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Curriculum Continuity in Mathematics:
a case study of the transition from primary to secondary school

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Despite the introduction of the National Curriculum, problems appear to remain with the continuity of experience pupils have when they transfer schools. Evidence from studies suggests that such problems may be related to differences in pedagogic approaches and curriculum emphasis between primary and secondary schools. This paper reports on a case study designed to compare the approaches used in the teaching and learning of mathematics in a secondary school and its feeder primaries. The study indicates that similarities and differences in approaches may be driven by different external influences.

Introduction

The effect on pupils of the transition from primary to secondary school has long been identified as an issue of concern. A number of studies have suggested that disaffection and under-achievement in secondary schooling may have their beginnings before and during transition, although there is evidence that any non-curricular problems associated with transfer, such as a detrimental effect on motivation, appear to be short-lived (Gorwood 1986, ILEA 1988). More lasting under-achievement appears to be associated with aspects of the nature of teaching and learning in the transfer years.

Improving continuity and progression was given as an important element of the rationale for the introduction of the National Curriculum in the UK (see, for example, NCC 1989). Yet the Dearing review of the National Curriculum revealed that, despite the prescribed definition of the content of school subjects and the information provided by national testing, there remains a "loss of momentum in pupils' progress between the end of Key Stage 2 and the beginning of Key Stage 3" (SCAA 1996 p2). There is evidence from Ofsted reports (Ofsted 1993a and 1993b) of this loss of momentum in mathematics, although such evidence has limitations as research data (Hegarty 1998).

Studies of continuity in some areas of the curriculum have been reported which indicate that there may be a range of factors that could impact on the quality of curriculum continuity, including differences in pedagogic approaches and curriculum

emphasis between primary and secondary schools. No study focusing on curriculum continuity seems to have been carried out in the case of school mathematics.

This paper reports some data from a case study designed to analyse aspects of curriculum continuity in the teaching and learning of mathematics between a specific secondary school mathematics department and its four principal feeder primary schools. Analysis suggests that, at the time of data collection (summer term 1998), there were both similarities and important differences in approaches to mathematics across the year 6 to year 7 transition, often, it seems, driven by different external influences. The consequences of such similarities and differences are discussed in the final section of this paper in the light of the impending introduction of the National Numeracy Strategy (DfEE 1998).

Research into Curriculum Continuity

As the School Curriculum and Assessment Authority (SCAA 1996 p4) admit, while the National Curriculum provides a basis for a common curriculum for all pupils, improvements in continuity "will not flow from these curriculum and assessment arrangements as a matter of course". SCAA, and its successor, the Qualifications and Curriculum Authority, have focused on the transfer and use of records of pupil attainment (SCAA 1996, QCA 1998), yet there is other evidence suggesting that teachers' knowledge of the teaching methods and curriculum emphasis across the primary-secondary transition are important influencing factors (HMI 1993 p8).

Given that there appear to be no recent empirical studies of curriculum continuity in mathematics, studies of curriculum continuity in other aspects of schooling informed the design of the research reported in this paper. Huggins and Knight (1997) investigated the case of the teaching and learning of history using a combination of questionnaires completed by children and interviews with teachers. With data from four secondary schools together with one of each school's feeder primaries, they found, in addition to organisational problems that impeded schools from liaising, that "differences in ideologies were implicated with different beliefs about standards and the nature of school history". The research of Williams and Jephcote (1993) into the teaching and learning of Economic and Industrial Understanding revealed a similar pattern of differences in definitions and teacher perceptions. Boniface (1990) studied the teaching and learning of physical education in a secondary school and its four

main feeder primaries. She found a range of inconsistencies and discontinuities, including wide variation in the time allocated to P.E. in the primary schools, and marked differences in the curriculum covered.

Methodology

A case-study approach was chosen for this study in order to gain some insight into issues of curriculum continuity in mathematics. A secondary school (not that of the first author) in an average-sized city in England was selected, together with its four main feeder primaries. Overall, the study was designed to provide data on the similarities and differences in approaches to teaching and learning mathematics by studying the pedagogic practice, the liaison activities, pupil views, and other influences that might impact on curriculum continuity in mathematics. A range of data collection methods were used, including curriculum analyses, observation, questionnaires, and interviews.

Findings

The findings in the tables below come primarily from questionnaires and interviews. Comparison data is provided from the results for England obtained during the Third International Mathematics and Science Study (Keys *et al*, 1997, and Keys *et al*, 1996; Harris and Henkhuzens, 1998, provides additional primary school data).

Table 1, below, shows that the primary schools surveyed claimed to devote more time to mathematics than the national average, while the secondary school seems not only to allow less time for mathematics than the national average, but less than half the time allotted in its feeder primaries.

School	Time Allocation per week
Primary School 1	5.25 hours
Primary School 2	6.33 hours
Primary School 3	4.5 hours
Primary School 4	5 hours
Primary school survey	4-5 hours
Secondary school	2.5 hours
Secondary school survey	3 hours

Table 1: Time Allocations per Week for Mathematics in Year 6 and Year 7

Table 2, below, shows that most of the feeder primary schools in this study had some flexibility in setting practices, a situation reflected in the national data. The secondary school was characterised by a lack of such flexibility.

School	Class organisation
Primary School 1	pupils setted by attainment
Primary School 2	some use of groups setted by attainment
Primary School 3	variety of grouping practices
Primary School 4	variety of grouping practices
Primary school survey	Pupils taught in attainment groups at times: 78% Pupils taught in mixed attainment groups at times: 49%
Secondary school	pupils setted by attainment
Secondary school survey	data not available, but setting likely to be the norm

Table 2: Class organisation for Mathematics in Year 6 and Year 7

School	Mathematics scheme
Primary School 1	*Nelson Mathematics*
Primary School 2	*Master Maths* scheme, and *Ginn*
Primary School 3	*Heinemann, New Curriculum* maths, *BEAM* and *SPMG*
Primary School 4	*Cambridge* maths, *Mental maths* and *Ginn*
Primary school survey	all schools use some scheme, *Cambridge* maths used by 43%
Secondary school	*Key Maths*
Secondary school survey	all schools use some scheme, *SMP* used by 48%

Table 3: Mathematics schemes used for Mathematics in Year 6 and Year 7

Table 3 illustrates the variety of mathematics schemes experienced by pupils across the four primary schools. A more detailed comparison of the schemes of work forms another component of the case study and is not reported here. Table 4, below, shows the variety of approaches to mathematics experienced by pupils in these primary schools. Some pupils, particularly those from primary schools 1 and 4 go on to experience a somewhat similar approach in the secondary school.

School	Teaching approach
Primary School 1	teacher centred with reinforcement and consolidation
Primary School 2	variety, including investigational, and teacher-led
Primary School 3	variety, including project work, and consolidation and practice
Primary School 4	predominantly consolidation and practice with some group work
Primary school survey	variety of practices
Secondary school	mostly consolidation and practice, some groupwork and discussion
Secondary school survey	predominantly exposition followed by pupils working individually

Table 4: Teaching approaches used for Mathematics in Year 6 and Year 7

Table 5, below, shows the variation in the approach to calculator use in the various schools. The secondary school seems to demand a somewhat different approach to that of some of its feeder primary schools

School	Always	Sometimes	Never
Primary School 1		Checking answers; Routine computation; Solving complex problems	
Primary School 2		Checking answers; Routine computation; Solving complex problems	
Primary School 3	Checking answers: Solving complex problems	Routine computation	
Primary School 4	Checking answers; Solving complex problems	Routine computation	
Primary school survey	11%	74%	15%
Secondary school		Checking answers; Solving complex problems	Routine computation
Secondary school survey	45%	55%	0%

Table 5: Reported use of Calculators in Mathematics in Year 6 and Year 7

Discussion

The modicum of findings reported above allows some comment to be made on the similarities and differences in the various schools. In terms of the time devoted to mathematics, some of the primary schools in this sample are able to allocate more than twice as much time as the secondary school. This alone may account for some of the "loss of momentum" identified by the Dearing review (SCAA 1996). Setting practices for mathematics vary across the various schools, with one primary school adopting a similar practice to the secondary school, while in others there is more variety. The National Numeracy Strategy (DfEE 1998) does not seem to be explicit about setting practices, stressing instead its aim to reduce the spread of attainment at age 11. The draft Numeracy Framework (NNP 1998), however, is explicit, stating that, as the range of attainment becomes less, "setting may then no longer be desirable or appropriate (p21). In contrast, Ofsted are currently promoting setting in primary schools (Ofsted 1999), despite a lack of supporting research evidence (Sukhnandan and Lee 1998).

The reliance on published schemes or textbooks, aimed squarely at either the primary or secondary market means a further change for pupils. The choice of pedagogic

approach adopted by the teachers in the various institutions is also a change, at least for some of the pupils in this study. Here the impact of the National Numeracy Strategy may be more marked, given the imposition of a set lesson structure. On the other hand, one of the primary schools, primary school 4, claimed to be already implementing the strategy, yet gave their predominant teaching approach as "consolidation and practice". This implies that various interpretations of the Numeracy Strategy may well occur.

The findings reported in this paper may support other research which has suggested that the form of teaching group organisation, the choice of pedagogic approach (even how it is described), the selection of teaching resources, and the policy with regard to calculators, may have at least some of their basis in different beliefs about the nature of the school mathematics and how it is best taught. Having said that, some differences in approach may result from disparate, and sometimes conflicting, external influences. The impact of such differences on pupil progress at the time of primary-secondary transition is not clear at present and is being studied in a proposed extension to this work.

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