BRITISH JOURNAL OF EDUCATIONAL STUDIES, ISSN 0007–1005
VOL. 49, NO. 1, MARCH 2001, PP 40–55

PARADIGM LOST? SUBJECT KNOWLEDGE, PRIMARY TEACHERS AND EDUCATION POLICY

by LOUISE POULSON, *University of Bath*

ABSTRACT: In Britain, numerous policies have attempted to strengthen the subject knowledge of primary teachers. This paper assesses the evidence base for applying research on subject knowledge to teachers in primary schools. It concludes by suggesting that researchers and policy-makers would do well to reconsider the current emphasis on subject knowledge in initial teacher education and professional development; and, instead, give a higher priority to developing our understanding of the relationship between tacit and formal knowledge, and of how teachers learn.

Keywords: Education policy, primary teachers, subject knowledge

1. INTRODUCTION

Of the many reforms and changes affecting primary education in Britain during the past decade, one of the most fundamental has been an attempt to reconstruct the nature of teachers' knowledge and, by implication, their professional expertise and identity. Although educational policy research has addressed many of the wider, structural issues – such as the marketisation of education, and changes in the funding, governance and management of schools – there has been much less attention paid to the impact of policies deliberately aiming to change the nature of teachers' knowledge and expertise. As teachers' knowledge has come to be accepted as one of the keys to improving educational practice, top-down reforms have ensured that the acquisition and development of specific subject knowledge is at the centre of provision for initial teacher training and professional development. A familiar justification has been that strong subject matter knowledge is needed to teach the core curriculum in primary schools. So far, there have been few explicit challenges to the ideological dominance of subject knowledge in the primary teacher's repertoire; or to conventional ways of conceptualising it. This paper presents such a challenge: it examines

how and why knowledge of subject matter and subject-specific pedagogy has come to have such a high profile on the research and policy agendas for primary education. It also assesses the extent to which evidence from a substantial body of empirical research on primary teachers' subject knowledge supports the direction of recent policies affecting teacher training and professional development in Britain. Finally, it considers how more inclusive definitions of teachers' knowledge and its construction might be achieved.

2. The Development of Teacher-Knowledge Research

Underpinning the promotion of primary teachers' knowledge of subject matter, and subject-specific pedagogy, is the assumption that teachers who know more teach better. Cochran Smith and Lytle (1999, p. 249) argue that this apparently simple idea has governed multiple attempts to improve education through policy, research and practice, by focusing on what teachers know, or need to know. From being identified in the mid-1980s as a missing paradigm in research on teaching (Shulman, 1986), studies of teachers' knowledge and thinking have come to be regarded as an important aspect of educational research. In the mid to late 1980s, this work represented a substantial shift of emphasis, away from specifying the kinds of teacher behaviour associated with high student achievement. Since publication of the third edition of the American Education Research Association's *Handbook on Teaching* (Wittrock, 1986), the field of teacher-knowledge research has grown to such an extent that Connolly *et al.* (1997, p. 666) describe it as having exploded.

One explanation put forward for its growth was that whilst a knowledge base for teaching was often promoted rhetorically, its character was rarely specified (Shulman, 1987, p. 4): thus researchers sought a scientific basis for teaching and teacher education (Korthagen and Lagerwerf, 1996). There were, however, a number of different approaches and models underpinning studies of teachers' knowledge and thinking. Fenstermacher (1994) identified two major strands: one which was largely concerned with teachers' formal knowledge – conceptualised as a knowledge base; and another which was concerned with teachers' experience-based, practical knowledge. Shulman (1987) argued the need for teachers to make explicit what they did, and their reasons for so doing, to students, other teachers and the wider community. He proposed that researchers should work with practitioners 'to develop codified representations of the practical pedagogical wisdom of able teachers' (ibid. p. 11). Thus a key aim of both strands of teacher-knowledge

research was to conceptualise adequately the often implicit beliefs, values and knowledge of teachers.

The work of Shulman and his associates at Stanford University (e.g. Shulman, 1986, 1987; Grossman *et al.*, 1989) was highly influential: particularly in conceptualising subject knowledge, and its pedagogical application. Despite its focus on the knowledge bases of subject-specialist secondary school teachers, this work influenced many British studies of primary teachers' knowledge in the late 1980s and early 1990s. The model of subject knowledge developed by the Stanford *Knowledge Growth in a Profession* project, and widely adopted in subsequent research, was based upon a structure of the disciplines approach, derived from Schwab (1978), among others. A basic proposition was that subjects were structured according to the ways in which their content was organised (substantive structures), or according to the accepted ways of adding to that knowledge (syntactic structures). The Stanford researchers were particularly interested in the processes by which teachers selected and represented aspects of a discipline to students; and how they developed subject-specific pedagogical knowledge. This they had termed *pedagogical content knowledge* and claimed it as a distinctive part of the teacher's knowledge base (Shulman, 1986). It was assumed that in order to develop pedagogical content knowledge, teachers already had a strong understanding of the content and accepted modes of enquiry within a discipline. Since then, much attention has been paid to elaborating pedagogical content knowledge; and, as Fenstermacher (1994, p. 14) observed, '... the concept has spawned an extensive set of research studies.'

As highlighted earlier, there was a particular interest in applying the Stanford model of knowledge bases to British primary school teachers, even though many of the specific assumptions underpinning the investigation of subject knowledge in the Stanford project were not necessarily applicable to them. Largely because of the class teacher system, subjects in primary schools were neither strongly framed nor classified, according to Bernstein's theoretical categories (e.g. Bernstein, 1975). Consequently, primary school teachers, particularly those qualifying before the late 1980s, were unlikely to have well-developed knowledge of a single academic discipline; and few of them would constitute their knowledge and professional identity in terms of a specific subject. Furthermore, the early British research which used the concepts of subject matter knowledge and pedagogical content knowledge appeared to overlook, or ignore, another important point: that Shulman and his associates had, themselves, questioned the applicability of their research on subject

knowledge to teachers in primary schools (Shulman, 1987; Wilson *et al.*, 1987; Grossman *et al.*, 1989). Shulman (1987, p. 4) emphasised that the empirical work in the Stanford studies had been conducted with secondary-school teachers; and whilst he believed that much of the emphasis to be found in that work, particularly on the centrality of subject content knowledge, held reasonably well for teachers in primary schools, he was 'reluctant to make that claim too boldly'. As he pointed out, the notion of subject knowledge and its pedagogical application was considerably more complex when a teacher had numerous subjects to deal with. However, in a later paper, the reservations were expressed more strongly by the Stanford researchers:

> Given the differences between the demands of preparing to teach one subject and preparing to teach five or six subjects ... the implications of this research for elementary school teaching should be drawn cautiously. (Grossman *et al.*, 1989, p. 28)

In spite of these cautions, a number of research studies attempted to identify the extent of primary teachers' subject knowledge, and in some cases the relationship between knowledge and classroom practice (e.g. Aubrey, 1997; Wragg *et al.*, 1989). During the same period, there were also several investigations of the role of subject knowledge in teacher education, including the ways in which experienced teachers drew upon knowledge of subject disciplines in the content of mentoring student-teachers (e.g. Edwards and Ogden, 1998; Furlong and Maynard, 1995; Maynard, 1997). This interest in investigating primary teachers' knowledge bases in Britain in the late 1980s and 1990s probably owed as much to the policy context as it did to a search for a scientific basis for teaching, or the development of a new paradigm in research on teachers and teaching – a point which will be discussed in more detail later in this paper.

3. Teaching What They do not Know? Research Evidence on Primary Teachers' Knowledge

Given the generalist academic background and training of many primary school teachers, it is unsurprising that a number of the earlier British studies of subject knowledge presented what Brown and her colleagues (Askew *et al.*, 1997b; Brown *et al.*, 1998) have identified as a deficit model of teachers' knowledge: highlighting what they appeared not to know and deducing that improving teachers' own subject knowledge would lead to better teaching. For example, Wragg, Bennett and Carre (1989) reported a survey of teachers in 400 primary schools in Great Britain, which found that many

seemed to have limited knowledge of some subject areas, and did not feel confident to teach them in the National Curriculum: science being identified as particularly problematic, followed by mathematics. A second study in the same research programme (Bennett and Carre, 1993) found trainee teachers' subject knowledge, across a range of subjects, to be limited when they were tested at the beginning and end of their training. Aubrey's (1997) study of early years teachers claimed that their knowledge of mathematics content was often not extensive. A conclusion drawn in much of this work was that these apparently low levels of subject knowledge were problematic: teachers could not teach what they did not know (Bennett, 1993); therefore subject knowledge in initial training, professional development and in-service courses should be enhanced and prioritised. These research findings lent support to education policies which were already moving in the direction of giving a higher profile to separate subjects in primary schools; and a stronger focus on subject study in primary teacher education.

However, more recent research on primary teachers' subject knowledge has begun to question the assumptions and conclusions of those earlier British studies. Brown and her colleagues (e.g. Brown *et al.*, 1998; Askew *et al.*, 1997a, 1997b) have been rather more circumspect about deficit models of teachers' knowledge, and argue that there is, in fact, little research evidence to support such conclusions. They (Askew *et al.*, 1997a) also highlight two other important issues: first, that ways of identifying, and quantifying, teachers' knowledge of a subject have been problematic; and, second, that the knowledge required to teach primary children effectively may not be the same as knowledge of the same subject needed at advanced secondary school, or degree level. Reporting on their own study of the knowledge, beliefs and practices of 90 primary teachers of numeracy, who were identified as effective in relation to pupil outcome measures, they suggested that a sound grasp of the content to be taught, along with the ability to represent this to pupils, and to make conceptual connections between different aspects of a topic or content – in short, what Shulman and others have referred to as pedagogical content knowledge – may be more important than detailed knowledge of subject matter itself. They also indicated that despite the concerns about weaknesses in teachers' mathematical and scientific knowledge, expressed in official reports from school inspections (e.g. OFSTED, 1994), in 84 lessons observed in their study, no teachers made significant mathematical errors. In only two lessons were there occasions when teachers were clearly limited by their knowledge. Askew *et al.* (1997a, p. 59) conclude that: 'It is

therefore clear that some teachers of younger children have real problems over subject knowledge, but it is not clear how much this affects their effectiveness'. And that (p. 64) although there were gaps in teachers' subject knowledge, these did not seem to be especially damaging or difficult to retrieve.

A parallel study of the knowledge, beliefs and practices of a sample of 225 teachers in England, identified as being effective in teaching literacy through the recommendation of primary phase inspectors and headteachers, and through the use of OFSTED and LEA data, and pupil outcome measures (Medwell *et al.*, 1998; Poulson *et al.*, forthcoming, 2001), also concluded that there was no clear relationship between teachers' explicit academic knowledge and their effectiveness in teaching literacy. This study found that academic qualifications in English, or a related subject, were not extensive among effective literacy teachers: only a minority of them had degrees in any discipline; most had qualified as generalist primary teachers with a Certificate in Education more than twenty years previously. A more detailed examination of the subject knowledge of a smaller sub-sample of teachers was also undertaken. This involved completion of a test on aspects of linguistic and literary content related to teaching literacy, including items on morphology, phonology, syntax and socio-linguistics. The results (reported in Medwell *et al.*, 1998) indicated that the effective teachers of literacy did not appear to have particularly high levels of knowledge of language structure and terminology; their results differed little from those of a comparison sample of teachers representing the full-range of effectiveness. However, the effective teachers performed much better on items which were contextualised in practical classroom situations – such as commenting on the errors and strategies in examples of children's reading and writing. Prior to doing the test, the researchers had observed lessons, and one of the most striking things noted was the many instances where teachers covered content competently and confidently in the classroom, but later struggled to answer items in the test on the same content. When concepts in language or literacy were decontextualised from classroom practice, and presented more formally, they found them much harder to identify.

One conclusion might be that these people appeared to be teaching what they did not know. However, analysis of observed lessons indicated that they were able to present content to pupils and make conceptual connections between different aspects of language and texts. Their knowledge was functional: they knew about, and taught the features of language *in use*, but had greater difficulty with language *as system*. As in the study of effective teachers of numeracy (Brown *et al.*,

1997), a model in which teachers' prior knowledge of subject matter and its structure was then transformed into pedagogical content knowledge to make it accessible to pupils appeared not to be applicable. Knowledge of content seemed to be pedagogically situated; even so, the teachers taught effective lessons and maintained higher than average pupil gains on standardised tests from year to year.

In relation to research on student teachers, Calderhead (1998) argued that even those with well-developed subject knowledge were found to draw upon the observed practices of the supervising teacher in their planning and teaching of that subject, rather than their own knowledge base. Maynard (1997) also outlined how two studies of primary student teachers and mentors in Wales (Maynard and Furlong, 1993; Furlong and Maynard, 1995) provided evidence of the low priority accorded to subject knowledge in planning, teaching and discussion of the content of lessons. Like Calderhead (1988), Furlong and Maynard found that even when students had sound subject knowledge, they did not draw upon it in their planning and teaching, but preferred to copy and adapt ideas suggested by their supervising teacher/mentor; or which they had found in resource books – or even remembered from their own schooling. They proposed that, without intervention, subject knowledge might be regarded by primary student teachers as neither particularly important for teaching, nor for pupils' learning. Interestingly, the teachers who were responsible for supervising and mentoring also had difficulty in articulating their own knowledge in generalisable terms, rather than in relation to the specific context of their classroom and pupils. They did not articulate how the activities they commonly taught related to understanding within and about subject areas. Furthermore, when asked to mentor students in specific aspects of subject knowledge, they initially voiced grave reservations about the appropriateness and relevance of doing this. Teachers' comments, reported in the Maynard and Furlong study (op. cit.), suggest that the relationship between their classroom teaching and planning, and the key ideas within a subject was not something to which they necessarily gave conscious thought on a day-to-day basis. One teacher questioned whether the knowledge was so embedded and implicit that it had become almost invisible, or whether it was actually known at all. However, that did not mean that they were unable to teach these aspects of a subject: rather that they did not think about their teaching in such terms, and did not regard abstract subject knowledge as particularly important for themselves, or for student teachers.

Edwards and Ogden (1998) also expressed doubts about the applicability to primary school teachers of the Stanford model of subject knowledge. Their study of experienced teachers mentoring students outlined how discussion of learning in a range of subjects tended to centre on descriptive accounts of pupils' actions during observed sessions. There was little evidence of mentors developing principles of practice about teaching from concrete experiences in which both students and mentors had participated (p. 745). Edwards and Ogden (1998, p. 737) argued that subject knowledge was not something merely to be applied in classrooms, or woven into activities. They identified the importance of examining not only the *what* of teacher knowledge, but also the *how* of its construction within communities of practice in primary schools. They also suggested that the lack of evidence to support understanding of how subject content might be transformed into activities which allow pupils to engage with the substance, ways of working and discourses of particular disciplines may lie in the socio-cultural roots of the community of practice of primary school teaching (ibid., p. 746).

The message apparent in all the studies outlined above is that subject knowledge, and its pedagogical transformation and articulation is, as Shulman and his colleagues predicted, much more complex in relation to primary school teachers than for single subject specialists in secondary schools. Furthermore, there seems to be little evidence of a clear relationship between a well-developed formal academic knowledge of particular subjects and effective teaching in the primary phase of schooling. Although claims for a distinctive knowledge base for teaching fitted well with policies in Britain and elsewhere that aimed to raise the profile of teaching and set standards of entry to the profession, a closer look at relevant research reveals a much more complex picture. It is one which calls into question the efficacy of recent policies for primary teacher training and professional development – particularly those emphasising the acquisition of formal subject knowledge. The promotion of primary teachers' knowledge of subject matter and subject-specific pedagogy, whilst appearing to be underpinned by research, has been driven as much by ideology as by empirical evidence. It is important to examine why this has come about.

4. The Education Policy Context and Teachers' Knowledge

In order to understand this apparent inconsistency better, it is necessary to examine the wider context of research on teaching and teachers in the late 1980s and 1990s, and its relationship to education

policy. The emergent field of research on teacher-knowledge and thinking was positioned at a historically critical time: one in which education was being subjected to considerable changes; and in which there was a substantial degree of policy convergence across a range of otherwise diverse national contexts. Examples of policy convergence include the marketisation of education; a focus on educational outcomes and performativity; scrutiny of the school and teacher-education curricula; and the reframing of professionalism and effectiveness in teaching in managerialist ways. In Britain and elsewhere, from the mid-1980s onwards, numerous reports and proposals aimed to revamp teacher education and professional development, establish standards of entry to the profession and raise the status of teaching (Mayes, 1998, p. 776). In the USA, there were the reports of the Carnegie Forum on Education (1986), Goodlad (1990a, b, c), and the Holmes Group (1986, 1990, 1995). In New Zealand there were reforms following the Picot and Sexton reports (Lauder and Hughes, 1999); whilst in Britain, legislation changed the organisation, funding and accountability of teacher education and instituted a national curriculum, which attempted to set out standards of knowledge and skills for beginning teachers (DFEE, 1998, Circular 4/98).

Many of the reforms of education in the past two decades have been underpinned by a fundamental shift in thinking about its purposes. As free market economic policies have come to dominate and, indeed, have become almost a political orthodoxy for governments in Britain, attention has been turned to education, which has gained an ever higher profile on policy and reform agendas. It has come to be regarded as the key to developing a high-skills workforce needed for the development of a knowledge based economy, considered necessary to sustain economic growth within global markets. However, this shift in thinking about the purpose of education has been accompanied by a highly conservative rhetoric which, to a large extent, has blamed progressive ideas and practices for a perceived failure of the maintained education system. In primary education, integrated, enquiry-based curricula, and child-centred approaches – regarded by many as central to progressive educational practice – have received much criticism from politicians, government advisers and the media. A common argument has been that such approaches led to badly managed classrooms and poor teaching. Solutions put forward have included a return to a clearly bounded, subject-based primary curriculum, teacher-centred pedagogy, a greater degree of formality in classroom organisation, and an increasing emphasis on external accountability and performativity.

One of the key policy texts promoting this ideology in Britain was a pamphlet authored by Alexander *et al. Curriculum and Organisation in Primary Schools* (DFEE, 1992) – popularly known as the 'Three Wise Men' report – which argued that integrated curricula, and cross-curricular topic work, needed to be reconsidered in the light of a subject-led national curriculum in England and Wales.

> Over the past few decades the progress of primary pupils has been hampered by the influence of highly questionable dogmas which have led to excessively complex classroom practices and devalued the place of subjects in the curriculum. (1. Para 3.1)

In emphasising the centrality of subject teaching in the primary curriculum, Alexander *et al.* also made a strong case for strengthening subject knowledge among primary teachers. The report made reference to research on teachers' knowledge which, the authors claimed, lent support to its arguments.

Interestingly, within the literature on teachers' knowledge, there has been little connection between the search for a scientific basis for teaching, and the wider structural issues shaping social and educational policies. With a few exceptions (e.g. Grossman and Stodolsky, 1994), it is rare to find cross-fertilisation between research on teachers' knowledge and other fields of enquiry relating to schools and teachers: for example, policy scholarship (Bowe *et al.*, 1992; Grace, 1995); the history and formation of school curriculum subjects and subject sub-cultures (Goodson *et al.*, 1998); the study of teaching as work (Nias, 1989; Menter *et al.*, 1997); or the social construction of teachers' professional identities and communities of practice (e.g. Grace, 1978; Lawn and Grace, 1987; Ozga and Lawn, 1981; Woods, 1997). One reason for this is that almost all the research on teachers' knowledge has had a psychological orientation: emphasising cognitive processes and largely taking the individual as the unit of analysis. A further point is that much of the work on teachers' tacit knowledge has emphasised the personal dimensions of teacher-thinking and knowing: particularly the notion of teachers' voice, accessed primarily through narratives and stories (e.g. Clandinin and Connelly, 1987; Elbaz, 1991). The metaphor of 'getting inside teachers' heads' (Feiman-Nemser and Flodden, 1986, p. 506) is indicative of this preoccupation. A strength of the approach is its emphasis on teachers' agency in constructing and reconstructing knowledge as part of their professional growth; a drawback is the scarcity of reference to the socio-cultural and historical contexts of teachers' knowledge, or to teaching as social practice. The metaphor implies a simple and direct relationship between

thought and language: that teachers' language acts as mirror, or conduit, for their thought, and merely reflects or conveys ideas which are assumed to lie within an individual's mind. This assumption largely ignores the complex and dialectical relationship between language and thought outlined in the work of Vygotsky (e.g. 1962). It also highlights a failure to acknowledge that language is a social institution: one which pervades all other social institutions and the social self (Volosinov, 1973, p. 13). An individual's use of language indicates not only *their* intentions, but also the instituted intentions of other speakers, both past and present. The products of communication – spoken and written – are living evidence of a continuing social process, into which individuals are born and within which they are shaped, but to which they also actively contribute. Volosinov argued that this process constitutes, at the same time, both socialisation and individuation.

Feldman (1997, pp. 759–62) suggests that although some researchers have begun to explore the socio-cultural nature of teachers' knowledge, much of the work in this field – particularly the strand concerned with formal knowledge, or knowledge bases (Fenstermacher, 1994), is underpinned by a computational model of the mind, highlighted by Bruner (1990), among others. According to this model, knowledge is seen as something to be accreted, stored, and then transmitted to others. Whilst there have been powerful challenges to the model, highlighting the situated nature of cognition and learning in social and cultural practice (e.g. Lave and Wenger, 1991), few studies concerned with teachers' knowledge bases, and their cognitive processes, have examined the structure of the disciplines approach critically, considering its development as a powerful ideology (Cherryholmes, 1987). Instead, it is often assumed that all disciplines have clear syntactic and semantic structures, and that subjects in the school curriculum can be equated with disciplines. In many respects, this represents a more restricted conceptualisation of knowledge, and its organisation and structure within disciplines, than that found in Schwab's own writing. For example, Schwab (1978) maintained that the structure of disciplines was not fixed, and that within some disciplines there were numerous ways of organising and structuring knowledge.

A further issue, identified by Young (1998), is the failure to distinguish between what are generally regarded as fundamental forms of knowledge and school curriculum subjects (Hirst, 1974). The notion of fundamental and relatively unchanging forms of knowledge and understanding which shape people's experience and understanding of the world can be traced back to Kant, and beyond;

school subjects, as Hirst recognised, are socially-constructed ways of organising knowledge (Young, 1998, p. 12). Furthermore, the nature of school subjects may change not only across time, but also according to the particular context in which that subject is taught, and the values and assumptions of those who teach it. To a large extent, an unproblematised conception of knowledge has been accepted by researchers, and imposed by policy-makers keen to identify 'what works' in education. But, in a review of research on numeracy teaching, Brown *et al.* (1998) caution against over-hasty and selective conclusions being drawn from research in order to support particular policies: 'The complexity of the findings and of the possible interpretations suggests that ministerial desires for simply telling "what works" are unrealistic' (p. 378).

The emphasis on formal knowledge, and top-down policies prescribing in detail the knowledge bases and competencies to be acquired by teachers in primary schools has resulted in tacit knowledge, and its relationship to formal knowledge, being largely ignored. However, those aspects of primary teachers' knowledge which are context-specific – situated in, and deriving from, the social and cultural practices of the school and classroom, and the inter-subjectivity between teacher and pupils – are equally important in understanding how to improve practice. Cochran-Smith and Lytle (1999, p. 291) suggest that it is possible, and indeed useful, to talk about knowledge of teaching in ways that break down the traditional distinction and polarisation between formal and practical knowledge. Indeed, Castells (1996, p. 159) provides a useful comparative example from industrial production, where the strong relationship between tacit, practical knowledge and formal knowledge in the work-place was an important factor in explaining the success of some Japanese companies in the post-war period. But, he points out, this is something largely overlooked by Western management experts. The 'knowledge creating company' (Nonaka, 1991, quoted in Castells, 1996, pp. 159–60) is based on an organisational interaction between explicit and tacit knowledge. Nonaka argues that much of the knowledge accumulated in the firm is constructed from experience and cannot be communicated by workers under excessively formalised management procedures. However, sources of innovation multiply when organisations are able to establish bridges to transfer tacit into explicit knowledge, explicit into tacit, tacit into tacit and explicit into explicit. Nonaka also suggests that when this happens not only is workers' experience communicated and amplified to increase the formal body of knowledge, but also that knowledge generated in the outside world can be incorporated into the tacit knowledge of workers, thus enabling them

to work out their own uses and to improve on procedures. The parallel with teachers' knowledge is easy to draw, yet the example reminds us how damaging, in the longer term, may be the consequences of the current obsession with teachers' formal knowledge, and with controlling what and how teachers learn. It also highlights how such policies may, in fact, serve to undermine some of the aims which they were intended to achieve. It is possible, Ball suggests (1999), that as teachers' knowledge is reframed – and teachers themselves reformed – that the outcome may be rather different from that anticipated.

One particular cause for concern in the current political and policy climate is the dearth of opportunities for teachers to identify and communicate tacit knowledge, and make connections between formal and tacit knowledge: thus constructing a stronger, and ultimately more effective basis for improving classroom practice. But this would require a greater degree of trust of teachers, and freedom for them to learn in ways which may not always fit neatly with government agendas for education. Many of the original intentions of researchers seeking the 'missing paradigm' of research on teachers appear to have been forgotten, or lost: in particular, the notion that researchers and practitioners should work towards developing '... codified representations of the practical pedagogical wisdom of able teachers' (Shulman, 1987, p. 4). Paradoxically, whilst there has been enormous interest in teachers' subject knowledge, remarkably little attention has been paid to their *learning*. Both Moje and Wade (1997) and Wilson and Berne (1999) argue that opportunities for teachers to learn, from their classroom practice, in school, and in the wider professional context have often been 'happenstance, random and unpredictable' (Wilson and Berne, 1999, p. 174); and, furthermore, that we have very little sense of what exactly it is that teachers learn; how learning takes place; or its relationship to teachers' communities of practice. Instead of highlighting, and attempting to remedy, apparent deficits in primary teachers' subject knowledge, the educational research and policy agenda for the twenty-first century would do well to include investigation of teachers' learning in both formal and informal contexts. There is still much to be learned about the knowledge which successful primary teachers do possess; about the conditions and circumstances in which teachers' knowledge has been generated and developed throughout their careers; about the relationship between knowledge, values and classroom practice; and about the ways in which teachers can be encouraged to articulate and develop their knowledge and, in the process, making connections between the individual/personal and the wider social and cultural dimensions of teaching.

5. References

ALEXANDER, R., ROSE, J. and WOODHEAD, C. (1992) *Curriculum Organisation and Classroom Practice in Primary Schools* (London, Her Majesty's Stationery Office).

ASKEW, M., BROWN, M., RHODES, V., WILIAM, D. and JOHNSON, D. (1997a) *Effective Teachers of Numeracy* (London, King's College, University of London).

ASKEW, M., BROWN, M., RHODES, V., WILIAM, D. and JOHNSON, D. (1997b) The contribution of professional development to effectiveness in the teaching of numeracy, *Teacher Development*, 1 (3), 335–356.

AUBREY, C. (1997) *Mathematics Teaching in the Early Years: An Investigation of Teachers' Subject Knowledge* (London, Falmer).

BALL, S.J. (1999) Global trends in educational reform and the struggle for the soul of the teacher. Paper presented at British Education Research Association Annual Conference, University of Sussex, September 1999.

BENNETT, N. and CARRE, C. (Eds) (1993) *Learning to Teach* (London, Routledge).

BENNETT, N. (1993) Knowledge bases for learning to teach. In N. BENNETT and C. CARRE (Eds) *Learning to Teach* (London, Routledge).

BERNSTEIN, B. (1975) *Class, Codes and Control* (2nd edition) (London, Routledge and Kegan Paul).

BOWE, R., BALL, S.J., GOLD, A. (1992) *Reforming Education and Changing Schools: Case Studies in Policy Sociology* (London, Routledge).

BROWN, M., ASKEW, M., BAKER, D., DENVIR, H., MILLETT, A. (1998) Is the national numeracy strategy research-based? *British Journal of Educational Studies*, 46 (4), 362–385.

BRUNER, J. (1990) *Acts of Meaning* (Cambridge, Mass., Harvard University Press).

CALDERHEAD, J. (1988) The development of knowledge structures in learning to teach. In J. CALDERHEAD (ed.) *Teachers' Professional Learning* (Basingstoke, Falmer).

CARNEGIE FORUM ON EDUCATION (1986) *A Nation Prepared: Teachers for the Twenty-first Century* (New York, Carnegie Forum on Education).

CASTELLS, M. (1996) *The Rise of the Network Society* (Oxford, Blackwell).

CHERRYHOLMES, C. (1987) A social project for curriculum: post-structural perspectives, *Journal of Curriculum Studies*, 19 (4), 295–316.

CLANDININ, D.J. and CONNELLY, F.M. (1987) Teachers' personal knowledge: what counts as personal in studies of the personal? *Journal of Curriculum Studies*, 19 (6), 487–500.

COCHRAN-SMITH, M. and LYTLE, S. (1999) Relationships of knowledge and practice: teachers learning in communities, *Review of Research in Education* A. IRAN-NEJUD and D. P. PEARSON (eds) (Washington, D.C., American Education Research Association).

CONNOLLY, F.M., CLANDININ, D.J. and HE, M.F. (1997) Teachers' personal practical knowledge and the professional knowledge landscape, *Teaching and Teacher Education*, 13 (7), 665–674.

EDWARDS, A. and OGDEN, L. (1998) Constructing curriculum subject knowledge in primary school teacher training, *Teaching and Teacher Education*, 14 (7), 735–747.

ELBAZ, F. (1991) Research on teachers' knowledge: the evolution of a discourse, *Journal of Curriculum Studies*, 23 (1), 1–20.

FEIMAN-NEMSER, S. and FLODEN, R.E. (1986) The cultures of teaching. In M. WITTROCK (ed.) *Handbook of Research on Teaching* (3rd edition), 505–526 (New York, Macmillan).

FELDMAN, A. (1997) Varieties of wisdom in the practice of teachers, *Teaching and Teacher Education*, 13 (7), 757–774.

FENSTERMACHER, G.D. (1994) The knower and the known: the nature of knowledge in research on teaching, *Review of Research in Education*, 20, 3–56. L. DARLING-HAMMOND (ed.) (Washington, D.C., American Education Research Association).

FURLONG, J. and MAYNARD, T. (1995) *Mentoring Student Teachers: The Growth of Professional Knowledge* (London, Routledge).

GOODLAD, J. (1990a) *The Moral Dimension of Teaching* (San Francisco, Jossey-Bass).

GOODLAD, J. (1990b) *Places Where Teachers Are Taught* (San Francisco, Jossey-Bass).

GOODLAD, J. (1990c) *Teachers For Our Nation's Schools* (San Francisco, Jossey-Bass).

GOODSON, I., ANSTEAD, C.J. and MARSHALL MANGAN, J. (1998) *Subject Knowledge: Readings for the Study of School Subjects* (London, Falmer Press).

GRACE, G. (1978) *Teaches, Ideology and Control: A Study in Urban Education* (London, Routledge and Kegan Paul).

GRACE, G. (1995) *School Leadership Beyond Education Management: An Essay in Policy Scholarship* (London, Falmer Press).

GROSSMAN, P.L., WILSON, S.M. and SHULMAN, L.E. (1989) Teachers of substance: subject matter knowledge for teaching. In M. C. REYNOLDS (ed.) *Knowledge Base for the Beginning Teacher* (New York, Pergamon).

GROSSMAN, P.L., and STODOLSKY, S.S. (1994) Considerations of content and the circumstances of secondary school teaching, *Review of Research in Education*, 20, 179–22. L. DARLING-HAMMOND (ed.) (Washington, D.C., American Education Research Association).

HIRST, P.H. (1974) *Knowledge and the Curriculum: A Collection of Philosophical Papers* (London, Routledge and Kegan Paul).

HOLMES GROUP (1986) *Tomorrow's Teachers: A Report of the Holmes Group* (East Lansing, Michigan, the Holmes Group).

HOLMES GROUP (1990) *Tomorrow's Schools: Principles for the Design of Professional Development: a report of the Holmes Group* (East Lansing, Michigan, the Holmes Group).

HOLMES GROUP (1995) *Tomorrow's Schools of Education: A Report from the Holmes Group* (East Lansing, Michigan, the Holmes Group).

KORTHAGEN, F. and LAGERWERF, B. (1996) Reframing the relationship between teacher thinking and teacher behaviour: levels in learning about teaching, *Teachers and Teaching*, 2 (2), 161–190.

LAUDER, H. and HUGHES, D. (1999) *Trading in Futures: Why Markets in Education Don't Work* (Buckingham, Open University Press).

LAVE, J. and WENGER, E. (1991) *Situated Learning: Legitimate Peripheral Participation* (New York, Cambridge University Press).

LAWN, M. and GRACE, G., (eds) (1987) *Teachers: The Culture and Politics of Work* (Basingstoke, Falmer Press).

MAYES, C. (1998) The Holmes Report: perils and possibilities. *Teaching and Teacher Education*, 14 (8), 775–792.

MAYNARD, T. and FURLONG, J. (1993) Learning to teach and models of mentoring. In D. McINTYRE and H. HAGGER *Mentoring Perspectives on School-based Teacher Education* (London, Kogan Page).

MAYNARD, T. (1997) The limits of mentoring: the contribution of the Higher Education tutor to primary students school-based learning. In J. FURLONG, J. and R. SMITH (eds) *The Role of Higher Education in Initial Teacher Training*, 101–118 (London, Kogan Page).

MEDWELL, J., WRAY, D., POULSON, L. and FOX, R. (1998) *Effective Teachers of Literacy: Final Report on a Research Project* (Exeter, University of Exeter).

MENTER, I., MUSCHAMP, Y., NICHOLLS, P., OZGA, J. and POLLARD, A. (1997) *Work and Identity in the Primary School: a Post-Fordist Analysis* (Buckingham, Open University Press).

MOJE, E.B. and WADE, S.E. (1997) What case discussions reveal about teacher thinking, *Teaching and Teacher Education*, 13 (7), 691–712.

NIAS, J. (1989) *Primary Teachers Talking: A Study of Teaching as Work* (London, Routledge).

OFSTED (1994) *Science and Mathematics in Schools: A Review* (London, Her Majesty's Stationery Office).

OZGA. J. and LAWN, M. (1981) *Teachers, Professionalism and Class: A Study of Organised Teachers* (Basingstoke, Falmer Press).

POULSON, L., AVRAMIDIS, E., FOX, R., MEDWELL, J. and WRAY, D. (Forthcoming, 2001) The theoretical beliefs of effective teachers of literacy in primary school: an exploratory study of orientations to reading and writing, *Research Papers in Education.*

SCHWAB, J.J. (1978) *Science, Curriculum and Liberal Education* I. WESTBURY and N.J. WILKOF (eds) (Chicago, University of Chicago Press).

SHULMAN, L.S. (1986) Those who understand: knowledge growth in teaching, *Educational Researcher*, 15 (2), 4–14.

SHULMAN, L.S. (1987) Knowledge and teaching: foundations of the new reform, *Harvard Educational Review*, 57 (1), 1–22.

VOLOSINOV, V.N. (1973) *Marxism and the Philosophy of Language* (New York, Seminar Press).

VYGOTSKY, L.S. (1962) *Thought and Language* (Cambridge, Mass., MIT Press).

WILSON, S.M., SHULMAN, L.S. and RICHERT, A.E. (1987) 150 Different ways of knowing: representations of knowledge in teaching. In J. CALDERHEAD (ed.) *Exploring Teachers' Thinking*, 104–124 (London, Cassell).

WILSON, S.M. and BERNE, J. (1999) Teacher learning and the acquisition of professional knowledge: an examination of research on contemporary professional development, *Review of Research in Education*, 24. A. IRAN-NEJUD and D.P. PEARSON (eds) (Washington, D.C., American Education Research Association).

WITTROCK, M.C. (1986) *Handbook of Research on Teaching* (3rd edition) (New York, Macmillan).

WOODS, P. (1997) *Restructuring Schools, Reconstructing Teachers: Responding to Change in the Primary School* (Buckingham, Open University Press).

WRAGG, E.C., BENNETT, S.N., and CARRE, C. (1989) Primary teachers and the national curriculum, *Research Papers in Education*, 4 (1), 17–45.

YOUNG, M.D.F. (1998) *Curriculum of the Future. From the New Sociology of Education to a Critical Theory of Learning* (London, Falmer Press).

Correspondence
Louise Poulson
Department of Education
University of Bath
Claverton Down
Bath BA2 7AY