ACTIVITIES AND ACHIEVEMENTS QUESTIONNAIRE

1. Non-Technical Summary

A 1000 word (maximum) summary of the main research results, in non-technical language, should be provided below. The summary might be used by ESRC to publicise the research. It should cover the aims and objectives of the project, main research results and significant academic achievements, dissemination activities and potential or actual impacts on policy and practice.

Our aim was to understand how cultures of learning and teaching can support learners in ways that help widen and extend participation in mathematically demanding courses in Further and Higher Education (F&HE).

We asked:

RQ1: How effective is “Use of Mathematics” (UoM) in comparison to the traditional “Mathematics” AS level (TRAD) in promoting various Learning Outcomes for 16-19 students?

RQ2/3: How do learning and teaching cultures produce different Learning Outcomes and how is this influenced by gender, class and ethnicity? And how are these cultures influenced by institutional systems and policy contexts?

Our questionnaire survey sample involved over 1700 students in over 100 classes in 6thForm and Further Education Colleges (6fFEC) and measured student Learning Outcomes. These included added value to attainment scores, self efficacy in mathematics, intention to continue study in HE, dispositions to further mathematical study, and university course choice.

Close study of over 40 students from more than 10 classrooms in 5 case study Colleges sought insights and explanations of how learning is influenced by pedagogy, the different programmes, and institutional conditions and how these influence students’ ‘trajectories’.

The students were surveyed (and a subsample interviewed) on three occasions, thus allowing for value-added analyses (and narrative trajectories). Additionally, we built a measure of teachers’ self-reported pedagogic practice, from Transmissionist to connectionist. The interviews of the sub-sample of students were connected with the case study fieldwork that involved interviewing teachers, managers, and observing classrooms, so could connect students’ trajectories into or out of mathematics with their stories of ‘troubles’ (e.g. with mathematics, or family).

Outcomes include validated instruments and measurement scales for students’ disposition to study in HE, disposition to study mathematics further, and self efficacy in using mathematics; and for teachers’, self-reported Transmissionism of classroom practice.

Synthesis of qualitative and statistical analyses led to main results that include the following:
1. The “Use of Mathematics” Programme is more successful than the traditional “AS Mathematics” in keeping students who have only GCSE grades B or C engaged in mathematics through their course, and they tend to achieve one grade higher than predicted in this AS qualification. The drop-out rate is significantly lower, and the proportion obtaining a U-grade at the end of the year or dropping out is also significantly lower for the “Use of Mathematics” course.

2. Our observations of the two different programmes suggest that less well-prepared students may find the pace of the “traditional” AS Mathematics course too fast, as teachers commonly devote little time for developing ‘understanding’. The Use of Mathematics Programme does to some extent ‘force’ conceptual learning through modelling, comprehension tasks, exploring mathematics with technology, by virtue of the assessment components, particularly its coursework requirement.

3. The reasons given by students in favour of coursework support this: the UoM students generally believe that coursework helps them (i) because they find exams hard, and (ii) because it pushes them to explain and so to understand.

4. Student dispositions to study more mathematics declined over the year, especially for “White” “English-speakers-only” students. Sometimes mathematics had served its purpose, while others discovered the subject was too hard: for others it’s ‘worth the struggle’. Strategic decisions have to be made as to the value of mathematics.

5. However, a statistically significant factor in the decline was the strength of teacher-centred teaching practices that students experienced: we discovered that highly student-centred, “connectionist” pedagogy made a difference.

6. A case study of one ‘connectionist’ practice revealed how this pedagogy ‘worked’: many students reported enjoying mathematics here.

7. Close analysis shows how connectionist pedagogy can make learning mathematics a communicative practice, which involves learners in public explanations, evaluations, and discussions. This pedagogy was found to be supported in a College where the institutional culture supported an open access policy, and large numbers of less well-prepared students were being taught the traditional AS level Programme, which they found initially very challenging. The pedagogy was adapted to this context.

8. Teacher-centred, transmissionist pedagogy was found to be supported by institutional cultures where the students were selected (often grade C was not enough to get access to AS) and league-table results were paramount. Such teaching tends to be highly paced, where teachers do much of the explaining, evaluating and ‘showing’ of procedures, and students’ mathematical productions are ‘private’.

9. Students’ aspirations developed through the course and their mathematics experience and grades were significant to their university and career trajectory: most did not change their desired university course/subject from beginning to end, but their university of choice and their subject were affected by various
troubles and influences attributable to their experience of mathematics, inter alia.

In conclusion, our theorisation of the ‘value’ of mathematics helps understand and connect all these results. For all students - and their teachers and Colleges - the exchange value or ‘currency’ of mathematics is vital, and this is where policy impacts on practice, sometimes unintentionally and harmfully.

However, mathematics only makes ‘sense’ to students when they see its ‘use value’ (in modelling and solving problems, or in communicating with and through mathematics – in ‘connecting’ conceptually). Many students have difficulty here, and this is where Programme and pedagogy can have an impact: implications for policy and practice follow as a consequence (see TLRP Research Briefing 38 at http://www.lta.education.manchester.ac.uk/TLRP/Research%20Briefing.pdf).

The results of the project have been widely reported to academic conferences (3xBERA, 2xAERA, ISCAR, BSRLM, 2xPME), and networks including a seminar series on ‘Mathematical relationships’ (ESRC) and Teacher’s Mathematical Knowledge (Nuffield), and meetings of the Widening Participation Programme of TLRP.

We have also communicated findings widely to practitioners through our own 4 teacher-conferences, through TLRP conferences on six occasions, and to policy-makers at two special policy-orientated TLRP conferences, in Scotland and in London (for HEFCE, June 2008). Two new ESRC-funded research projects have been inspired by the outcomes of this project, and will be studying mathematics learners’ transitions from GCSE to College, and form College to first year university.

The website (http://www.lta.education.manchester.ac.uk/TLRP/) shows the publications to date: the working papers will give rise to further publications shortly.

1000 words