathematics education? For the Learning of Mathematics 19(3), 27–32.