Francis Duah and Tony Croft

The first MSOR Student Engagement Event

Part 1 – What the engaged students tell us about mathematics

Francis Duah
Mathematics Education Centre
Loughborough University
f.k.duah@lboro.ac.uk

Tony Croft
Mathematics Education Centre
Loughborough University
a.c.croft@lboro.ac.uk

Here we report upon an event held by the Network to which, for the first time, undergraduate mathematics students from universities in the Midlands were invited. The aim was to explore their views on their undergraduate experience, teaching and learning of mathematics and statistics, and peer support.

The report is in two parts: the first deals with aspects of the teaching and learning of mathematics, and the second with statistics. The mathematical elements formed the basis of a presentation at the British Mathematics Colloquium held at the University of Leicester in April 2011.

Abstract

Improving the engagement of students in their own learning and in wider teaching and learning issues is a now an important driver in most institutions of higher education. The Higher Education Academy has identified student engagement as a priority area for development. What student engagement means in practice for the MSOR community is not clear. The purpose of this paper is to report on a workshop to which undergraduate mathematics students from several Midlands universities were invited. In the workshop students were asked to reflect upon and discuss their own engagement as individual learners and as part of a wider mathematics community. The extent to which students want to be engaged as partners in their learning was explored, together with their views as to what would be the characteristics of a department with high levels of student engagement. This paper reports upon the findings from the workshop.

1. Background

The landscape of higher education is changing very rapidly. With the impending, very significant changes in the fees regime, increasing demands and expectations from students and their parents, pressure to significantly reduce costs, and of course rapid changes in technology, listening to the *student voice* is arguably more important than it has ever been. One of the primary aims of the Higher Education Academy is to improve the student experience, and in 2009 *student engagement* was identified as a priority area for development. There is an impetus from the Academy and from within higher education institutions more generally to encourage ways in which students can become active partners in shaping their learning experience, individually, locally, and nationally. What *student engagement* means in practice for the Mathematics Statistics and Operational Research communities (MSOR) is unclear, as is the extent to which engagement is taking place at the present time. There is a need to develop an understanding of what student engagement means in MSOR if we are to explore ways of enhancing this.

In order to start to explore what engagement means in MSOR a one-day workshop was held at the University of Birmingham on April 1st 2011. Mathematics departments in 11 universities in the Midlands area were asked to invite between two and four of their undergraduate mathematicians to participate at the event. At the workshop students were asked to consider and discuss what engagement means for them personally at two different levels: engagement as individuals with their own course of study, and engagement and contribution to wider departmental, university and national initiatives associated with MSOR. They were also asked to consider what would be the characteristics of a mathematics department which exhibited high levels of student engagement – how would we know?

2. The students

Of the 11 universities invited, six were successful in recruiting students for the workshop. There were two students from Aston University, two from Keele University, two from Loughborough University, four from the University of Leicester, five students from the University of Nottingham and one from the University of Warwick.

The students were put into small groups to discuss the range of issues alluded to above. At the end of the timed discussions, the outcomes from the discussions were then presented either in the form of a flip chart or some other visually aided form. Examples of such outcomes are illustrated in figures one, two and three. A member from each group then provided feedback from the outcomes of the discussions within each group to the wider audience.

3. The meaning of engagement with Mathematical Sciences

There is no single definition of 'Engagement'. In fact Trowler's literature review [1] discusses a range of definitions and concludes with a definition for the Higher Education Academy:

> ***Student engagement is concerned with the interaction between the time, effort and other relevant resources invested by both students and their institutions intended to optimise the student experience and enhance the learning outcomes and development of students and the performance, and reputation of the institution***. (p.2)

The above definition is, however, generic and therefore we posit a subject-specific meaning of engagement with mathematics. For the purpose of this report we define engagement with mathematics as:

> ***The time, energy and resources that students devote to the study of mathematics and active participation in mathematics related enrichment activities as well as the extent to which students interact with the extra-curricular activities provided by their institution and aimed at inculturation of students into the community of practicing mathematicians.***

What the students tell us about their level of engagement with mathematics is reported in relation to the above definition.

4. Students' current levels of engagement.

Students were asked to discuss in their groups to what extent they felt engaged with mathematics at an individual or wider level. They were provided with several examples of different activities which might indicate engagement. Each participant was also asked to write on post-it notes the ways in which he/she felt engaged with mathematics. One of the aims of this exercise was for us to gauge to what extent we were actually working with 'engaged students'. Fig 1 is a graphical representation of the students' self-reported level of engagement. The horizontal axis represents a spectrum from very low levels of individual engagement with the learning of mathematics on the left, to very high levels on the right. The vertical axis represents engagement in wider MSOR teaching and learning-related activities with the higher levels towards the top of the scale. Thus these axes partition the plane into four quadrants. The students were then asked to place their post-it notes on the chart in a position which they felt best represented their overall level of engagement.

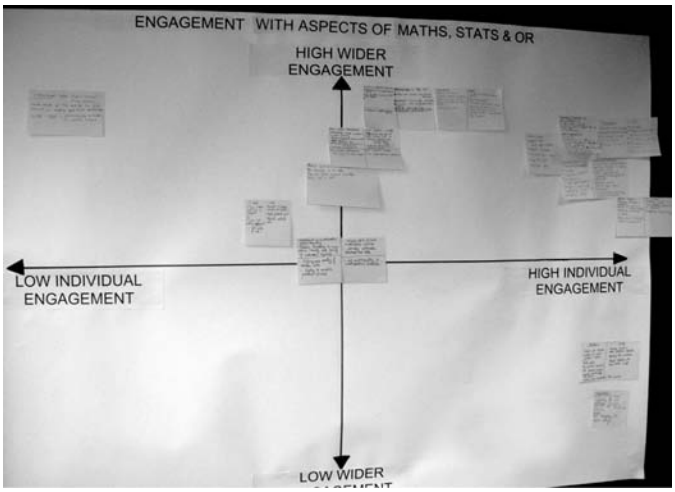

Fig 1 – Levels of Engagement

Of the sixteen students who attended the event, nine appeared to have high levels of individual and wider engagement with mathematics. Two are highly engaged at individual level but do not actively engage with the wider mathematics community. One student stands out as someone who has high levels of wider engagement with the mathematics community within his university. However, he is less engaged with his own course of study of mathematics. Fig 1 also shows three of the students whom we identify as "middle of the road students" because they seem to have placed their post-it notes either at the centre or close to the centre of the chart. These may be students that need support to enable them to engage even more

with mathematics. One participant arrived late and did not take part in this first activity.

Most of the students have high levels of individual engagement with mathematics. Students with high levels of individual engagement claim they attend lectures regularly, read around the subject using either general mathematics books or course texts. These students make regular use of their university library where general and prescribed mathematics books may be borrowed. The engaged students also suggest that they regularly revise and complete problem sheets and make use of online search tools such as Google to help them solve mathematics problems. Students whose institutions have Virtual Learning Environments make use of them regularly and seek support online or visit learning support centres. These engaged students suggest that they visit and talk to lecturers often about their modules to help clarify misunderstandings they may have with the content. There are some, though not many, who even at undergraduate level are engaged in reading research papers and working with staff on research projects. The highly engaged participants appear to work often on their projects or coursework for those modules with these course requirements. Above all, they like or love mathematics as a subject.

The students who attended the event are also 'widely engaged' in a number of ways. For example, some are student representatives on staff-student committees and support their mathematics departments by helping with open or visit days and school enrichment activities. Some are part of the Undergraduate Ambassador Scheme, visiting schools to help and advocate the learning of STEM subjects in and beyond school. Although some students mentioned their participation in mathematics societies as a way in which they are engaged with the subject, not all mathematics departments have a mathematics society. While many are widely engaged with the university mathematics community, the lack of a mathematics society in some universities may be impeding the wider engagement of some students in the community of practising mathematicians.

A good number of the engaged students seek to provide feedback to staff either through staff-student committees or module evaluation forms. Some students are actively and widely engaged in interesting ways; they are working with staff on learning resources and helping to shape mathematics modules to improve the quality of their learning experience. Some report interesting relationships with staff where they are engaged with proof reading lecture notes being prepared for future students. A good number of the students are also involved in some form of peer support scheme such as peer mentoring. An interesting example is a house system at one university where students in all years are allocated to houses each named after a famous mathematician. Each house has a student house president and an academic tutor.

Some participants have either low levels of individual engagement or low levels of wider engagement. For example, one participant claimed to have poor attendance at lectures and tutorials and only start studying usually two months before examinations. Others suggest infrequent reading of lecture notes and use of learning support available.

As a result of this initial engagement exercise we felt confident that the majority of the students with whom we were working during the workshop were 'engaged students' who were taking their own learning very seriously and who were open to and enthusiastic about wide participation in MSOR activities.

5. Characteristics of a department with high levels of engagement

Departments with high levels of engagement are likely to have high levels of student satisfaction. Hence knowledge of the characteristics of departments with high levels of engagement is important for the MSOR community who aim to improve engagement and student satisfaction with mathematical sciences. Fig 2 is a sample of what was produced by one small group of participants illustrating their views about the characteristics of a department with high levels of engagement.

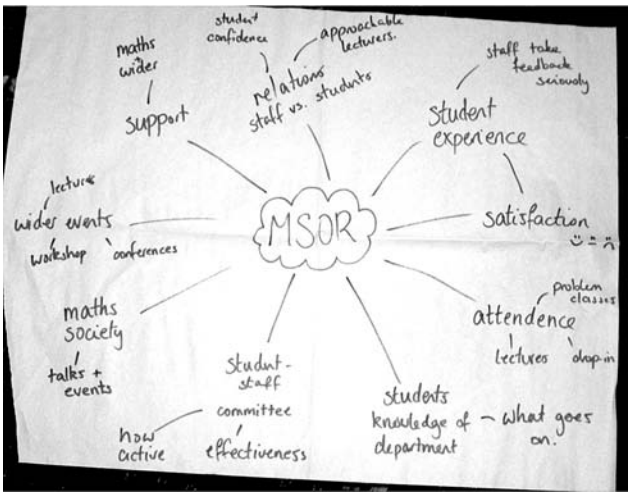

Fig 2 – Characteristics of a highly engaged department

Participants described departments with high levels of student engagement as ones with good staff-student relationships. Staff in such departments are described as approachable, available outside lectures and helpful to students. The students described engaging departments as ones that provide wider support to the study of mathematics such as Mathematics Learning Support Centres. Peer support schemes, such as peer mentoring and peer assisted learning schemes, are provided by such departments. Engaging departments are noted to have staff-student committees that take feedback from students seriously and act on them. Regular review of modules in response to module evaluations is a feature of these

departments and students are aware of what goes on within the departments.

Engaging departments are characterised by good attendance by students at tutorials, lectures, mathematics talks, workshops and events. A mathematics society is very active and may organise social and academic events for students. Whether the objective of mathematics societies should be about socialisation of members or the enhancement of the academic experience of members or both were alluded to as a bone of contention. The views of student unions have not been solicited but the participants at the event cited student unions' opposition to the use of mathematics societies for academic activities. Hence future research may need to be conducted to ascertain the aims and objectives of mathematics societies and their utility to students and mathematics departments.

Departments with high levels of engagement are also described by the engaged students as those that provide good mathematics experience and have high levels of student satisfaction with their courses.

6. Students' views about peer support

Peer support appears to be valued by participants, but there is no consensus as to whether it has to be a formal or an informal scheme. Although a formal peer mentoring scheme was often cited by the students as a scheme they have experience of, they also acknowledged that informal arrangements of support exist amongst students. When students have difficulties with engagement with their course of study, the participants suggested that students would often first turn to their friends for help and support. This would suggest that departmental efforts early on to build student-student relationships and friendships and to develop a good learning community are not wasted.

When commenting on an effective formal mentoring scheme, participants suggested that mentors should be friendly and approachable and have the ability to help with mathematics related difficulties that mentees may have. However, students felt that mentoring should be about supporting mentees in their learning of mathematics but not teaching them mathematics; mentor meetings should be about sharing experience. In a somewhat contradictory way some groups of participants felt mentoring should be about imparting knowledge gained. Nonetheless, mentoring was felt to be good for supporting junior students in module selection and "logistical arrangements". Fig 3 shows an example of a poster which indicates the engaged students' views about peer mentoring.

Moreover, it was felt that such a scheme should not have a fixed one-to-one mentor-mentee relationship since the mentor and the mentee may not get on. Mentees should have the freedom to seek support from whichever mentor may be available at anytime. There was no consensus as to

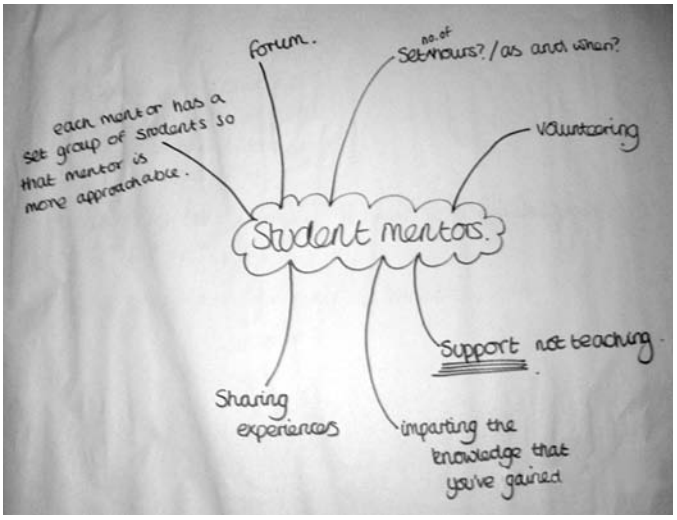

Fig – 3 Students' views about an effective peer mentoring scheme

when and how long mentors and mentees should meet and this may need to be explored in future research.

The use of technology in mentoring was discussed and online discussion forums appear very popular with the students. Although Skype and Facebook were cited as resources that could be used in supporting learning, Facebook and other social networks were not particularly popular with the students as they are seen as resources for socialising rather than 'working'. In fact the idea of keeping work and social lives separate was often mentioned.

7. Conclusion

From the discussions that emerged and the flip charts produced, it was evident that the students are engaged and know how they want to be engaged. They are willing to articulate their views on teaching and learning of mathematical sciences and how things could be improved to enhance their mathematical experience. However, if any real difference are to be made in enhancing students' experience, then their voices need to be heard and "taken seriously" as they repeatedly mentioned in the charts they produced.

Sessions focussing on other aspects of MSOR also took place during the workshop. These included discussions on what motivates students in lectures, students views of what is important in good teaching, what is important for students and for student learning, and students' conceptualisation of the learning of statistics at university.

References

1. TROWLER, V. 2010. *Student Engagement Literature Review*, York, The Higher Education Academy.

Footnote

Several of these students have since agreed to give presentations in a special student-led session at CETL MSOR 2011 (5th/6th September at Coventry University).