Researching Primary Trainees' Choice of Examples: Some early analysis of data

Ray Huntley

University of Gloucestershire

This paper reports on the early findings of a doctoral study exploring primary trainee teachers' choices of mathematical examples and the relationship between this and their mathematical subject knowledge. Through a combination of interview analyses and lesson plans gathered from the final school placement of one cohort of B.Ed trainees, some approaches appear to be commonly held by trainees about the nature and purpose of examples in the planning and teaching process. This paper presents the research design and some early outcomes from the data with a view to developing a second phase of data collection.

Keywords: Primary, Trainees, Examples

Introduction

The research reported here aims to examine the critical relationship between teachers' subject knowledge in mathematics and their use of learning examples, whether generated by the teacher or the pupils, in the classroom. The work evolved from the researcher's interest in these areas, following 18 years of primary school teaching and leadership followed by working on Initial Teacher Education programmes since 2002.

In 1992 concerns about teachers' subject knowledge were raised by Alexander et al, and later the curriculum for initial teacher training (ITT) included a strong focus on subject knowledge both for trainees' standards and providers requirements (DfEE 1998). In recent years evaluations of the National Numeracy Strategy (NNS) have maintained that teachers' subject knowledge is a weakness, and Strategy consultants and others have developed materials to address this. It is against this background of ongoing concern about subject knowledge that this research commenced, looking particularly at the level of mathematical subject knowledge in primary trainee teachers and how this influences their choice of examples.

Subject Knowledge Research

Shulman (1986) identified seven categories of teacher knowledge, three of which have been used as a focus in later studies - s*ubject matter knowledge, pedagogical content knowledge* and *curricular knowledge,* in particular those by Rowland et al. (2000), Rowland, Huckstep and Thwaites (2003), Ma (1999) and Askew et al. (1997), all of whom refer to mathematical knowledge and its use in teaching. The study by Rowland et al. conceptualised the Knowledge Quartet, and one element within that framework involved the choice of appropriate examples by trainees during their lessons.

The Study: Context and Methods

The study reported here began during the 2007/8 academic year in one ITT institution. Data was collected from the final year (3rd Year) cohort of the B.Ed programme and included the following range:

- School placement data in terms of year groups taught
- GCSE and A-level grades in mathematics prior to starting the course
- Mathematics interview test data – item scores and totals
- Mathematics module assessments from each year on the course
- Diagnostic Numeracy Test scores from early in the 1st Year
- Results from 'Confidence Counts', an additional mathematics support module
- Trainees' self-audit of subject knowledge for mathematics

The entire cohort totalled approximately 120 trainees, with some having joined in Year 2 or 3, others having repeated a year along the way. The trainees in the cohort were contacted by email to ask for volunteers to take part in the research, outlining the part they would play and any materials needed from them, as well as explaining the ethical aspects including the trainees' consent to using their data. This took place during the spring and summer of 2008, after the completion of final school placement and during a time when dissertations were being completed and many trainees were going through the process of applying for teaching posts for the following term. The cohort was asked to supply examples of mathematics lesson plans from their final placement, along with any resource sheets, either published or personally produced, that were used in school. Consent was also sought to interview a sample of trainees, which by virtue of the fact they were volunteering, would be a self-selected sample. Researcher expectations were not high due to the timing of the collection, and the number of trainees who provided lesson plans totalled 22 out of the cohort of around 120. From those who submitted lesson plans, only 10 were interviewed, the remainder being either unwilling or unavailable at the times required. The total number of plans submitted was 406, which provided a broad collection of examples to analyse, and these were spread across all primary year groups (including mixed-age classes) and all mathematics attainment targets. The breakdown of year groups and topics is included in tables later, along with information about the cohort from pre-course data and module results from during the course.

Results and Discussion

This paper reports some preliminary analysis of the data collected from Phase I in terms of obtaining an overview of the range and scope of data within the lesson plans and how the interview outcomes provide insight into the approaches trainees use when planning mathematics lessons and selecting examples.

One of the first concerns was whether the sample group who provided lesson plans, and from which the sub-sample who were interviewed was taken, were representative of the cohort as a whole. To gauge this, a comparison was made of the sample against the whole cohort for various test scores, including GCSE and AS/A level results, pre-entry interview test scores and yearly mathematics module results. These are summarised in the following table, with exam figures showing the percentage of the group attaining that result, and the test and module scores being averages:

Measure	Cohort (n=22)	Sample (n=108)
GCSE grade A*/A	19%	23%
GCSE grade B	33%	32%
GCSE grade C	48%	45%
A-level grades A-C	100% (3 trainees)	64.3% (14 trainees)
Interview test score	54.7%	56.1%
Year 1 module	52.0%	53.8%
Year 2 module	56.1%	57.4%
Year 3 module	56.6%	60.3%

Given that the data appears to show a close match between the cohort and the sample, there was some degree of confidence that any findings from the sample could be said to be representative of the entire cohort to some extent.

The mathematics lesson plans which were submitted by the sample group were sorted by year group and by mathematical topic to see which particular pupil groups and which areas of mathematics had the most representation in the data to be considered for analysis. Lesson plans for Year 4 occur most, with 79 separate lesson plans being provided, with 57 from Year 3 being the next highest. In terms of topic areas, it was no surprise that lessons on number featured prominently, with addition and subtraction lessons accounting for 59 of the 406 in total, and multiplication a further 49 lessons. Not far behind were lessons featuring fractions, decimals, percentage and ration, which made up 40 lessons. Combining these results allowed the selection of Year 4 addition and subtraction as the year and topic which was best represented, a total of 21 lessons coming from that overlap of year and topic. This, however, does not represent a substantial amount of data, and this will be addressed through further data collection in Phase II, and at that stage, some detailed analysis of the types of examples being selected by trainees can be carried out.

The data which has allowed the most profitable analysis from Phase I is the interview data, which although only came from 10 trainees, gave some interesting insights into the approaches taken to plan mathematics lessons and the consideration of examples. The interviews were semi-structured and the interview schedule was based around five key themes: planning, resources, choice of examples, theoretical frameworks and subject knowledge. Each interview lasted around 15 to 20 minutes, much shorter than anticipated, and this is another aspect which can be further addressed in Phase II by developing a more in-depth schedule which can probe trainee experience more fully within the themes selected.

The interview questions around the notion of planning for mathematics lessons began with an open question about how trainees approach the planning process, once they know which year group and topic they will be teaching. It was noticeable that most of the trainees responded by briefly considering the relevant learning objectives in the Primary National Strategy and then searching for ready-made activities on teachers' websites or in published books such as '100 Numeracy Lessons.' It was also evident that trainees disregarded suggested teaching approaches suggested in the PNS or the old NNS by saying they tried to find more interesting activities than those given. The following are a selection of the responses around this aspect: "I have a look through the NNS and see what they should know to get an idea where to pitch it, then I'll have a look around for ways of doing it more creatively," "I'd probably go on Primary Resources," and "I'd probably look in the framework to see what they say about it."

This led to a consideration of the types of resources used by the trainees to support their planning. It seems they are vary aware of a wide variety of published resources and websites which offer 'off the peg' lessons for the full range of topics at all levels, and such resources are often the regular diet for many trainees and indeed some teachers. Those which received most mentions amongst the interview sample were: 'Primary Resources', Abacus Evolve, '100 Numeracy Lessons' and 'Teachers' Resources Online.' It would appear that trainees are unwilling to invest time in considering planning lessons themselves, and prefer to rely largely on materials made by anonymous authors. This may change as they move through their teaching career beyond the NQT year, but possibly there is a danger of settling into a habit that could prevent effective planning skills ever developing.

The next theme in the interviews is that of 'choice of examples', and it became apparent from the comments made by the trainees that they do not really understand the notion or purpose of choosing examples other than for filling up a worksheet in terms of quantity rather than pedagogic quality. There was a general sense from the data that the sequence of examples on a worksheet or for the main teaching input should progress simply according to pupil ability, from easier to more difficult, but without considering the pedagogic reasons as to what makes an example easy or more difficult. The following comment is typical of the type received in response to discussions about choice of examples: "You've got to try to make sure you use examples to help support each level, work your questions up in terms of differentiation."

However, the range of comments included the following two responses, the first of which seems to demonstrate awareness that an example is only helpful if the child recognizes it as helpful in moving their understanding forward. If they cannot see the concept within the example, then they regard the example as something abstract and irrelevant: "You need to understand what actually helps each child, if it doesn't help them they just see it as an object." The last comment on this aspect demonstrates that for many trainees, the choice of example is based on their own competence and confidence, with them not wishing to have to deal with unexpected questions during their teaching, something referred to by Rowland, Huckstep and Thwaites (2003) as 'contingency': "I always make sure I choose examples that work." The penultimate theme identified in the interviews is that of theoretical frameworks, and given that the sample group of trainees had almost completed the full three year B.Ed programme, it was assumed that they would have been able to recall some key theories which inform mathematics teaching and learning. However, as the selected comments demonstrate, there was some degree of vagueness about their knowledge of such frameworks: "I learnt a lot about ELPS," (Liebeck 1984).

This comment refers to a model promoted strongly by the University of Gloucestershire, derived from Bruner's (1966) enactive, iconic and symbolic approach, but reformulated as 'experience, language, pictures and symbols'. It shows that some of the course input is found to be useful and relevant to some trainees. However, the next comments reveal some confusion between theoretical frameworks and school-based published teaching schemes, or textbooks which support trainees' subject knowledge development: "Abacus is quite good" and "Cockburn on subtraction…and Chinn…"

The remaining comments in this area show a lack of awareness of theoretical perspectives, and even antipathy towards them: "None that I can think of," "I don't think there are any," "I don't use them in planning," and "I've got a non-reading approach."

The final comments are drawn from discussion in the interviews about the trainees' perception of their own level of subject knowledge; although for this theme there was no distinction between subject matter knowledge, pedagogic content knowledge and any other category of mathematical knowledge needed for teaching. The comments often show that trainees are still rather anxious and lacking confidence, even a matter of weeks before they are due to start their NQT teaching year: "It's alright, but I learn fractions every time I teach them," "Maths is the thing I'm scared of teaching," and
"I should be better than I am because I did AS level, but the methods have changed."

Summary

The data collected so far in this study has provided an initial insight into the subject knowledge and choice of examples by one group of primary trainees. From a small, self-selected sample of final year B.Ed trainees, there is some evidence that awareness of theoretical influences is weak, subject knowledge continues to be a cause for anxiety and the process of selecting examples for teaching and learning mathematics is rather more random than pedagogically planned. The focus for Phase II of the research seems clear as a result of the data collected in Phase I, and will be on selecting a sample to form a multiple case study, with participants being scrutinised as they move towards final school placement, through planning and teaching mathematics, and finally to a period of reflection after the placement. From phase II it is anticipated that a conceptual framework can be constructed which can describe trainees approaches to choosing examples and support future trainees in that process.

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