Contents

The Initiation into the Discourses of Mathematics Education

Una Hanley and Tony Brown Manchester Metropolitan University

How do students use language in developing an understanding of their professional task? This paper draws from a study examining the case of non specialist students following the mathematics strand of an initial training course for prospective primary school teachers. It considers how their existing knowledge about learning mathematics, gained through experience of learning mathematics themselves in schools, underlies or limits their understanding of their future task as a teacher. Here we focus on some early attempts by students to introduce more 'official' styles of expression when speaking of teaching and learning. We suggest that from the outset the student's path is severely constrained.

We are interested in how initial training students become initiated into professional ways of describing their future task as teachers. In this paper we meet some students early on in their first year of an initial training course, apparently caught between their perception of their own school learning experience and a tentative grasp of how they will develop skills as a teacher themselves. This was carried out as part of a broader study examining primary student teachers'understanding of mathematics and its teaching (Brown, McNamara, Jones and Hanley, 1999). The course they are following is designed to enable student teachers to engage with a dialectic between their actions and their reflections on these, based around their own writing and discussion with tutors and peers. At the same time they examine government curriculum documentation and academic literature which introduce specific styles of referring to teaching and learning. This forms a basis for the student's building up their own personal practical knowledge based around the specific demands they face (Elliott, 1993, pp. 193-207; Hanley and Brown, 1996). We suggest that their own experience as pupils has highlighted for them particular characteristics of teacher behaviour to which they now need to consider for themselves. In their minds there are certain things that schools and teachers do. We question how they reconcile these understandings with the language they increasingly find themselves obliged to use. We call this the 'official'language, by which we mean the styles of referral they meet in college sessions, in schools, in curriculum documentation and in textbooks.

We make our observations as tutors on the teaching team for the course, with particular concerns relating to the evaluation of that role. There is a ‘course content’, which must be attended to and which relates in some measure to governmental guidelines on what a trainee teacher needs to do, as well as course specific concerns for developing reflective practice. As course tutors 'we face certain constraints within the course criteria. Given the nature of the course, these criteria are governed by a multitude of sometimes conflicting demands. None the less, the tutor must find ways of following the progress of students as shifts are made in the perceptions of their role. The shift is not concerned with movement towards an ideal; rather one in which the 'naive' student comes to understand and locate herself within her own construction of practice. Both as teachers and as researchers reflecting on the functioning of the course we see ourselves in the tradition of reflective practice present in much recent research (e.g. Adler, 1993; Connelly and Clandinin, 1988; Cryns and Johnson, 1993; Hatton and Smith, 1995; Schon, 1983; Olson, 1995).

We shall commence with an outline of some of the issues facing students on the course. We shall then look at some examples of student writing produced during early stages of the course. We conclude with an analysis of the transition we see them making between alternative ways of describing classroom mathematical activity.

The Course

A key task for the students, as they progress through the course, is to move towards capturing their understanding of the professional language of the mathematics teacher, in writing. As the course proceeds it relies, increasingly, on the student's ability to analyse his or her practice through the medium of reflective writing. Towards this, they are encouraged to keep a diary arising from work carried out in college sessions, which they are invited to review regularly. The writing is concerned with situating themselves in particular accounts of teaching and learning situations. Over a period of time, the descriptions in the diary move away from those of nervous student speculating about what they might do towards that of a teacher reflecting on what they do in fact do during spells in school. In the study we were interested in how they would begin to accommodate the official language and use it in describing their own experience (e.g. Hanley, 1994). Whilst such writing reveals a view of student reality, it also reveals where the tutors must now direct their attention. The writings carry with them particular ways of speaking about mathematics and mathematics teaching which evolve as the student is faced with employing a more 'official' language. From early on students are offered this more 'official' language, for example, the style of expression used in government curriculum documents. In recognising this language as a characteristic of the culture to which they aspire, students move toward utilising it. In some senses, they are apprenticed to the language as they seek to reconcile aspects of experience with words now made available to them. Recognition of this shift often becomes an important part of their reflection.

The approach taken within the course is underpinned by a poststructuralist view of language which sees it as being very much part of the world being described (e.g. Coward and Ellis, 1977, Brown, 1997). Attempts to capture the world in writing are thus instrumental in creating the reality being described. The way we describe the world conditions the way we see it and the ways we act within it. The world and descriptions of it are in an ongoing relation with each other. Such writing provides anchorage, that is, points of reference in the form of 'position statements' as new ways are developed of seeing things (Brown, 1994, 1996). One such anchorage point is introduced at the beginning of the course when students are asked to consider their experience to date, as learners of mathematics. Their understanding is necessarily coloured by a multitude of specific discourses, which prepare their perceptions. In describing this experience, they produce not only a history of these perceptions, but also their understanding of what it is to be both a teacher and learner of mathematics. In coming to develop their practice as teachers of mathematics, they already have established notions of what this practice might be. Before we come to explicitly understand something we already have a preconception of it. "We drive at an insightful and explicit understanding of something only on the basis of "something we have in advance"" (Gallagher 1992, p. 61, citing Heidegger). In reflecting upon new experiences, not only do we necessarily view them through the f1lters created by previous experience, but we can only discuss them in the language we know.

Student writing

We shall consider work produced by students in the first session of the course where they were invited to discuss and write about their existing understanding. The students were asked to list and share their ideas under the heading of 'mathematics is .. .'. A video was introduced featuring an extract in which members of the public described their own varying experiences with mathematics. Also, an investigative task was presented as an 'alternative' mathematical experience, where students, working together in groups, were invited to noe what they did as they went along. As such the session invited students to be open about their existing views of mathematics, while simultaneously sneaking in certain aspects of the course agenda with its own specific views and ways of talking.

We offer some brief comments by some of the students attending the course. Our intention is to focus on their struggle in describing teaching and learning situations with appropriate language and consider how 'official' ways of talking have already begun to infiltrate their mode of expression:

1.In this extract from a short piece, Anna writes about her feelings after the first session:

Today made me think back to how I was taught at school, in my case and I think most, we were given questions and answers but not the bit in between so when it came to doing work by yourself it was very frustrating not being able to get answers and a large majority of students would give up.

The world of school mathematics is recalled and summarised very briefly here as 'questions and answers but not the bit in between'. Anna's own every day use of language appears to struggle as she seeks to compare the investigational task with her previous experience. Later she adds,

(With ref. to video), ... it also frightened me because it made me realise how much I take for granted and it must be really difficult to get through to children so young.

In spite of introducing the notion of 'the bit in between' to describe the experience in this session here, Anna refers to learning in more prosaic terms. She writes initially of her fear of taking things for granted. This perhaps reminds her of her own state of mind when her teachers took aspects of her own learning for granted. It must, she says, be really difficult 'to get through to children'.

2. Beth writes:

I thought that today's "cow problem" was an excellent introduction to the maths session of this course as we had to think mathematically to solve the problem, but we did it without even thinking about it. We found ourselves following a process - systematically working out the problem. We even used algebra to write down the solution, so all our textbook maths work hadn't gone down the drain after alL ... we were given a realistic situation to deal with, not just a sum on a page.

Beth seems to have picked up on more of the language of the trade, albeit rather tentatively. She was able to follow 'a process - systematically' working out the problem.' However the context of 'the solving of the problem' is rather intriguing. She was, she says, thinking mathematically without even thinking about it. The language, it appears, has enabled her to categorise forms of behaviour, perhaps previously unexamined, into activity which she can now view as 'mathematics'. She may also be suggesting, in common with the voices of other students not included here, that mathematics is more do-able if it is not categorised or named as 'mathematics' in the first place. If it can be disguised it is not so bad!

Like Anna, Beth seems to have difficulty in using her own everyday language to describe adequately her experiences as a pupil. Yet she distinguishes between 'text book maths', perhaps represented in algebraic form and 'a realistic situation'. She may be distinguishing between to forms of language; the everyday language in which 'realistic' scenarios are most often couched and the specifically mathematical language which categorises text book presentations.

3.Interestingly, neither in the following extract, nor from the longer piece from which it was taken, does Debbie choose to write about her own experiences as a pupil, but none the less, she seems to have definite views about 'learning'.

She writes:

I believe that if children sometimes work in pairs or groups to solve mathematical problems involving trial and error it will develop their curiosity to find the solution, thus fostering growth of cooperation and collaboration.

By each child giving some input, they will inevitably reach a conclusion much faster than individually - this is because the children will develop and refme each others ideas.

Once the child has gained a complete understanding, we can move from the practical work to looking and analysing on paper, finding a systematic way of recording the results. Here we may find a pattern within the figures e.g. a chart which can proceed without carrying out the practical activity any longer.

Debbie's writing, in some ways, appears to be almost over-burdened by the need to employ as much as possible of the 'official' language introduced in the session. The language is also strongly associated with claims about her own beliefs regarding how children ought to work and has the assertive tone of much professional literature written to support particular ways of working. For example, the emphasis is very much on teaching strategy, making an unproblematic link between this and learning outcome.

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There seems to be a little jumbling in relation to the subjects of the writing. At the beginning Debbie refers to children, later sliding into a reference to herself. She talks about 'complete understanding' and can describe a move from the 'practical' to 'analysing on paper', with some conviction. The subject of her writing, a consideration of group work, is, one might suggest very much part of the 'official' line of current practices in teacher education colleges. Debbie's facility with the 'official' ways of talking and working is very much in evidence, suggesting that she has encountered it before. To an extent, her experiences in the session seem clouded by the terminology used, and a somewhat idealistic picture of student/child participation is created.

4.**In** response to the question 'mathematics is? .... " Elaine wrote the following, here reproduced in its entirety;

Maths is a difficult subject with subject areas such as equations and fractions which are very hard. When I think of maths I think of sums and times tables. I think that maths would be impossible to me without a calculator ! Maths is confusing and complicated but it is a necessity of life and without it there would be no prices in shops and life would not be the same.

All these words are what working mathematically is; talking, discussing, questioning, reasoning, listening, observing, checking, confirming, experimenting, trial and erroring, contributing, adopting, recalling, hypothesising, conjecturing.

Elaine's own description of mathematics appears to have been written with some difficulty, relying on the listing of subject areas together with a recall of processes which were both 'confusing and complicated'. Her reference to mathematics as a necessity for life appears as a gesture to the expectations of the course rather than as an expression of personally held belief. That is, she seems to be talking in terms of what she feels she is expected to say rather than basing her comments around her own experience. Perhaps the most striking feature of this writing is the fact that about half of it appears as a list copied from the white-board, comprising words offered by students in the session, describing what they had been doing as during the investigative task. The last two words, 'hypothesising' and 'conjecturing', had been added by the tutor. Elaine seems to have made no attempt to work on the list or f1lter aspects of it into her own writing. She appears to understand that it needs acknowledgement, but is unable to interact with it in any way, or to convince the reader that any of the words are significant for her.

Language and practice in transition

Students are caught between writing creatively and wntmg conventionally about their evolving professional task. The language they use is not a straight forward map of their experience as they see it. Rather they need to bring meaningful experiences to the vocabulary with which they are presented whilst, at the same time, finding ways of capturing, reflecting and acting on their actual experience. This is somewhat akin to Lave and Wenger's (1991) analytical perspective on induction, "legitimate peripheral participation", which sees learning resulting from asymmetric co-participation within a community of practice where development of expertise and understanding is situationally and contextually grounded. Learning in this model is not "from talk" but "to talk"; the master/apprentice relation, where it exists, functions to confer legitimacy rather than to provide teaching. As early as the first session, students come to realise that they can only go so far in employing their own personal language before coming up against the demand to use a more 'professional'style, as they become initiated into the conventions of mathematics teaching. Whilst not wishing to make too many claims for each of the transcripts, we suggest aspects of the initiation process in its early stages are represented in the student's recognition of the need to adjust their way of describing teaching and learning situations. This process begins with a consideration of the experiences students have had as pupils in school, substantially unexamined and unrecognised from a potential teacher's perspective. The language they use to describe the learning situations seems to largely based on a post hoc description of their remembered experiences. They are now faced with trying to set up a rationale to govern their future actions as a teacher.

There are however, definite risks in moving too quickly into a more 'official' way of talking since the student's way of describing things can become disconnected from their own experience, even if their own everyday language is not up to the task of effectively expressing their way of seeing things. The new way of talking does perhaps indicate areas that might now be examinable and may suggest the possibility of something 'better', even if this can only be done in a tentative way. The business of negotiating a ‘fit’ between language and experience is a lengthy and complex process. Perhaps Anna can now categonse an area previously not remarked upon in her own history, 'the bit in between'; Beth can begin to locate the new language against something she is currently experiencing, and include a little of it in her writing. We found ourselves following a process - systematically working out the problem.' Debbie seems somewhere further down the line in the process of her own initiation; at least, the facility with which she utilises specific language in her writing, would appear to suggest this. Her writing echoes the style of much 'professional' literature she may have been exposed to. She, for example, offers an uncritical view of 'group work' and her account makes unsubstantiated leaps between teaching strategies, (arranging the children in a group); desirable modes of pupil behaviour, (cooperation and collaboration), and pupil learning (complete understanding). One follows upon the other in an unproblematic way. It is difficult to determine whether she is regurgitating a line rehearsed previously elsewhere, whether she is attempting to describe events in the session in terms which she recognises as desirable, or both of these things. In a sense, the language itself is so powerful that the behaviour to which it refers is subordinated to it. The experience could be described as language - led.

In the case of poor Elaine meanwhile, it seems that her apparent terror of the subject is combined with a desire to respond to the task appropriately which she interprets as reproducing the words offered by her peers about what mathematics really is. For her it would seem that her own personal experience of mathematics has been anything but talking, discussing, questioning etc ..

Conclusion

The modest aim of this short paper has been to highlight the task initial training students have in moving towards describing their experience in a new sort of linguistic register and show how constraining this can be. As we have referred to it elsewhere (Hanley and Brown, 1996), for such students there is a curious mixture of 'description-led experience' and 'experience-led description'. Firstly, their extensive experience of mathematics in schools as seen from the perspective as a school student is now being reclassified and redescribed according to a more professional style of referral. Secondly, they are being exposed to new experiences and perspectives where their existing language begins to feel the strain. Perhaps, as in the cases of Anna and Beth, the exercise described drew to their attention aspects of their experience which may previously have gone unnoticed and this may be a significant matter in the process of initiation. On the other hand, as in the case of Elaine the experiences and the language on offer seemed dislocated from her past experience and she seemed to be floundering with an ungrounded set of words.

Approaches to teacher research based around reflective writing focus around a reconciliation between practice and ways of describing it. This might be seen as a process of refining the language to be more precise in capturing one's perception of practice. Clearly, there is scope for both practice and description of it to develop in this process and, in a sense, either one can take the lead. Very often, for more experienced practitioners this can be used as a way of developing their own language, where they can assume a certain licence in seeing things in their own chosen way - in an act of liberation from the discourses that bind them. Such themes are common fare in many masters degrees pursuing practitioner orientations (e.g. Brown, 1996). For the students described here however, there is interference in the system, even within such an apparently harmless activity, since they are so clearly under pressure to use someone else's language. They have to describe their experience in someone else's terms and then later, certainly as they enter school as an apprentice, they also have to have the correct sort of experience to fit the language. The reflective process here is often quite overtly an initiation into social norms where students try out the correct language for size before making it a part of themselves. The professional role construction in which they are immersed is provided with a fairly limited wardrobe, rather like a liberal school uniform policy but where self expression amounts to little more than having your shirt hanging out.

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College Ideals and School Practice

D N (Jim) Smith Sheffield Hallam University

Introduction

In previous years many of our student teachers have commented upon their perception of a strong difference between the views of school teaching propounded by the university based teacher trainers and those propounded by teachers in their practice schools. This apparent dichotomy might be characterised as college tutors being seen to be advocating strong but idealised positions and approaches whilst the influential teachers in school are characterised as being more pragmatic and practical.

If there is a substantial element of truth in this perception then this must arguably lead to some confusion for the student teacher who has to try to satisfy the apparently conflicting university and school based requirements (as well as attempting to meet pupil needs, parental and their own professional aspirations).

Through discussions with student teachers I know that this confusion often arises, but have been less clear about how the issue is resolved. Do student teachers tend to support the college ideals or the school practice?

Aim of the study

Is there a gap between college ideals and school practice in terms of advocated mathematics teaching styles? If so, how is this difference perceived by student teachers?

Data collection

To inquire into these questions I undertook a survey of all twenty-one students on our one year Post-Graduate Certificate in Education Mathematics course. This was undertaken at two points in the year. At the time of the first survey the students had only spent six full days in secondary school mathematics departments. At the time of the second survey, the students had completed Semester 1, culminating in a five week block teaching practice. Perhaps surprisingly, there was no statistical significant difference between the opinions expressed at these two times. In the discussion which follows I have used the results from the first survey since this represents the view of the entire cohort, before the loss of the one student who left the course and the loss of data from two who were absent at the time of the second survey.

Results

In response to the question "Do you feel that there is a close relationship between college views about the nature of mathematics teaching and what you observe to be in practice in schools?", the majority replied in the negative. (4 Yes, 15 No, 1 replying that it depends upon the school and 1 non-responder). In a follow up question, students were asked to give reasons for their responses.

For the few that found a close relationship between college ideals and school practice, this proximity seemed to diminish further up the school

"There is a general proximity in teaching style adopted in years 7,8 *and 9 to that advocated by college tutors especially in the investigative, self directed and self assessment encouraged by the teachers of those years. Years]0 and* 11 *are more traditional exposition and practice, reason being that it needs to be that way for GCSE's".*

Teachers were seen to be " ... *constrained by practical difficulties in doing less than what they would see as ideal.* ", *"Some teachers would like to do more investigations etc. but don't have the time to develop many workable ideas.* " and teachers were seen to be constrained by the curriculum e.g. "] *believe the views to be the same but the practical application, due to the needs of the school to cover a large syllabus, is different. "*

For the majority who found some disparity between college ideals and school practice, the following quotations illustrate these views:

"]n college, the emphasis is on investigative work and appropriate practical work ... "

"So far in schools all] have seen is teaching by SMP, where pupils work from booklets ... ". Six out of the twenty one students made similar observations.

"College views on maths teaching encourage more variety ... "

"I have only seen teacher exposition ... "

"In school, activities / practical work seem to be regarded as a necessary thing to do twice a year. It is considered a waste of time and doesn't achieve exam results ... In college activities seem to be the main emphasis. "

"The vast majority of what I observed up to now ... has been the traditional teacher standing at the front explaining and going through examples followed by practice by the pupils from a text book. I did see one year 7 mixed ability class using a data base to analyse a data field

Students were asked to consider the Cockcroft report, paragraph 243. This well known paragraph advocates that teaching at all levels should include opportunities for exposition by the teacher; discussion between teacher and pupils and between pupils themselves; appropriate practical work; consolidation and practice of fundamental skills and routines; problem solving and investigative work.

Many of the students were not clear about the difference between problem solving and investigative work. The group as a whole were offered a view that problem solving is work which might start in a number of ways, but which often proceeds towards a narrowly defined end point. By contrast, investigative work generally has a clearly defined starting point, from which pupils can proceed in a number of different directions and may produce a relatively wide variety of outcomes.

The student teachers were asked to estimate the percentage of lesson time that was spent on each of the Cockcroft 243 categories of exposition, discussion, practical work, routine practice, problem solving and investigation. This distribution was requested in three different ways;

i) as an estimate of time spent in practice by teachers of mathematics in schools; with 17 usable results, (and 1 non reply with a further 3 students bracketing categories together without indicating the balance for each component).

ii) as an estimate of the lesson time that college tutors advocated; with 19 usable responses (and a further 2 students bracketing categories together)

iii) finally students were asked about their own intended distribution of time in their teaching; with 18 usable responses (and a further 3 students bracketing, categ,ones tQg~thy~

The 'usable' results were placed in a 6 by 3 matrix;

	Time in schools	**College advocated**	**Own intentions**
Exposition	1.41	0.93	0.05
Discussion	2.50	1.28	0.21
Practical work	1.31	0.36	0.29
Routine practice	15.91	8.17	1.28
Problem solving	1.68	0.21	0.69
Investigation	6.27	6.68	0.01

Analysis

The chi-square test for associatively was conducted, showing a chi-square total of 49.24 on 10 degrees of freedom and SP<O.005. The various contributions to the chi-square total are shown below.

	Time in schools	**College advocated**	**Own intentions**
Exposition	20.88%	12.24%	15.20%
Discussion	8.71%	19.14%	16.53%
Practical work	9.47%	15.92%	15.70%
Routine practice	45.88%	11.19%	19.93%
Problem solving	9.76%	16.51%	17.92%
Investigation	5.29%	24.98%	14.65%

Hence there is strong evidence of association, with the major contributions being discrepancies in the views on routine practice' and 'investigation' categories.

Subsequent two-way analysis was undertaken to consider any potential relationship between students perceptions of school and college views. Here, the chi square total was 43.42 on 5 degrees of freedom, with SP<O.005. this shows strong evidence of association. The major difference is in the views of routine practice' with students perceiving more routine practice in school than they perceive college tutors to be advocating. The second area of difference in perceptions is in 'investigation' with students perceiving less investigative work in school than college tutors appear to be advocating.

Analysis was undertaken to compare students own intentions with their perception of school practice. Again, there was strong evidence of association (chi square total 21.89, SP<O.005). The main area of difference being that students would aspire to place less emphasis upon routine practice and more upon investigation.

There was no significant difference between the perceptions of tutors advocacy and the student teachers own intentions.

Further observations

Student teachers were also asked to comment upon any other aspects of the inquiry questions; there was a lot of support for the view that

"The more traditional methods of teaching are used particularly with more able pupils. However, more investigative tasks are given to lower ability pupils ... "

and some support for the view that

"teaching styles vary greatly from one teacher to another ... "

with one student commenting;

"College appears to give the impression that Activities are the answer to mathematics teaching. However, I feel that they are counteracting a lack of this style in practice with the hope that student teachers will use this as part of their range of styles"

and one student commenting;

"In order to pass exams ... practice makes perfect... Practice exposes children to a wide range of problems and instils confidence and reveals children S weak points. Investigations may not stretch a child sufficiently. "

Discussion and conclusions

These views are based upon the limited experience of these student teachers in the school environment. However, they point out that there is a gap in the perception of what is being advocated by college tutors and what is perceived to be going on in many of our local schools. How do students resolve these contradictions? Do they decide that tutors are impractical theorists with no idea how to teach in a real classroom? On the other hand do they decide that the practices they observe in school are, for whatever reason, dire and dull? A partial answer is that these particular student teachers at this moment in their careers give strong evidence of relating their intended teaching activities much more closely to those perceived as being advocated by college staff than to what they perceive to be going on in school. Both college staff and student teachers appear to be agreed on the need for increased investigative work and less routine practice.

Clearly there are limitations to the generality of this small scale study. Among other considerations, we must ask whether the perceived views are a fair representation of reality. In other words do student teachers share a common understanding of the Cockcroft 243 terminology, do tutors really advocate such a distribution of teaching time, and do teachers really distribute their time as it appeared to these student teachers? How reliable is the evidence? How typical are these students, schools and tutors?

Setting aside these questions and accepting the evidence at face value, the conclusions drawn are as follows.

i) These particular student teachers ally their views closely to the perceived views of their college tutors. It is reasonable to speculate that once these students become full time teachers, this initial influence may fade over the years.

ii) These particular student teachers regard school teachers of mathematics to be doing too much routine practice work and insufficient investigative work. They appear to be convinced of the desirability of engaging their pupils in active learning tasks although one or two seem to be indicating that tutors are overstating the case in an effort to counterbalance school practices.

My own observation is that in practice, this difference of opinion does lead to difficulties for student teachers who try to introduce more active learning into lessons where the pupils are unfamiliar with such approaches and the student teacher feels that staff are less supportive of such approaches. On the other hand, most schools seem to expect student teachers to be keen to try out new ideas.

iii) Many of these student teachers are aware of school teachers adopting different ways of working with different ability pupil groups. This is largely an observation on the part of these students, not a point that has been very strongly made in the taught course.

A final thought; these student teachers were happy to distinguish between the Cockcroft 243 teaching styles, which might be considered to be an encouraging sign. However, less encouraging is the observation that none of the sample ventured to comment that there might be more than one style in operation at any one time.

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The Initial Teacher Training National Curriculum for Primary Mathematics . . . a realistic target?

Alan Bloomfield, David Coles and Alison Price* Cheltenham & Gloucester College of Higher Education
*Oxford Brookes University

Introduction

This article describes our investigations into the links between students' qualifications in mathematics prior to coming to Cheltenham & Gloucester College of Higher Education (CGCHE) and their performance on modules in the first two years of a three year Primary B. Ed. programme. It is based upon the workshop with the same title which took place at the 1997 Association of Mathematics Education Teachers (AMET) Annual Conference in Leicester. The conference was dominated by discussion of the Initial Teacher Training National Curriculum For Primary Mathematics. At the time of the conference this document was being circulated for consultation by the Teacher Training Agency (ITA) and has since been finalised (ITA, 1997). A brief summary of the workshop discussion at the AMET conference raises a number of concerns and possible strategies for meeting the ITA changes facing mathematics education teachers.

Mathematics within the CGCHE Three Year Bachelor of Education Degree

In 1994 the primary education team devised a new B.Ed. programme in accordance with DfE circular 14/93 (DfE, 1993) This was to be a generalist course preparing students to have a greater pedagogical knowledge of the core and some foundation subjects but less study time devoted to specialist subject itself. It was decided that two thirds of the intake would be trained for Early Primary (4-8) and a third for Later Primary (7-11), while the Postgraduate Certificate in Education (PGCE) course would be weighted in the opp~site direction, since it is at Key Stage Two that subject specialisms, developed during subject study at first degree level, might be of greater benefit. In the first year of the degree, all REd. students would take a module each in English mathematics and science, two workshop modules concentrating on study skills, child development and aspects of primary practice, and three other modules chosen from art, history, physical education and religious studies. (A compulsory information technology course and a further option in geography have been introduced since the original validation.) The course was written, validated and recruited very successfully to start in October 1995.

Learning Mathematics and Being Mathematical

Our task was to write a mathematics module suitable for intending primary teachers and accessible to all students whatever their entry qualifications in mathematics. The module, PP170, entitled 'Learning Mathematics and Being Mathematical', was designed so that;

Students will undertake investigative mathematical activities which involve them in using and applying mathematics in the areas of number, algebra, data handling and shape and space. The experiences will be used to enable the student to develop insight into the ways in which mathematics is learnt. (CGCHE, 1995)

The module was to have a range of intended learning outcomes. These included, the intention that: on completion of the module the student will be able to demonstrate that they:

i)*have the knowledge and understanding necessary to teach the mathematics covered by the National Curriculum at Key Stages* 1 & 2

ii) are able to carry out investigative mathematics as part of a group

iii) are able to reflect on their own mathematical learning and the processes involved. (CGCHE, 1995)

The module consists of workshops, group work and report writing. The students are required to take the College Diagnostic Mathematics Test prior to the module and are given diagnostic assessment material based on Key Stage Three SA Ts questions as an initial subject audit. This is a self-audit with students creating their own list of 'gaps' in subject knowledge.

On entry the students take the College Diagnostic Numeracy Test gives feedback in the areas of Basic Arithmetic, Fractions/Decimals, Percentages/Ratios, Basic Algebra, Significant Figures/Indices, Problem Solving, and Charts/Tables/Graphs. The students' work is graded 'Excellent', 'Satisfactory' or 'Would Benefit from Revision' in each area. Students with four or more areas needing revision take an additional module, 'Confidence Counts' in their own time during the first semester.

Self study material is also available for students to work on specific topics. In the light of these assessments and theiur entry qualifications inmathematics, the students are placed into 'sets' for the mathematics module.

On the basis of the above assessments, self audits and their previous mathematical background, students are required to identify areas of the curriculum in which they need support in developing their own mathematical knowledge and skills. Differentiation is achieved by giving students a choice in the topics that they cover as well as the level at which they work. They work on these topics within groups where they support one another's learning as well as completing some aspects of study individually. Where the majority of a group are experiencing difficulties with a topic, this would be addressed during taught workshops. Outside of workshop time, the students are also required to read and work through 'Mathematics Explained for Primary Teachers' (Haylock, 1995). Workshop sessions focus mainly on developing knowledge, skills and understanding across the key components of NC mathematics; particularly the processes of mathematics, together with an understanding of number and algebra. An introduction is given to the use of calculators and specific IT environments such as Logo, Excel and SketchPad.

Assessment

The assessment of the module is:

i)80% for a <u>iournal</u> in which they are required to reflect on the learning of mathematics, (2 500 work maximum)

ii) 20% for a <u>computer-marked examination,</u> based on KS3 SATs

(students must achieve a pass grade in both of these elements)

iii) Two mathematical <u>reports</u>, showing their ability to

communicate some of the mathematics they have learnt. These are marked as satisfactory/unsatisfactory, but currently do not count towards the final grade for the module.

The Second Year of the B. Ed. Degree

In the second year the students build on their understanding of mathematics in the module, PP241 ElL 'Teaching Primary Mathematics' taught separately for Early Primary and Later Primary students. This is taken over the whole year in parallel with serial school attachment - two days a week in school- allowing the students opportunities to teach mathematics and evaluate their teaching. The assessment for this course is in two parts. The first consists of a 3 000 word assignment in which the students are asked:

In discussion with the class teacher, identify an aspect of number from the Mathematics National Curriculum. Identify and discuss the key facts, skills and concepts. Plan an activity or a group of related activities designed to help children learn this.

Discuss the issues involved in teaching the aspect of number, critically analyse your planning for the activity, report objectively on the implementation and evaluate its impact on the pupils involved.

The students also submit a portfolio of individual, group and school based tasks which is graded satisfactory/unsatisfactory. These portfolios had not been completed at the time of writing.

Data Preparation and Analysis

The main question we wished to explore was whether the student's mathematical subject knowledge on entry had any significant effect on their performance during the course and subsequently on their performance teaching mathematics in school. In order to do this we have used the following as measures of subject knowledge on entry:

- Highest mathematics qualification (GCSE grade or A level)

Score on the college diagnostic numeracy test

To enable correlation coefficients to be calculated these data were coded as follows:

The Data

In summary therefore, for the cohort of students we have information about the following:

- Highest entry qualifications in mathematics

- College Diagnostic Numeracy Test
- Year 1 Computer marked examination
- Year 1 Reflective Journal
- Year 2 Assignment in mathematics education

Mathematics Qualification

Other e.g. Access Course at GCSE level: 1

GCSE Grade C :	2
GCSE Grade B :	3
GCSE Grade A :	4
Maths A Level Grade F, G:	5
Maths A/S Level Grade A, B, C, D, E	6
Maths A Level Grade A, B, C, D, E	7

Student Entry Qualifications 1995

Highest Maths Qualification	Number of students
Other e.g. Access Course at GCSE level:	1
GCSE Grade C :	93
GCSE Grade B :	6
GCSE Grade A :	10
Maths A Level Grade F, G:	6
Maths A/S Level Grade A, B, C, D, E	1
Maths A Level Grade A, B, C, D, E	7
Total	124

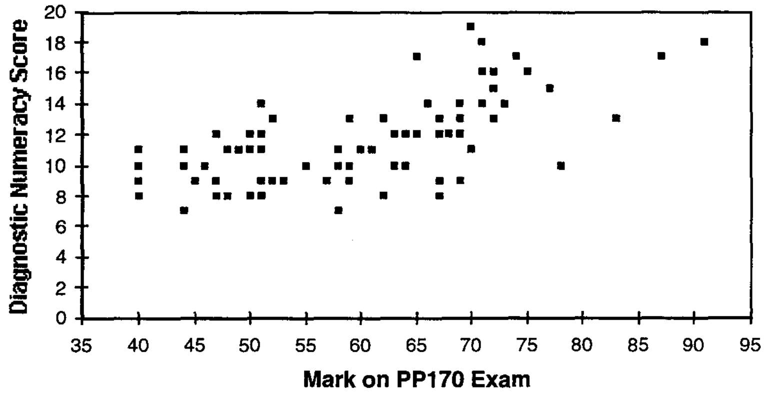
Diagnostic Numeracy Test

This is divided into seven sections and student performance is graded excellent, satisfactory or needs revision. A total score for each student was calculated by giving three points for an *excellent* rating, two points for *satisfactory* and one point for *needs revision.* This gave potential scores ranging from 7 to 21.

	PP170 Exam	**PP170 Journal**	**PP241 Essay**
Diagnostic Numeracy Score	**0.6813**	**0.3994**	**0.1373**
	N=82	**N=88**	**N=85**
	Sig. 0.000	**Sig 0.000**	**Sig 0.105**
Entry Qualification	**0.3864**	**0.0916**	**0.0230**
	N=110	**N=117**	**N=114**
	Sig 0.000	**Sig. 0.163**	**Sig 0.404**

Table 1 - Correlation of Mathematics subject knowledge on entry with Module Grades

Figure 1: Scattergraph of Diagnostic Numeracy Score against PP170 Exam Mark



The measures of performance on the course which were used, the PPl70 Exam and the PPl70 Journal, were available as raw marks on a scale from 20 to 85. However, it was clear that they should be treated as ordinal level data rather than interval level data. Consequently Spearman's rank order correlation was used as the measure of association between the variables. These were calculated both from the raw scores for the course work and also using codes representing degree classifications only. The correlation coefficients were very similar using either method. Only those calculated using the degree classification codes are quoted here.

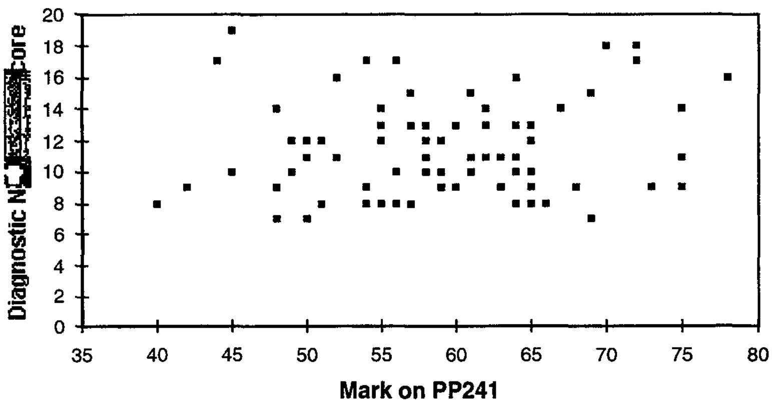
The scores for the PP241 assignment are taken to be the first measure of teaching competence. These scores were treated in the same way as the PPl70 marks and similarly only the degree classification is used in the analysis.

There were approximately 135 students in the year group but complete data is not available for all students and this results in different sample sizes in each analysis. The diagnostic numeracy test was not taken by all the students. Also a number of students withdrew during the course of the two years and consequently do not have grades for PP241.

Results

The results are presented as a table showing the correlations between the two measures of maths subject knowledge on entry and the measures of performance during the course. Two scattergraphs are also included to give a visual impression of the level of association between the variables. These have been presented using raw marks rather than ranks.

Figure 2 : Scattergraph of Diagnostic Numeracy Score against PP241 Mark



Discussion of Findings

The most striking pattern here is the declining level of correlation between mathematical subject knowledge and performance through the course. The entry qualification (e.g. GCSE) is a significantly worse predictor of performance than the diagnostic numeracy score. This might be partially explained by the fact that the diagnostic numeracy score is a current measure of subject knowledge, while the *GCSEI* A level score is a measure of past performance for many students, who may have passed their GCSE or even GCE **O** Level several years ago.

Since the PPl70 Computer Marked Examination is also intended to measure subject knowledge, the higher levels of association found at this stage are unsurprising. Indeed a significant aspect is the relatively low level of association between the entry qualifications and performance in the examination.

Subject knowledge does seem to have some influence on the students' ability to reflect on their own mathematical thinking as represented by the PPl70 Journal grade. Thus, knowing more mathematics or understanding it more thoroughly, appears to contribute to being able to think. in greater depth about what is involved in doing mathematics. However, there are also students with higher subject qualifications, (i.e. A level) who find it difficult to examine their own thinking and identify the steps that they take in solving problems. Conversely, some students who had weak subject knowledge on entry show more ability to reflect on their own thinking and develop a deeper understanding of what is involved in mathematical thinking than perhaps would have been expected.

Finally we note that subject knowledge on entry is of limited value in predicting performance on the PP241 assignment. Clearly some students who enter with the minimum GCSE grade C <u>can</u> develop the skills and understanding necessary to show a good level of competence in reflecting on what is involved in teaching and learning mathematics. Since almost three quarters of students entered with GCSE grade C, these findings will need to considered with some caution of course.

Discussion at the end of the AMET Session

At the end of the session at the AMET conference there was an opportunity to discuss the above findings and to comment on whether they were typical of others' experience or research. Colleagues also commented on more general concerns in relation to the draft National Curriculum for Initial Teacher Training.

<u>Predictors of success</u>

One of the possibilities raised was that the total grade performance at GCSE across the whole range of subjects might for standard age entry students be a better predictor of performance on the course rather than focusing on just mathematics qualifications. Other pointed out that it might make a considerable difference if one considered whether a candidate had taken the Higher or the Intermediate papers at GCSE.

One group commented that

'GCSE grade C is a nationally acknowledged baseline, which we would be ill advised to move from. It's just a baseline for going on to all sorts of professions, teaching being just one of them ... (What is important is) what mathematics they need to develop, when they go into teaching.'

Others felt that entry qualifications were not necessarily of central importance ...

'Whether its mathematics or how to teach mathematics, it's how they take it on as reflective learners which indicates whether they are going to be successful or not. '

In our findings there was some evidence that the ability to reflect on your learning was a useful indicator of the ability to reflect on teaching.

<u>Teaching mathematics to ITT students</u>

Another concern was the very short time available to those involved with the PGCE Primary route into teaching.

'With B.Ed courses there is a little bit more time in which we can deal with this. In a PGCE course we only have a year in which to cram everything in .... should a grade C be adequate for PGCE entry?'

<u>Auditing mathematical knowledge</u>

A debate about the need for and nature of a subject based audit produced arguments for and against a national subject audit prior to the start of any lIT course.

'If there's going to be an audit, it's better that it is a national based audit rather than a course based one. Once they have been accepted on the course it really doesn't matter ... I think it would be rather better if we used a national test rather than one associated with an institution.'

'That's dangerous because a national based test would be set by someone like the TTA. They haven't actually used the research evidence in support of what sort of knowledge teachers need in order to be effective teachers.' If we are trying to reach the ITA standards, fine ... but if we are actually trying to produce more effective teachers in schools then we have to work in a different manner. '

One group mentioned the possibility of HEls using other measures to determine whether an applicant for teacher training was likely to become an effective teacher.

'By talking about a subject audit after students are accepted onto a course, we are acknowledging that GCSE mathematics at C is not enough to equip the majority of students to teach. Maybe some more aptitude based tests before they are accepted onto courses for initial teacher training (should be used).'

Concluding Remarks

It seems to very important what we as mathematics education teachers do after trainees begin their course. The use of entry qualifications does not provide a reliable guide to future performance even within a course. In the AMET workshop colleagues talked about reflective learning and commented that *aCSE* may not actually tell you very much about the nature of the mathematical knowledge that people have. Such may be superficial, instrumental, algorithmic and without any relational understanding. What we want in teachers is the ability to relate, to make connections and to help their pupils to make connections. One of the features of the National Council of Teachers of Mathematics (NCTM, 1989 & 1991) approach to the curriculum is the need to make links between different areas of mathematics; this feature is missing from the mathematics national curriculum in England & Wales (DfE, 1995)

In our courses we need to combine thinking about mathematics with thinking about how to teach mathematics. There is also a need to make explicit the reasons why some mathematics is taught to trainees because it underpins what is taught in school. In the present context of school based initial teacher training it is essential that such connection making involves mentors in schools as well as trainees and HEI teachers.

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Square roots - an algorithm to challenge

Pat Perks and Stephanie Prestage School of Education, University of Birmingham

Six weeks with a group of PGCE students (usually 40) is *not a long time. However it is our university allocation before the first main teaching practice. There is so much going on for these students and so much to think about that we often look for memorable hooks for our sessions (Prestage* & *Perks* 1992). *Such hooks offer a shorthand to recreate the discussions, attitudes and thinking at a later date. These ITE students are in the process of developing theories of teaching. They will work on developing their subject knowledge, their planning and teaching skills, their knowledge of assessment practices, their management of resources and of people and all other aspects to be found under Shulman's umbrella heading 'pedagogical content knowledge' (Shulman 1986, Brown and McIntyre* 1993, *Cooper and McIntyre* 1996, *Askew et al 1997). In this article we analyse our practice to begin to determine our parallel pedagogical content knowledge and offer in some detail a session from the Autumn term.*

Challenging beliefs

There is plenty of evidence in the literature for the need to challenge the beliefs of ITE students to enable them to develop their professional thinking. Ball has written extensively in the area (Ball 1988, 1990), as have others:

... an implicit view that teachers have something called "beliefs" ... which need to be accessed and changed. (Hayles, 1992, *p 33)*

Neglecting the effect of students' prior knowledge about teaching on the reception of new knowledge has a high cost; students resist, transform or pick selectively from theory. (Hatton, 1988, *p 345).*

We aim to challenge existing beliefs that the students hold, beliefs about the nature of mathematics, the nature of their learning and how others learn. Add to this our belief that a student teacher needs to re-think their own subject knowledge and transform it in some way before using it in the classroom, and our sessions need to challenge at many levels.

In order for craft knowledge to be useful, one must break out of the sterile loop of a recycling approach to theory building. (Kagan, 1993, p44)

When constructing sessions we work from the following principles:

- if emotions are engaged then the process of learning can be enhanced -if you feel it in your heart as well as analyse it with you head the effect might be longer lasting. (lhis belief is supported by evidence from the students' reflective writing)
- personal (his)stories / experiences act as powerful agents in learning;
- teachers can only move learners from where they are;
- talking about situations is better than being told;
- writing about a session can move thinking on to another level.

The session described below reflects these principles. The particular aims of the session were to think about telling in mathematics, and the purposes of telling (Smith 1996); to notice the power of language when it is invested with the authority of the teacher; to discover the many personal histories of learning mathematics; to make evident the consequences of previous learning experience and to discuss the implications of these for teaching.

The context for the session is the algorithm for finding square roots. Success in school mathematics can be achieved by memorising definitions, rules and algorithms. It could be argued that, in some cases, successful mathematicians emerge through creating their own sense from the memorising but this aspect of learning needs to be made explicit. Algorithms for subtraction and multiplication might be the ones first met followed by adding fractions, multiplying negative numbers and solving simultaneous equations through to differential calculus later on. If you rehearse the rhythms and processes of these algorithms one of the main verbs employed is the verb 'to put', " ... put the 3 down and carry I ... put the I there", " ... put down a nought and multiply by this number first", " ... multiply those 2 numbers and put them under a long line", " ... cross out the nought and put a 9 ... ". Meaningful if you know what you are doing but complete non-sense if you do not.

The session style is based on students sharing their experiences of learning mathematics in the session. It is designed to hook their emotions, for them to stand back and share those emotions and, by this sharing, to encourage critical reflection on their past experiences and perceptions. What would it feel like to be a pupil in a class learning the algorithm for say multiplication and not have a clue what was going on? What does it feel like to be asked to remember a sequence of rules that is completely unmemorable and without purpose? Are you brave enough to admit it? Are you brave enough to ask? Do you keep your head down and pretend to know what's going on? What does it feel like to be helpless in a mathematics classroom? Maybe you think you have remembered but later on discover that your memory lets you down and you remember an incorrect version of the sequence. What does it feel like to be tested on what you haven't a clue about and grouped into attainment sets accordingly? And, more importantly, what if the teacher does not notice, does not realise? What if as a pupil you are very good at hiding? Is it important for would-be teachers to be aware of such feelings? Do we need to create or recreate such emotions? Especially as it is rare that our mathematics graduates own (or own up to) such memories of coming to know school mathematics.

A brief extract from the session, which is given in the first week, follows. We choose to do this session early as it gives rise to many of the issues described above. Relationships are still tentative; the group identity is vague, so it is easy to work with their insecurity. The session is based on pure control and the tutor remains deliberately distant to create the feelings. (Steph also wears her half moon glasses perched threateningly on the end of her nose, with a look-over which can freeze the marrow). The session starts promptly at 9. 30am

The session

Teacher: Today's session is a revision lesson ... on square roots.

Someone arrives late - the look demands an apology. Everyone looks round relieved to see everyone else is there.

Teacher: Today's session is a revision lesson ... on square roots. As graduate mathematicians I am sure you have all met this before.

Teacher sets the scene to discourage questioning. The word revision holds certain power.

Please put the title on the top on a clean page, in the middle and underline it.

The students look nervous but do as asked.

Why do teachers ask these things? Why do grown-up learners comply? Why do nearly all of them underline the heading?

Teacher: I shall go through the algorithm for finding the

square root of a number, I'm sure you have met it before.

Slight murmur round the room. The teacher moves on quickly before anyone dissents, The isolation makes them think they everyone else knows.

Teacher: *(explaining the algorithm in words whilst putting figures on the* OH7)

Mark off the 69196 on periods of 2 digits starting from the decimal point.

```
       2| 6|3
       6|91|69
       4
    46)291
       276
   523) 1569
        1569
```

The greatest integer whose square is not more than 6 is 2; so put a 2 in the first column of the answer; put 22 i.e. 4 under the 6 and subtract.

Bring the next two digits down.

Write down twice 2 i.e. 4 and find the approximate value of 291+40 (=7);

work out 47x7 (=329); too large for 291; try 46x6 =276. Put the 6 in the second column of the answer and next to the 4; put 276 under the 291 and subtract.

Bring down the next two digits (69), ready to repeat the process.

Work out twice 26 (=52) and then find the approximate value of 1569+520 (=3).

Try 523 x 3 (=1569 exactly). Put the 3 in the third colurrm of the answer.

-v69169 = 263

Teacher pauses and assumes complete understanding Is *this a joke or for real?*

Teacher: Now then I have some questions here for you to

do,

The OHT is changed to show 15 *questions.*

Teacher: The last few are starred, if you get onto these you are doing really well. I'd appreciate it if you would work in silence.

The latter is given as a statement, not a request.

General murmurs round the room, teacher demands silence.

Its a bit like Oliver Twist. Who will be the person who asks for more? A hand is raised.

S: Er I haven't done this before, would you go through it

again.

Teacher repeats the process, barely maintaining patience.

Another hand is raised.

S: Where did you get the 4 from?

T: ... because two twos are 4 , now if there are no more

questions ...

Resignation soon fall s *upon the room, as most struggle with the questions, arms covering the work, eyes down, occasional glimpses to the person sitting next to them.*

Imagine the next ten minutes, one or two have cracked the algorithm, most have not. The teacher walks around the room. Work is covered so that she cannot see the students' attempts. Heads are tilted **in** covert looks at others' calculations. The room feels divided. (Pat is having a nice time because she has cracked the algorithm, she has seen this performance before, and is on the starred questions.) One or two students are attempting to look unconcerned as others scribble furiously. Time targets are set, with a patronising "Don't worry if you haven't got onto the starred questions". Some are still on question 2.

Eventually a halt is called. Some sighs of relief. The answers are called out.

T: How many got them all right?

No hands.

T: How many got more than 10 right?

One or two hands.

T: Congratulations.

Further embarrassment as hands are raised for 9, 8, 7 6, 5 ... correct. Lots of praise is given to the people who have the most correct. A count discovers that the group splits into half at 6 correct. Two attainment groups are identified.

T: We will work in these two group for the method session.

The top group will work on Monday, the remedial group, who clearly need more mathematics practice, with me on Tuesdays.

Is this really the way to set group?

The setting of the group is the final straw. The classroom management supremo recognises the incipient mutiny! Steph removes her glasses and suggests that they relax and begin to think about their reactions to the session and their reactions as they worked on the algorithm.

The discussion

The discussion afterwards is charged as the students grapple with feelings of inadequacy and unfairness. The discussion lasts about an hour with small group and whole class discussion and we channel the discussion down several routes. We discuss the learning of an algorithm and their reactions to the expectations of the teacher, we discuss the difference between doing mathematics and understanding mathematics and their expectation of being able to 'understand' the algorithm. These latter expectations are evident amongst some and that any problems, if they exist, belong with the teacher.

51: The explanation was too fast.

52: The teacher should have explained it properly so that we

could understand it.

53: I would have gone more slowly so that my class could

follow.

Others are more used to personal failure in understanding (their experience from their degree studies?)

54: I kept wondering where the 2 came from.

55: I wondered why I was the only one who couldn't do it.

56: I knew it was *re vision,* I had seen it before, but it still did not make sense.

No-one questioned why the algorithm. The fascination with obeying the rules and getting the right answer and the related tick is still strong. This was challenged by asking what mathematics was in the session - a recurring question throughout the course.

The discussion probed more deeply into the feelings of inadequacy felt by some in contrast to the power of success felt by others. 50me felt personally threatened by the teacher.

57: I wondered why she was doing this, she was horrid, so I wasn't going to do it.

58: I thought that if this was what teaching is I should leave now.

We began to discuss the power of the teacher, the role of the learner, teaching styles and purpose, of doing and understanding, of the buzz from getting things right. The issues that we had hoped would emerge did so. In the discussion the students make explicit the role of their emotions and beliefs in their learning and how their personal histories enabled them to manage or not manage the situation. The strong emotions created conflict and challenge between the students who emerged as learners with different styles and expectations. Reflecting on these differences as emergent teachers meant beginning to work on their theories of teaching.

The writing

As part of their assessment portfolio the students do eight pieces of reflective writing over the year. Several weeks after this session the students handed in their second piece of writing. More than half the students chose to write on this session. The emotional hook allows them to remember. We offer here some of their writing and delight in the power of this hook and in the depths of the thinking evidenced here.

About the use of the word revision:

The teachers' presumption that we all knew the technique and it was just a revision sessioj underlined my sense of confusion and failure. I realise that presuming out loud that pupils can easily do something may put enormous pressure on them to meet these expectations.

Diane

About the session:

I could not complete any question other than the first, the ten minutes passed slowly ... I felt very embarrassed ... I put my hand up at 3 even though I had only done one question I could take no more

humiliation that day *Becky*

I felt there was a definite sense of isolation, the fear of not understanding in front of your peer group created the silence ... such

feelings are not conducive to learning. *Simon*

Throughout the exercise I continued to struggle ... I had the satisfaction in discovering one error but immediately found another ... This highlighted the difficulty some pupils must find in being motivated to carry on when as soon as they solve one problem another surfaces. I realise that this must be in some way catered for

in the planning of a lesson. *Diane*

About the discussion:

Steph then stared to ask us how we felt about this session and people said how they felt like they were back at school or humiliated, angry, turned off, cheated, bottom of the class and so on until we had all analysed out feelings and realised just how bad

this example was and also how true it could be. *Andrew*

The discussion was vital. it lifted the atmosphere, allowed me to see others' difficulties ... it was a relief to discover that I was not alone, other people felt just as confused, frustrated and annoyed as I did.

Jason

About the mathematics:

... discussing the breadth of mathematics involved it became clear how important that is and how wide your thinking must be to encompass all you can

teach *John*

About setting:

In my student life I was always put in the top set so I had no understanding of what it felt like to be in a low set .... I did not enjoy the experience and can now imagine why students act with resentment once they are told they are not as good as their friends.

Catherine

Conclusion

We reflect on our sessions each year to make them more effective for the next as well as making explicit our practice. In our recent inspection we were challenged on the multi-layered construction of our sessions, our labels are complex, but we believe that the very complexity of being a teacher needs addressing early and throughout the ITE year.

In training teachers to manage learning the very difficult nature of the teacher's work must be acknowledged. (Des forges, 1985, *p 131).*

We aim to problematise 'teaching' for the students in order that they can, with support, look for solutions and so to develop their own theories of teaching. We know that telling does not work, that we can only help to move each student from where he or she is at and encourage them to work intellectually on becoming a teacher. Teaching is not only about doing, it is also about thinking.

A third meaning of thought is belief ... Such thoughts grow up unconsciously. They are picked up - we know not how. From obscure sources and by unnoticed channels they insinuate themselves into the mind and become unconsciously part of our mental furniture. Tradition, instruction, imitation - all of which depend upon authority in some form, or appeal to our own advantage, or fall in with a strong passion - are responsible for them .... Such thoughts are pre-judgements, not conclusions reached as the result of personal mental activity.

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The Effect of Training on the Perceptions of Secondary Teachers towards the integration of Pupils with Special Educational Needs.

Sally Taverner and Frank Hardman

Current frameworks guiding the provision of initial teacher training in HEIs make reference to pupils with Special Educational Needs. This study surveyed teachers of Mathematics and English to ascertain how much training they had received with respect to SEN pupils and the effect of that training on their perceptions of the appropriateness of mainstream integration of those pupils.

Introduction

We recently published findings (Taverner,S., Hardman,F. & xxx, 1997) which looked at secondary English and mathematics teachers' attitudes to the integration of pupils with special educational needs (SEN) in the mainstream classroom. We expected, and one of us writes as a mathematician, that English teachers would be more tolerant of SEN pupils in their lessons whereas mathematicians, with their highly set, content-led approach, would hold less favourable attitudes. However, this proved to be far from the case. We found no significant difference, by subject, between teachers towards the integration of SEN pupils in the mainstream classroom. Mathematics teachers were found to be equally as tolerant and caring as their English colleagues. The purpose of this article is not simply to engender a 'feel-good' factor however! We did find significantly differing attitudes between teachers but this was linked to their length of service and the specific training they had received. It is with these findings in mind that this paper has been written.

The Sample

Questionnaires were sent out to teachers working in English and mathematics departments within the Newcastle University Initial teacher Education partnership. The questionnaire contained statements concerned with the integration of pupils with special educational needs which ranged from disabilities which do not necessarily impede academic progress, social- emotional problems and students with disabilities who historically have not been present in the mainstream secondary classroom.

The respoins erate was a pleasing sixty-eight per cent with the two subjects areas fairly evenly balanced.

Overview of Findings

The responses to our questionnaire showed that teachers who had more than eleven years service were significantly more likely to disagree that a pupil with a specific educational need should be integrated into the mainstream classroom. Rather than dismiss this as the onset of cynicism we went on to look at the training received by these teachers that related specifically to SEN pupils.

When the data was analysed in this way, rather than by subject specialism, it was generally found that the longer they had been teaching, the less likely they were to have undertaken a course in SEN during their initial teacher training as can be seen in Table 1 below.

	Valid N	Yes	No
Years Teaching:			
Under 1 year	12	7	5
1-5 years	15	7	8
6-10 years	20	8	12
11-15 years	12	0	12
16-20 years	20	9	11
21+ years	24	2	22

Table 1: *Undertaken course in SEN during ITT*

It can be seen from table 1 that, despite criteria laid down in Circular 9/92 (detailed later), nearly half of those who trained in the last five years reported that they had not undertaken a course in SEN. This reflects the findings of Garner (1996) who surveyed teachers who began their career in 1994. He reports that "The evidence gathered from this group of NQTs suggests that both the regulations contained in Circular 9/92 and the guidance within the SEN code of practice exist largely as works of fiction and well-meaning rhetoric."

It can also be seen from Table 1 that no-one in our sample with 11-15 years in teaching (trained 1980-1984) had undertaken a SEN course during their initial teacher training. Given the dominance of the Cockcroft report (1982) during the latter part of this period this seemed surprising, surprising that is until the report was revisited. There is no specific mention of the teaching of mathematics to pupils with SEN except under the heading 'remedial'. Even then the paragraphs concentrate more on the nature of the delivery (more oral and practical work) than any other single aspect of provision. This apparent lack of focus in the ITT received by teachers with 11-15 years in the profession does not appear to have been rectified since qualifying. Of this group, only 25% had subsequently followed a post-graduate course or received INSET on this topic as shown in Table 2 below. The data also reveals that of those with more than 15 years experience, 64% had received no further professional training regarding SEN.

	Valid N	Yes	No
Years Teaching:			
Under 1 year	11	2	9
1-5 years	16	5	11
6-10 years	20	5	15
11-15 years	12	3	9
16-20 years	20	9	11
20+ years	24	7	17

Table 2: *Received INSET in SEN since gaining QTS*

Therefore it would appear from these findings that, broadly speaking, the longer one has been in the teaching profession the more likely it is that you did not receive any training in SEN during ITT and further that you are unlikely to have taken part in any additional training since joining the profession. It seems more likely then, although it is impossible to unravel from our data, that the reason for long-serving teachers' diffidence towards the integration of SEN pupils into mainstream classrooms is more to do with their lack of specialist training than the onset of that well-known staff room malaise: galloping cynicism.

Implications for teacher training

Those involved in teacher training may be pleased to note that those who were trained under the guidance issued in circular 9/92 have a higher proportion who report receiving training in this area. This is despite the lack of emphasis it receives in that circular.

Circular 9/92 (Initial Teacher Training secondary Phase) has only two specific mentions of training requirements with respect to special educational needs. These are included in competence 2.6 Further professional development;

2.6.5 the ability to recognise diversity of talent including that of gifted pupils

2.6.6 the ability to identify special educational needs or learning difficulties

Any mention of special educational needs is conspicuous by its absence in the other four competences (Subject Knowledge, Subject Application, Class Management, Assessment and Recording of pupils' Progress). The most recent publication, at the time of writing, regarding secondary IIT is the 'Framework for the Assessment of Quality and Standards in Initial Teacher Training'. This was originally published in 1996 and came into immediate use for the academic year 1996/7. Did special needs receive a higher profile in this publication ?

The new framework

The 96/7 framework, which was jointly developed by the Office for Standards in Education (Ofsted) and the Teacher Training Agency (ITA) has four main aims:

- provide a means of assessing the quality of ITT and the standards achieved;
- provide evidence to inform decisions on accreditation and allocating student numbers;
- provide a means of identifying strengths and weaknesses in the training in order to help providers identify clear targets for improvement;
- contribute to raising standards of attainment in school by improving standards in IIT.

While one could quibble as to the order in which these aims are listed, one hopes they are of equal value. In order to achieve these aims the framework is broken into five areas:

Area C: teaching competence of students and NQTs;

Area T: quality of training and assessment of students

Area S: selection and quality of student intake

Area R: quality of staffing and learning resources

Area M: management and quality assurance issues

The first two of these areas are identified as the central areas which form the focus for the inspection process.

Area C is broken down into three cells:

Cl (Now STl): students' subject knowledge for teaching the relevant age-phase;

C2 (Now ST2): students' planning, teaching and classroom management skills;

C3 (Now ST3): students' assessment, recording and reporting of pupils' progress.

Each cell contains a set of criteria for evaluation in inspection and/or audit. Within the framework there are only two criteria which are linked specifically to teaching pupils with special educational needs:

C3b) identify the learning needs of pupils, including able pupils and those with special educational needs;

TIe) ensure that students understand the particular responsibilities of schools and teachers specified under the Education Reform Act 1988 and under the Code of practice for Special Educational Needs.

While these specifications represent a move forward in the recommended provision of **ITT** with respect to pupils with SEN, we will have to wait and see how they are interpreted in practice and how much emphasis is placed on them in the inspection process. Given the moves towards a more inclusive education and the fact that 1998 sees the twentieth anniversary of the publication of the Wamock report (1978) which recognised that an SEN component should be included in all **ITT** courses, the current lack of focus is perhaps surprising.

Fortunately there remain many examples of good practice in the area of **ITT** and pupils with SEN, despite the increasing pressures on **ITT** courses to deliver for, and to, a wide range of needs within a decreasing contact time. The reader is reminded of an article in an earlier edition of this journal (Pilkington and Singh, 1994) which exemplifies this point.

'The quart into a pint pot' argument against the content of the National Curriculum in schools now seems, following various revisions exemplified by that of Dearing, to be more pertinent to the content of **ITT** courses. Perhaps, now that he has looked at HE in general, Sir Ron could be persuaded to review the provision ofITT in England and Wales.

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