Re-Imagining Opportunities for Primary Teachers' Subject Knowledge Development on School-Based Teacher Education Courses.

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Abstract
The landscape of teacher education is undergoing significant change in many countries and this is often associated with a move towards greater school involvement in the preparation of teachers. One aspect of teaching expertise that is particularly challenging for primary student teachers is the development of subject knowledge across a wide range of subject areas. Subject knowledge for teaching is multi-faceted and is itself linked to broader questions about curriculum and the content that should be taught. It is timely, therefore, to consider how subject knowledge development might be reconceived in a school setting and how university and school staff might work in new ways with student teachers to this end. Communities of practice theory is employed as a framework for analysing the learning environment and evaluating these future possibilities. It is argued that collaboration with peers, with their mentoring teachers and with a wider professional community is an under-exploited way of integrating facets of subject knowledge: giving this time and status through structured activities might be a particularly fruitful form of hybrid working in situ. The paper concludes by proposing four principles to underpin this sort of practice.
Keywords: *Teacher knowledge**,** Subject knowledge**,** Teacher education**,** Professional knowledge**,** Communities of Practice*

1.0 INTRODUCTION

This paper is an attempt to reconcile two current developments with relevance for teacher preparation. One is the renewed interest in the knowledge content of school curricula (Young, 2013; Baker, 2015) at a time of government interest worldwide in comparative international tests. Such comparisons tend to draw attention to easily measurable aspects of pupil performance, leading to short term 'fixes' at national level (Hogan, 2016). For example, in the English context, current government policy is signalled by a white paper referring to a knowledge-based curriculum as 'the cornerstone of an excellent, academically rich education' (DfE, 2016a, p.20).

Meanwhile, notwithstanding the lack of evidence linking teachers' subject mastery with pupil outcomes (Education Datalab / FFT, 2015), a recent review of teacher education (DfE, 2015) highlights subject knowledge, including subject-specific pedagogy, as a top priority for the sector. Meanwhile, at primary level, it is telling that the latest National Curriculum (DfE, 2013) emphasises discrete subjects and higher age-related expectations, particularly in terms of arithmetic and grammar and that plans have been announced for a statutory times tables test (DfE, 2016b). While, in these different ways, subject knowledge is foregrounded, a simultaneous development is a move towards school-based teacher preparation in many countries (Ellis, 2010; Zeichner, 2010). This shift challenges the traditional view of the university as provider of educational 'content' for teachers and places new demands upon professionals within school. My intention in exploring these two strands is to come to some form of synthesis that offers a framework of principles for a new set of practices that might be explored and enacted by student teachers, university tutors and mentors in school.

The subject knowledge required by teachers has been extensively explored and modelled both in terms of its nature and structure (e.g. Shulman, 1987; Gess-Newsome 1999) and its relationship to teachers' professional status (Ellis, 2007b). Within primary education more specifically, the problem of developing adequate subject knowledge across a broad curriculum has long been seen as particularly acute. Alexander (2010) is among those who have noted the challenge for the generalist class teacher, while Eaude (2011) also makes the case for connections across the curriculum and a focus on the child as well as the subject. While much of the subject knowledge debate has been played out within a secondary education context, one aim of this paper is therefore to examine the issues from a primary perspective.

These perennial issues now exist against the backdrop of a changing landscape of Initial Teacher Education (ITE). In some quarters moves towards school-based learning have been seen as a threat to teachers' professional status. As far back as two decades ago, Hoyle & John (1995) characterised this shift as a deliberate threat to the knowledge base of the teaching profession and concerns about the quality of training have also been expressed (e.g. Hodgson, 2014). Meanwhile, the survival of the university as an integral part of ITE in the future has also been called into question (Furlong, 2013). However, alongside these voices, there are also those who see in school-based ITE possibilities for new and productive forms of learning. Hagger & McIntyre (2006) have argued for this particularly

strongly but, by their own admission, refrain from exploring subject knowledge development as part of their vision for a school-based ITE curriculum.

As with many aspects of teacher expertise, there is a distinct possibility that subject knowledge priorities may be understood differently by school-based teacher educators; Brown, Rowley and Smith (2016) warn of a school focus on immediate classroom practice and centralised guidance, for example. Considering this issue more specifically, therefore, Van Driel & Berry (2010) are among those calling for the examination, analysis and modelling of aspects of subject knowledge in school as well as at university and Ellis (2007a) puts forward some valuable principles to underpin future practices. The second aim of this paper, therefore, is to build on this work by considering how these might be enacted in the primary school setting. As a way of making sense of the possibilities for learning offered in the school setting, this article uses the ideas associated with communities of practice (Lave & Wenger, 1991; Wenger, 1998), not as a template for practice, but as a theoretical lens. Though the specific context is an English one, these ideas have wider significance, due in no small part to the 'policy borrowing' among English-speaking countries identified by Furlong (2013, p.6).

2.0 LITERATURE REVIEW
2.1 The Nature of Knowledge in Schools
To a great extent, the subject knowledge required by a teacher will stem from the content to be taught and England, in common with many countries, has for some time had a national curriculum. While the level of prescription in the current iteration (DfE, 2013) for the 'core' subjects of English, Mathematics and Science has inevitably led to lively debate, the English curriculum is nevertheless one that dictates broad content rather than pedagogical approach. With student teachers embedded to a greater extent in specific school settings, early encounters with the curriculum may increasingly be mediated through a school's particular context and learners, rather than in terms of universal principles. As suggested by Moore (2012), recognition of the diversity of learners' communities, cultural reference points and prior experiences are of great importance, as is the challenging of assumptions. Indeed, this holistic, learner-oriented view may be one distinct advantage of school-based teacher education. However, in terms of curriculum, this may also exacerbate a possible tension identified in the recent work of Michael Young and colleagues (Young, 2013; Young & Lambert, 2014) on 'powerful knowledge'.

Young's (2013) argument for the teaching of 'powerful knowledge' rejects a curriculum skewed towards meaningful content, rooted in pupils' personal experiences. This, he suggests, is an impoverishing view of education. While some have seen a curriculum centred on pupils' lives and interests as an antidote to a limited 'pedagogy of poverty' (Haberman, 1991), Young's form of emancipation is about entitlement and access to the best current knowledge in a field, starting 'not from the student as learner but from a student's entitlement or access to knowledge' (Young, 2013, p. 107). From this perspective, schooling must go beyond the everyday: 'powerful knowledge' is specialised in its academic origins and clearly differentiated from prior knowledge based on common sense or real world experiences. Although simultaneously rejecting exclusive and static forms of 'given' knowledge as another undesirable position, this is a perspective that raises interesting questions at a time of moves towards highly situated forms of student teacher learning.

Young's (2013) argument about boundaries (albeit negotiable) between disciplines and subjects is strongly based on secondary schooling. A 'knowledge turn', or re-instatement of disciplinary knowledge, at a time of government commitment to a curriculum in England organised around discrete subjects, is relatively easy to envisage at a secondary level. It has been welcomed, for example, within Geography (Mitchell & Lambert, 2015) and History (Counsell, 2014), but the situation in the primary sector is less clear-cut and may present distinctive challenges. Catling & Martin (2011) offer a critique from a primary Geography perspective, making a case for children's own knowledge having equal status to academic knowledge. However, this is not a simple dichotomy: Young does in fact value links to pupils' experiences but makes a clear distinction between this as a useful *pedagogical strategy* and the substantive curriculum content. What is perhaps more specifically a primary school issue is that defining 'powerful knowledge' across a wide-ranging primary curriculum and among non-specialist practitioners may be especially difficult. One dimension of this is the primary practitioner's need to recognise connections between subjects. While the published English curriculum (DfE, 2013) superficially corresponds to Bernstein's (1971) notion of the 'collection curriculum', its enacted form may also partly resemble his 'integrated' model. As Bernstein points out, successful integration of this kind places great demands on teachers' knowledge both at individual and collective levels. The nature of this knowledge and particularly the distinction between knowledge of a subject *per se* and knowledge of pedagogy will be explored in the next section.

2.2 Subject Knowledge for Teaching

A common starting point for considering the nature of teachers' subject knowledge is the taxonomy proposed by Shulman (1986; 1987). In attempting to represent the multi-faceted nature of this knowledge, Shulman initially proposed that this comprised subject matter knowledge, pedagogical content knowledge and curricular knowledge (Shulman, 1986), later adding four other components of an overall knowledge base for teaching (Shulman, 1987). Within each of these domains, knowledge may take various forms: propositional, case or strategic, the latter emphasising the role of teacher judgement, a theme later taken up and extended in his explorations of the 'wisdom of practice' (Shulman, 2004). Of Shulman's domains it is pedagogical content knowledge (PCK) that has been of particular interest, defined as: *'the particular form of content knowledge that embodies the aspects of content most germane to its teachability'* (Shulman, 2004, p. 9). PCK remains open to a variety of interpretations, however, and Van Driel & Berry (2010) are among those noting uncertainties around the concept. An important question, for example, is whether this is merely the *integration* of other forms of knowledge, including subject matter and pedagogy or the *transformation* of those other sources into a distinctly new form of knowledge (Gess-Newsome, 1999). The idea of this being about transformation is used in many accounts of subject knowledge for teaching (Rowland, 2013; Van Driel & Berry, 2010) and this interpretation hints at one of the reasons why PCK may be as attractive as a potential entity. As Ellis (2007b) points out, a perception of teachers having privileged access to a special category of knowledge is closely bound up with claims relating to professional status and autonomy and Shulman himself includes scholarly understanding as one of six essential characteristics of any profession (Shulman, 2004).

However, this paper's focus on primary teachers highlights the difficulty of a teacher developing specialist PCK across an entire curriculum. At this point, a return to Shulman's (1986) original thoughts may be useful. His domain of subject matter knowledge goes beyond substantive knowledge and draws on ideas proposed by Schwab (1964) which additionally include knowledge of a subject's *structure* (in terms of organisation and relationships with other subjects) and *syntax* (or rules and conventions). This is reminiscent of Bruner's (1977) emphasis on the fundamental principles and structure of a subject, as opposed to isolated facts or techniques, as the basis for transfer of training. While Bruner had in mind pupil learning, I would conjecture that prioritising a primary student teacher's ability to discern the workings of a subject in this syntactic sense might be particularly powerful as a focus within a condensed, non-specialist and school-based form of training. Helping student teachers to navigate such a framework might provide the basis for subsequent content development more independently; indeed Anderson & Clark (2012), in a study of New Zealand primary teachers, suggest that syntactic knowledge, while frequently under-developed, can form a strong foundation for PCK development. Their conclusion, significantly, is that gaps in knowledge will persist if subject knowledge is worked on independently and without mediation; real development requires genuine participation in a subject-oriented community, a theme I will return to later.

Looking beyond these considerations, the very notion of PCK raises some important issues. McEwan & Bull (1991) argue that seeing scholarly knowledge as detached from a pedagogic element suggests an objectivist, fixed view. Similarly, the idea of transformation into a single new category has also been seen as marking out Shulman's PCK as a form of universal, normative knowledge (Fenstermacher, 1994; Gess-Newsome, 1999). Significantly, however, in view of the interest here in school-based learning, Van Driel & Berry (2010) challenge this normative view and reassert contextual and personal factors, describing PCK as: *'a complex interplay between knowledge of subject matter, teaching and learning and context and the way in which teachers combine and use this knowledge to express their expertise.'* (p. 659). This opening for contextual factors is also acknowledged in Ellis' (2007b) dynamic model of subject knowledge development based on the inter-relationships of culture, practice and agents. In arguing for the 'active participatory nature of subjects' (p.450), he rejects an objectivist viewpoint in favour of a contextual epistemology. Superficially, this seems difficult to reconcile with Young's (2013) stand against a curriculum based on the everyday and the 'real world'. However, perhaps it is possible to envisage a form of 'powerful knowledge' that, while not rooted in pupils' prior experiences, is nevertheless locally defined to a certain extent.

Ellis (2007b) also takes issue with the view of subject knowledge development as an individual enterprise. Subject knowledge, he claims, exists as much *among* participants as within them. Two aspects of Ellis' arguments are of particular interest given the aims of this paper. Firstly, there is his reference to the literature on communities of practice (Lave & Wenger, 1991; Wenger, 1998). Ellis's thinking, particularly in its focus on cultural identity and the practices within subjects is geared towards secondary teaching and begs the question whether a comparable community exists for the novice primary teacher. Nevertheless, in an era of school-based learning, this is a possibility that merits exploration later in this paper. Secondly, Ellis calls for closer teacher educator involvement with the school settings used for training and with those working in them and this seems especially relevant. All of this leads me to consider how, specifically, we might seek to 'expose, to understand and to transform subject knowledge' (Ellis, 2007b,

p.459) within school, as he envisages. New developments in ITE more generally might facilitate this form of collaboration and so it is this to which I now turn.

2.3 Looking Afresh at Subject Knowledge in School

Recent developments in the preparation of teachers have seen an increasing emphasis placed on training in school. For Hagger & McInytre (2006), this is a logical response to a failure of the theory into practice model. Arguing for teachers' craft knowledge having a higher status, they suggest that teaching is so context-bound that it can only be understood in a situated, case-by-case manner, through a process of what they term 'practical theorizing' (p.58). Hagger & McIntyre acknowledge, however, that accessing teachers' expertise, often held tacitly, is far from straightforward and the means by which subject knowledge in particular might be developed is not elucidated. Indeed, where subject knowledge is concerned, there may be special grounds for caution. Hodgson (2014) reports on a survey of teachers in England in which fewer than 20% felt that schools were equipped to develop student teachers' subject knowledge. While primary teachers accounted for only a tiny minority of respondents, one might expect the issue in this phase to be even more acute. As Murray & Passy (2014) point out, the breadth of subjects and added dimension of cross-curricular understanding required for this phase mean that, in terms of subject knowledge development, 'the current postgraduate curriculum strains to achieve the impossible' (p. 501).

In this school-based context, attention has frequently turned to the new ways in which learning might take place. More specifically, the blurring of role boundaries between university and school personnel and the creation of hybrid educators and experiences has been developing in a number of countries including the UK (Conroy, Hulme & Menter, 2013), the Netherlands (Van Velzen et al. 2012), The USA (Zeichner, 2010) and Australia (Kriewaldt & Turnidge, 2013). Sometimes characterised as 'clinical' forms of ITE, these collaborative models emphasise strategies such as examining evidence and developing judgments, based on authentic experience in the workplace contexts. The aim, as summarised by Burn & Mutton (2013) is to integrate and learn from different sources of knowledge *in situ*. Considering subject knowledge more specifically, various approaches might be envisaged and three are presented here as brief examples.

Rowland (2013) and colleagues discuss the 'Knowledge Quartet' as a framework for post-lesson analysis of mathematical subject knowledge under the headings of foundation, transformation, connection and contingency. This in turn would be one possible focus for the 'teacher rounds' described by Ellis *et al.* (2015). These rounds involve focused lesson observations and the gathering of data for joint analysis so it is conceivable that these could have a subject orientation. Finally, Nilsson & Loughran (2012) report on the use of Content Representations (CoRes) in Science, which provide prompts to elicit a teacher's PCK of a topic.   Rather than representing abstract, generic knowledge, they are based on the premise that this topic is to be taught to a specific group and so may be well suited to a context-sensitive understanding of the subject matter. Of particular interest for a school-based course is the linking of this by Loughran *et al.* (2001) to collecting reflections on experiences of teaching this content in the form of Pedagogical and Professional Experience Repertoires (PaP-eRs). The building of a collective resource of this kind may lend itself well to school-based working.

While opportunities may, therefore, abound for school-based subject knowledge development in principle, there exists a potential inherent problem. As pointed out by Mutton, Burn & Hagger (2010), schools are not only sites for student teacher learning but also for their demonstration of practical competence. The socialising influence of the school's community is considerable and so newcomers need help to identify learning possibilities that go beyond mere experience. This is a sentiment echoed by Ellis (2010) who rails against an 'impoverished' view of experience as the transfer of expertise from mentor to student. Instead, he argues for a participatory model based around collaborative inquiry into practice. A further factor for consideration is the role of the university in this enterprise. Furlong (2013) draws attention to the marginalisation of the university in many forms of teacher education but suggests that two important roles remain: helping teachers to develop practical theories and exposing them to wider principles or perspectives beyond their immediate experience. The second of these resonates with Young's (2013) notion of powerful knowledge and implies that the university may provide an important means of reconciling the situated with the generalizable.

In the context of subject knowledge, Ellis (2007a) advocates giving attention to working within the school setting with the aim of teachers and student teachers collectively 'transforming' the object of teaching. This links to Van Driel & Berry's (2010) vision of explicit discussion among teachers potentially leading to: *'a collective PCK, that is, a shared or common form of teachers' professional   knowledge about teaching certain subject matter'* (p.660). This has much in common with the collective codification of knowledge envisaged by Loughran *et al.* (2001). All of this, therefore, presupposes a particular form of community in the workplace that goes beyond the traditional mentor-student teacher dynamic. It is here that the literature around communities of practice may provide a useful perspective.

2.4 Communities of Practice as an Analytical Tool

The notion of learning within a community of practice, as characterised by Lave & Wenger (1991) and Wenger (1998), has become a popular way of acknowledging the inherently situated and social aspects of learning. The concept has been appropriated in many forms over the past two decades and Wenger (2009) himself has reflected on its evolution from a purely analytical tool to a more instrumental one used as a model for cultivating relationships. In this case, however, it is the original conception as an analytical perspective from which to understand learning that is of value. I seek to use it here, as have others (e.g. Taylor, 2014; Johnston 2016) as a lens through which to examine learning in a school setting. In doing so, however, I am interested in the insights and implications arising from the limitations of the model as well as its strengths. Three fundamental aspects of communities of practice seem to merit particular attention in this respect: the characteristics of such a community, the means of participating in that community and the ways in which meaning is created.

Wenger (1998) is at pains to point out that a community of practice is a special sort of community, based on three characteristics: mutual engagement, joint enterprise and a shared repertoire. Mutual engagement might, for example, be seen in the fact that mentors and student teachers work alongside one another on a daily basis in a classroom. Wenger acknowledges, however, that this does not necessarily imply a productive and harmonious relationship and, as noted by Chambers & Armour (2011), learning in a school setting may have much to do with unofficial learning within a dysfunctional community of practice. Joint enterprise is based on ownership, accountability and negotiation. In the context of subject knowledge development, this might raise questions about whether there is a form of reciprocal learning at work and who controls this process. The possible existence of a shared repertoire in the form of routines, tools and the like, underlines the potential for school-based learning to provide privileged access to an experienced teacher's practices but it is far from obvious what this shared repertoire might be within the context of subject knowledge development. Furthermore, the very nature of a community of practice is open to interpretation: Hodkinson & Hodkinson (2004) distinguish between the universal 'field' that all teachers belong to and a narrower group with a coherent sense of identity. In their study of secondary teachers, they relate this latter version to the often tightly-bounded subject departments, whereas the existence of a true subject community of practice for primary teachers has been questioned (Anderson & Clark, 2012). With the lack of this form of inherent structure in primary schools, the feasibility of identifying a subject-oriented community at all requires consideration.

Within a community of practice, Lave & Wenger (1991) describe the process of legitimate peripheral participation as 'an opening, a way of gaining access to sources for understanding through growing involvement' (p.37). Certainly, a structured, gradual journey of increasing involvement in practice would seem to be characteristic of school-based learning. However, the authors' emphasis on understanding is significant and relates to their mention of 'engagement in social practice that entails learning as an integral constituent' (p.35). In an echo of Ellis' (2010) distinction between experience and learning, it has been noted that school teaching can be a fairly isolated act and that communities with *practice* as their first purpose may be rather different from learning communities (Wubbels, 2007). Clearly there is a need to establish student teacher learning about a subject (as opposed to its enactment in lessons) as an object in itself. Not only that, but apprentice-like learning in school is likely to represent only part of a new teacher's development and, as Johnston (2016) suggests, their participation in the community may be compromised by their status as temporary guests. As argued by Fuller *et al.* (2005), the communities of practice model, in its original guise, seems to take little account of learners' prior knowledge or the potential for direct on-the-job teaching. The implication may be that a structured programme, rather than a straightforward apprenticeship, will be needed.

Finally, Wenger (1998) conceives of workplace learning as the ongoing negotiation of meaning, through a process not only of participation but of reification. Reification, or the giving of form to concepts or experiences, prompts a consideration of the ways in which subject knowledge might be represented and what messages might be conveyed by this. An emphasis on audits and quantifiable 'measures' of knowledge, for example, may reinforce the view of teacher-as-technician, which Mitchell & Lambert (2015) see as damaging to teachers' engagement with the curriculum. As Wenger (1998) points out, however, reification may take the form of a process as well as a product. Seen in this light, subject knowledge development may be 'embodied' in a whole variety of ways, including a set of agreed practices. The other significance of meaning being constantly *negotiated* is the implication of this being a reciprocal process, as newcomers interact in a dynamic relationship with practice. However, as Fuller *et al.* (2005) have argued, this sense of learning as a two-way process is not fully examined in Lave & Wenger's (1991) writing, so the ways in which working with a student teacher to explore a subject may bring professional development and benefit to the experienced teacher are worthy of attention.

The ways in which subjects and knowledge are viewed in school clearly merit further examination, but the issues arising from this brief foray into the literature on communities of practice now provide three additional questions that serve to guide a consideration of future possibilities:

1. To what extent is it realistic to conceive of a subject-oriented community within a primary school setting?
2. How might student teachers' subject knowledge development in the workplace be structured as a form of legitimate peripheral participation?
3. How might collaborative subject knowledge development in school involve mutual learning and benefit for both novice and experienced teachers?

2.5 Looking Ahead: Re-Imagining Opportunities

In keeping with Lave & Wenger's (1991) conception of their theory as a means to 'inform educational endeavours by shedding new light on the learning process' (p.39), I am now seeking to use this perspective to arrive at a tentative set of principles to underpin school-based subject knowledge development for primary teachers. In doing so, I also wish to consider the role of the university in these developments. To take firstly the question of community itself, it is of course more difficult to discern in a primary setting the sort of well-defined, coherent group at single subject level mentioned by Hodkinson & Hodkinson (2004). Nevertheless, to return to Wenger's (1998) characteristics, student teachers and experienced colleagues do exhibit a sense of mutual engagement and joint enterprise. With newcomers now woven, sometimes for an entire year, into the fabric of a classroom with the concomitant sense of accountability for progress, this is truer than ever and there are clear opportunities to fulfil Lave & Wenger's (1991) requirement for the learner to see a mature form of practice before them. A more questionable community of practice characteristic, however, may be the need for a shared repertoire and the role of the mentor in this respect also merits some examination.

In the ITE literature, the intense, sometimes emotive, nature of this one-to-one relationship with an individual who is simultaneously critical friend and assessor has been frequently emphasised (Jones & Straker, 2006; Chambers, Hobson & Tracey, 2010). In increasingly school-based ITE models, the stakes attached to the successful functioning of this relationship become yet higher. For practising teachers to move beyond more limited forms of mentoring, the shift in identity is potentially a substantial one and White, Dickerson & Weston (2015) have questioned the readiness of school-based teacher educators to adopt this extended remit. Building on this, Scott-Douglas (2016) draws attention to an additional dimension of community: that comprising school-based mentors themselves and their HEI-based colleagues. Significantly, he draws attention to the value of engaging these teachers as learners and to their potential receptiveness to collaborating on meaningful, scholarly tasks. It is possible, therefore, to conceive of 'joint enterprise' in this sense too.

It is here that Lave & Wenger (1991) again offer a valuable perspective. In their view, the role of the 'master' practitioner is less about teaching than about conferring legitimacy upon the 'apprentice'. With this in mind, a mentor could be seen not only as a skilled guide, but as a gatekeeper, or conduit, to a wider and relatively under-exploited community of colleagues. This de-centring of expertise and the location of 'mastery' in the community, rather than the individual, is potentially a powerful model for seeing the school more broadly as a site for learning and lessening the focus on a single member of staff. Taken further, there are links here to calls for sharing expertise more effectively among teaching professionals. In the US context, for example, Darling-Hammond & McLaughlin (2011) outline a vision of teachers working collaboratively in communities which extend beyond single schools, are based on shared interests such as subject matter and are 'anchored in problems of practice' (p.84). In parts of the UK, there have been initiatives aimed at building greater equity for pupils through carefully structured collaboration within, between and beyond schools (Ainscow *et al.* 2012). While the underlying purpose of the collaboration may differ in these examples, principles such as realising untapped potential within particular settings, challenging teaching orthodoxies and asking schools to take responsibility for education in a locality, rather than within their own walls, hint at the possibilities for developing subjects in a similar manner.

If a form of subject-related community is therefore conceivable, we must consider what form student teacher participation might take. The nature of periphery within Lave & Wenger's notion of legitimate peripheral participation is interesting in this respect. The authors are clear that: *'A newcomer's tasks are short and simple, the costs of errors are small, the   apprentice has little responsibilities for the activity as a whole.'* (Lave & Wenger, 1991 p.110). As student teachers become increasingly embedded in schools and often viewed as colleagues-in-waiting, remaining on the periphery of practice for long enough becomes ever more challenging. For prospective primary teachers, lacking the department structure of their secondary counterparts, engaging with subject knowledge in the low-risk manner outlined above is likely to prove difficult. Indeed, Ellis (2010) has critiqued the widespread view valorising the accumulation of teaching experience. Giving increased status to subject knowledge development seems important, therefore, and accords with Lave & Wenger's (1991) depiction of a *learning* curriculum, characterised by situated and

sometimes improvised opportunities rather the giving and receiving of knowledge. Significantly, however, Lave & Wenger go on to critique models of education that, rather than build towards full participation in practice, seek instead an exchange value for learning. In this respect, ITE necessarily diverges from their model somewhat. While Lave & Wenger's view of the 'parasitic practice' (p.112) of test-taking may call to mind an over-use of quantifiable subject audits, the fact remains that, in educating teachers for a diverse range of contexts and, in many cases, certifying them against externally-imposed standards, some form of exchange value beyond the immediate setting is required. The question arising, therefore, is how a local, school-based community might generate some transferable subject knowledge principles. A possible answer is offered by turning to the third identified facet of communities of practice: the negotiation of meaning. Wenger's (1998) discussion of reification, not only of artefacts but of processes, is significant and Lave & Wenger's (1991) notion of transparency is also useful in this respect: such processes may be simultaneously invisible in their unproblematic everyday use, but also made visible in the sense of being marked as significant for learning. At the heart of any learning curriculum is a need, therefore, for an explicit acknowledgment of the often tacit ways in which experienced educators come to understand subjects.

Learning, however, can be a two-way process and, despite widespread views that hosting student teachers is not merely a professional responsibility for teachers, but also an opportunity for learning (Darling-Hammond & McLaughlin, 2011), Fuller *et al.* (2005) note that an under-developed aspect of the communities of practice model is the potential for reciprocal learning to include 'old timers'. This might also suggest a missed opportunity to reclaim the initiative and reasserting some professional autonomy (Ellis 2007b) in the realm of subjects and curriculum. If we are to consider a potential object for joint activity in this sense, Lave & Wenger (1991) again offer insight, this time in their discussion of talking *within* practice, as distinct from talking *about* practice. Lave & Wenger draw attention to the power of stories and cases as repositories for shared understanding. Shulman (2004) has long been an advocate of learning through cases, as 'the territory between theory and practice' (p.543) and, more specifically, this seems to link closely to the PaP-eRs approach (Loughran *et al.* 2001) referred to previously. While situated cases need to be subjected to critique and used with caution, the joint collation and interrogation of such knowledge could serve as a mutually beneficial activity. At this juncture, returning to a consideration of the university's role may be pertinent.

To return to Furlong's (2013) view of two future university contributions to ITE, there is perhaps now scope to envisage a broader remit. Furlong's first role for the university as a mediating influence, helping student teachers to develop personal theories, has particular relevance for the development of structured programmes of subject-oriented learning that are distinct from daily class teaching. The other function - that of connecting situated experiences to wider perspectives - links closely to a focus on stories or cases from practice and the provision of a forum for sharing, comparing and deriving principles from them. The aforementioned view of subjects in terms of syntax, structure or fundamental principles (Schwab, 1964; Bruner, 1977) might be brought to bear on these discussions. To these two roles, however, could be added a third. In line with the development of collaborative structures extending beyond schools (Ainscow et al. 2012) and drawing on their resources of subject expertise from across faculties, universities could seize the opportunity to be a hub for emerging communities of practice, operating as a valued local partner. Central to all of this is the need for teacher educators to attempt to cross conventional boundaries to include work within the school setting, as outlined by Burn & Mutton (2013), so that they can be at the heart of authentic and meaningful subject knowledge debates with student teachers and experienced practitioners alike. This role relates to a further boundary-crossing issue implicit throughout the preceding discussion. If we are to take seriously Ellis' (2007b) view of subject knowledge development as dynamic, contextual and collective, the sorts of subject knowledge development under consideration here are unlikely to be the exclusive province of pre-service teacher education. Mutton, Burn & Hagger (2010) are among those who see providing a grounding for ongoing professional development as a hallmark of effective ITE. Extending this form of community into sustainable CPD would seem to be highly important, therefore.

As a way of drawing together the preceding discussion and with a view to the future, I now offer a brief example – inevitably rather idealised - and propose a set of broad principles to underpin school practice and the respective roles of school and university staff.

3.0 METHODOLOGY
3.1 An Illustrative Case: Visual Representations in Mathematics

This fortnight, student teachers are developing their knowledge of visual representations of mathematical concepts, a focus that has been jointly identified by school and university-based educators. This decision was made at one of a number of professional development event for mentors each year aiming to foster both a sense of collaboration on important priorities and an enhanced understanding of ITE-specific pedagogies, such as ways of bringing tacit knowledge to life. The student teachers have been given designated non-teaching time to carry out

structured tasks in school, based in this case on focused observations of practitioners in three classes across the primary age range using Rowland's (2013) knowledge quartet. This task is related to a key reading on the use of visual models that has been provided at university for discussion between mentor and student teacher; in each case, a particular focused question or problem relevant to that setting has then been negotiated within school. The mentor has facilitated discussions with colleagues, access to resources within the school and helped to organise an observation timetable. Having observed brief episodes within a number of lessons, the student teacher produces notes documenting this school's practices. Shortly afterwards, these notes are brought back to university and collectively interrogated through group work activities, which involve the university tutor helping students to explore the general principles arising from these situated 'cases'. In doing so, further connections are made to other aspects of mathematics learning: both pedagogical, such as the role of concrete resources, and more substantive aspects of the chosen subject matter. Student teachers return to school with an agenda of discussion points, based on these more generalized debates, to address with their mentors so that a new, shared understanding of the issue can be developed. Mentors, in turn, seek out opportunities, such as involvement in planning, input in staff meetings and discussions with the mathematics subject co-ordinator, for the student teachers to share their ideas more widely in school.

4.0 CONCLUSION

This paper set out to consider, in a primary education context, the implications of a renewed emphasis on knowledge and teachers' subject knowledge in a period of increasingly school-based teacher education. Without wishing to understate the challenges presented, rather than viewing this in as a deficient model of schooling and ITE, I have been seeking to explore productive opportunities arising from this confluence of policy directions. A particular aim has been to reconcile a focus on 'powerful' forms of knowledge within the curriculum (Young, 2013) with a more context-driven and collective vision of subject knowledge (Ellis, 2007b). I am arguing that school-based aspects of ITE, mediated by the university in specific ways, might allow this to happen. While I wish to emphasise that there remains an important role for conventional university-based subject sessions and student teachers' independent study, the focus here has been on practices within school settings. Four key principles may be worthy of consideration.

Student teachers need to be helped to see subject expertise as residing within a community of professionals, with the mentor as gatekeeper to wider sources of learning within the school. In the primary school case, this is not a single subject community necessarily, but a community of teachers engaged in the more generic development of subject knowledge. Induction processes in school could highlight the breadth of opportunities and build understanding of the ways in which school colleagues work as a community; where schools can work closely together in local groups, a broader form of community can be envisaged, perhaps brokered by the university. Training for mentoring teachers could focus to a greater extent on the mentor's role as a conduit for wider experiences or, to adopt Lave & Wenger's (1991) terminology, *conferring legitimacy* on the student teacher.

Student teachers need to be allowed to remain on the periphery of this community for longer. Calling into question traditional school-based learning practices, the implication is that time may be given over to authentic subject knowledge development activities at the expense of hours spent teaching full lessons. Some specific activities have been referred to in this paper but the common feature of this approach needs to be the status given to such learning as a distinct experience, separated from the everyday business of teaching. This offers a mediating role for university tutors, as envisaged by Furlong (2013), of helping student teachers to make sense of these activities and develop practical theories and frameworks. Activities focused on revealing the underlying structure and syntax of a subject, such as the collective creation of frameworks of fundamental principles, may be particularly generative of future learning in this respect.

Attention needs to be given to the creation of a set of practices and cases, jointly between student teachers and experienced colleagues, drawing partly on specific contexts of schools, their teachers and their pupils. Such cases could take the form of likely misconceptions, but may also resemble stories or cases as models for examining decision making and the exercise of professional judgment (Lave & Wenger, 1991; Shulman, 2004). There is a danger, of course, that such cases could become overly context-specific, but this is where Furlong's (2013) other suggested role for the university may be relevant: tutors may help student teachers to make connections between situated content and wider perspectives. Put another way, such connections may be a synthesis of local priorities and 'powerful knowledge' (Young, 2013), whether codified in national curricula or not. This may enable a balance to be maintained between challenging assumptions and fostering the sort of collective PCK advocated by Van Driel & Berry (2010).

Finally, subject knowledge development now needs to be seen as a reciprocal enterprise, building on both student teachers' starting points and experienced teachers' interests. If primary teachers are to reclaim the professional initiative in the curriculum content debate, then perhaps a process of negotiating meaning (Wenger, 1998), stimulated by new entrants to the profession, would provide a focus. The induction of newcomers into a school community may be the impetus for the collective transformation of subjects envisaged by Ellis (2007b). This view points towards

Gess-Newsome's (1999) characterisation of PCK as a distinct form of specialised teacher knowledge, but now seen not as static and objective, but dynamic and constantly negotiated. While subject knowledge development across an entire primary curriculum will be a perennial challenge, particularly for non-specialist primary teachers, this paper has sought to identify some ways in which school-based ITE may be well placed to make an important contribution.

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