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Student relationships with maths and physics

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Background

This is the second of three papers conducted as part of the Understanding Participation rates in post-16 Mathematics And Physics (UPMAP) project. In this paper, school subjects are conceptualised as special types of discourses (Harré & Gillett, 1995; Sfard & Prusak, 2005; Mendick, 2006). Part of our work, therefore, is grounded in a different language from that generally used in the analysis of 'the problem of uptake in mathematics and physics', and wider, social and cultural forces are considered as well as individual issues to do with understanding and affect. We are open to a framing in which students respond to curricula, to pedagogies and to subject representations outside of schools (e.g. in films and magazines, on TV, in everyday conversations) by partial negotiations, both of themselves and of mathematics / physics. This identification with the meaningfulness of mathematics / physics is partly the result of such cultural forces but it is the individual's affective response, both conscious and unconscious, that ultimately attracts, or fails to attract, each person to the subject. Unless there is sufficient positive connect between a student's developing sense of self and the meanings they find in mathematics / physics, the student-subject relationship may not flourish but atrophy or become one of antagonism. Of course, such individual factors do not operate in isolation from other factors, for example those operating at the level of schools or society more generally. The methodology for our project is designed to help us investigate and, so far as possible, untangle the relationships between the various factors operating at various levels.

Research Questions

The purpose of this paper is to explore school students' perceptions, feelings and intentions towards physics and mathematics and to see whether what they vocalise is impacted by other factors. Such factors include school-based relationships, engagement with activities, influence from outside of school, structural issues around lessons, relevance of the subjects and intentions about the future.

Methods

We intended to recruit 12 schools with a total of 72 students, with each student being interviewed once a year on a total of three occasions (aged 15, 16 and 17). In our first round of interviewing we have conducted interviews with 100 15 year-old students. We decided to over-recruit to counteract issues to do with attrition resulting from students moving schools, students or schools withdrawing consent for subsequent phases and possible difficulties in tracing students post-16 (i.e. in the third round of interviewing). We used the subject of English and each student's stated favourite subject as comparisons against what students stated about physics and mathematics. In addition, we employed the use of metaphors in order to get at students' associations (conscious or unconscious) with physics, mathematics, English and their favourite subjects. For example, we asked 'If maths was an animal which animal would it be?' and then repeated the question for physics, for English and for their favourite subject.

This part of the project also contains an ethnographic component consisting of observations of classroom or out-of-classroom activities including activities identified from the Strand 2 interviews or the analyses in Strand 1. In each school the intention is to observe over the three phases of interviewing five lessons / out-of-classroom activities (likely to include science clubs, visits and department meetings) in mathematics and five in physics. This will give us a sample of 120 lessons / out-of-classroom activities. Rather than using a fixed observation schedule we have so far been using a more open approach based on those factors identified in the literature (e.g. Hollins et al., 2006; Kyriacou & Goulding, 2006) as being of potential significance (including type of questioning by the

teacher, extent of student collaboration, use of language, degree of student autonomy, use of textbooks, seating and other working arrangements).

Frame

We are in the process of using NVivo to code our 100 phase one transcribed student interviews. Our NVivo coding provides us with one type of analysis – namely at the student level.

We anticipate being able to combine this with analysis of our ethnographic findings, with analysis of other data we have for these 12 schools and with analyses of findings when we interview as many as possible of these students a second and a third time. Aside from the obvious point that this longitudinal element allows us both to establish continuities and discontinuities over time, successive interviews with students as they age will allow us to go into certain aspects in more depth. One possibility is that we will increasingly explore with students our hypotheses about what, at both the student and the school level, tends to enhance post-16 participation rates in mathematics and physics. We are, after all, keen that our work will have policy implications though we are very open at present as to the audiences, e.g. national government, school head teachers, school classroom teachers, those providing out-of-school experience in mathematics or physics.

Research findings

Emerging findings indicate how mathematics and physics can be experienced differently from other subjects. In part this is because students are aware that mathematics and science, along with English, are typically highly valued both by parents and by schools. At the same time, and apparently largely irrespective of whether students like mathematics and physics, these subjects are perceived as being more clear cut and less fun than other subjects.

We are attracted by the notion of student ‘identity’ and a student’s relationship with their school subjects as an explanation of post-16 subject choice but wish to see this as one level in a hierarchy that goes from the unconscious forces that operate within each of us to structural forces that operate at national level.