PRIMARY STUDENT TEACHERS UNDERSTANDING OF MATHEMATICS AND ITS TEACHING: A PRELIMINARY REPORTl

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The research set out to investigate the ways in which non-specialist student teachers conceptualise mathematics and its teaching and how their views evolve as they progress through an initial training course.

Objectives

(1) to develop an empirically informed theoretical account of how school mathematics and its teaching is constructed by the non-mathematics specialist primary BEd students as they effect the transition from learner of mathematics to teachers of mathematics;

(2) to document the cognitive and affective elements of the understandings of mathematics that students bring with them into ITE and the nature of the transition of these conceptions through their college life;

(3) to explore how the student teacher as learner negotiates a position within the complex school/college partnership involving as it does initiation into multiple facets of mathematics and good practice; and

(4) to explore how the ITE course could better enable students to critically engage ıı ı the transitional process which embodies their professional induction.

The study has shown how the mathematical understanding of such students is in the ffist instance embedded in a strongly affective account of their own mathematical experiences in schools, where mathematics was often seen as difficult and threatening. College training successfully nurtures a more positive attitude to mathematics as a s\lbject, albeit couched in a strongly pedagogically oriented frame. In later stages of training how~ver their conceptions of mathematics and its teaching are subsumed within the

organisational concerns of placement school, shaped primarily by schools' preferences for classroom practice. It is suggested that alternative conceptions of mathematics assumed at different stages of this training appear incommensurable. A theoretical model is offered as an approach to reconciling this conflict.

Empirical results:

Student perceptions were related to the phase they had reached In their training:

Phase A Students own experience as a pupil in school

(1) School experience of mathematics was felt to be intimidating by some 80% of the cohort and often associated with intense emotions. It was also felt to be lacking a clear purpose.

Phase B Students during early college sessions

(2) College work reduces fear of mathematics and failure in it. The majority of the cohort became more positive about mathematics very soon after entering college.

(3) College sessions on mathematics reposition the student (e.g from intimidated pupil to interested teacher) and redefines mathematics (e.g. from something done of the board by the teacher to something done with the hands by the pupil)

Boundary dilemmas

(4) Ideal notions of mathematics education are challenged in the real world of the classroom. The initial enthusiasm for mathematics in college sessions is tempered by the reality faced in classrooms.

(5) Students entering school on placements often expressed a need for recipe knowledge rather than repertoire skills

(6) College mathematics is not scheduled effectively to address practical teaching issues at stages of the course when it is most needed

Phase C Students during later school placements

(7) School mathematics becomes subsumed by the pragmatics of pedagogic and organisational concerns, such as the implementation of a scheme, or strategies for classroom discipline

(8) School Experience tutor and class teacher input was felt to be primarily pedagogic and organisational in nature and rarely discussed the teaching of mathematics explicitly

Transitional meta-narrative.

(9) Experience as pupil in school informs a model for teaching, where transmission conceptions of teaching persist albeit in hybridised forms remodelled by the intervention of other narratives.

Theoretical model:

A number of dualities, each of which could be seen as potentially dichotomous, were identified arising from what appeared to be alternative constructions of: mathematics, the teaching of it and the perspective we assume in describing this teaching .

Duality One - phenomenological/ official versions of mathematics

There was some evidence of two conflicting conceptions of mathematics whose relative influence varied over the course of training.

Mathematics 1 (phenomenological perspective):
Here the emphasis is placed on the student exploring mathematics, making connections, seeing structure and pattern and the teacher's task is understood more in terms of facilitating learning from the learner's current perspective rather than didactic teaching.

Mathematics 2 (official perspective):
Here mathematical achievement is understood more in terms of performance of prescribed mathematical procedures, quantifiable through diagnostic testing, where broader understanding is anchored around such test indicators in a statistically defined environment.

Duality Two - discovery/ transmission conceptions of mathematics teaching

The potential dichotomy between phenomenological and official versions of mathematics is to some extent mirrored in these supposed alternative teaching orientations. The choice between the extreme positions of discovery and transmission appears as an apparent conflict between valuing what children do see and measuring what they should see.

Duality Three -perceptual! structural conceptions of mathematics teacher's task

Within research in mathematics education the teacher's task is often depicted in two distinct styles of research output: phenomenological accounts in which the affective experience of the teacher is seen from an "insider" perspective and structural accounts where the teacher's task is defined externally in terms of more "official" objectives.

Resolution of the potential dichotomies
The potential dichotomy between Mathematics 1 and 2 (duality 1) might be seen as being associated respectively with discovery (learner perspective privileged) and transmission (teacher/ official perspective privileged) styles of

teaching (duality 2). Meanwhile, "connectionism" has been offered by Askew et al as a third type. We suggest this might also be seen as a reconciliation of the two perspectives, an approach which attempts to draw links between alternative perspectives as offered by children and discuss how these "connect" with the curriculum topics being addressed. Thus we achieve a conception of mathematics constructed to be more harmonious alongside the more traditional conceptions of mathematical topics, but without the associated assumption that this implies a particular pedagogical attitude to these topics. We suggest the divide between alternative conceptions of mathematics can be effaced by emphasising the circularity of moving between hard edged results of specific exercises and the socially conditioned individual who contextualises them in a personal way. Whilst connectionism addresses these concerns through its insistence on valuing alternative individual perceptions of key core ideas, our results seem to suggest that such an approach might be beyond the current intellectual and performative capacity of many non-specialist students, lacking sufficient sophistication in their subject knowledge.

In the third duality, perceptual and structural perspectives can be reconciled by seeing them as being mutually formative and both situated in a broader social construction. This echoes recent theoretical work in mathematics education research where the individual subject can be seen as acting through the filter of a variety of social discourses. Within ITE this could suggest the need for a more critical focus on how demands teachers face in their individual practice are associated with the interests of the various stakeholders.

Conceptualising transition

A further aspect of the study examined a theoretical perspective on the ways in which the transition of students during their course can be conceptualised by student teachers themselves and by those observing their developing practice (e.g. tutors, schools, researchers). We argue that the student's transition can be read in a number of ways and that alternative accounts of how students

progress in their course suit different and perhaps conflicting requirements when they enter school as qualified teachers, such as, for example, their ability to: prepare children for a national test in mathematics, encourage investigational mathematics or meet the school's specific requirement for classroom organisation. Students we observed, for example, experienced difficulty in their attempts to reconcile and organise the alternative understandings of the "mathematics" which arise in different measures at successive stages of college training. The theories we apply in describing the student's progress are partisan however according to the relative emphasis placed on different aspects of the training. The approach we have followed resists attempts to privilege any particular version of how the student became a teacher but rather invites an analysis of the sites which give rise to these alternative conceptions of the student's task and how these impact on ITE students. In addressing this concern with how transition is a function of the ways in which we choose to describe it, we invoke Ricoeur's work on time and narrative as an analytical approach to treating notions such as transition, development, initiation and progression in initial training of students for the primary mathematics classroom.

Acknowledgements

This paper reports on the Primary Student Teacher's Understanding of Mathematics and its Teaching project funded by the Economic and Social Research Council, project number ROOO222409.

1. An extended version of the final report is to appear in the British Education Research Journal.