Introduction

The concern of this paper is the importance of the cognitive tool of literacy in enabling pedagogical development. It will be argued here that literacy can empower learners to design their own representations of knowledge rather than absorbing representations preconceived by others; that it can be used to support the deep reflective thinking that is necessary for meaningful learning; and that it enables mindful and challenging learning. The stimulus for this concern is the 'training' model of teacher education (Pring, 2000) which views teaching as a craft, the skills and competences for which are derived from a positivist view of the world. Such a view is limited because it neither acknowledges the role of teachers' beliefs in informing their pedagogical practice (Chan & Elliott, 2004) nor does it accommodate differences in teachers' understanding (Hoban, 2002) of 'recommended innovations' which may have as much to do with socialising teachers into rules, procedures, principles and ways of working (Olson, 2003) as they have with enabling the "active construction of meaning"(Birenbaum, 2003, p18). This is essentially a 'think piece' which argues that a particular form of literacy, pedagogical literacy, is an important cognitive tool for a developed conceptualisation of pedagogical content knowledge and that, by extension, being *pedagogically* literate is an integral feature of being a professional teacher.

Literacy

Literacy is not a unitary phenomenon (Olson, 1994). In general terms, literacy is competence with a written script. Basic literacy once meant little more than the ability to write one's name. That definition was later expanded to mean the decoding of text, and by the 1930s it had come to include reading and expressing oneself through writing (Bransford et al., 1999). While once viewed as a generic skill taught as a set of fixed rules, contemporary views of literacy now encompass notions of active citizenship, new communications practices and information technologies, critical thinking and linguistic and cultural diversity. The meaning of literacy continues to be elaborated. Six forms of literacy will be briefly mentioned.

Amongst the many forms of literacy, there is *functional* literacy which, according to the Organisation for Economic Cooperation and Development (OECD), is less the ability to read and write and more the ability to comprehend and use written script to serve the purposes of everyday life at home, at work or in the community. Then there is *information* literacy which is the ability to recognise when information is needed and to locate, evaluate and use the information

effectively and ethically to accomplish a specific purpose. Information literacy can also be known as library orientation, bibliographic instruction, user education and information skills training. Another form is *critical* literacy which comes in several versions each underpinned by different theoretical perspectives (Robinson &Robinson, 2003). It involves the analysis and critique of the relationships among texts, language, power, social groups and social practices and shows us ways of looking at texts to question and challenge the attitudes, values and beliefs that lie beneath the surface. *Academic* literacy (Lea & Stierer, 2000) maintains that the writing experiences and practices of both staff and students in higher education can advance academic and intellectual potential; but only when these are embedded and developed in appropriate theoretical and pedagogical contexts. Academic literacy has evolved in the changing context and challenges of higher education and is defined as a social practice in which writing is shaped by the disciplinary discourse, individual identity and experience, and institutional values. Perhaps on a broader spectrum is *societal* literacy, (Elwert, cited in Olson, 2001). This is the specialised mode of thought needed to participate in large scale institutions such as education in which access to, and use of, written documents is critical to its continued functioning. The use of writing and reading has consequences for the way institutional relations are formalised. In a literate society, written contracts are legitimised by legal institutions and procedures. Literate practices in institutional contexts contribute to the evolution of a written language that is structurally different and more complex than oral language. Institutions consolidate literacy by promoting its use in all spheres of human activity, by encouraging intellectual exchange and disseminating information about matters and events of social concern. In turn institutions are reinforced by societal literacy. More recently there has emerged *dialogic* literacy (Bereiter & Scardamalia, 2005). It both reflects, and is an integral part of, dialogic learning in which knowledge is viewed not only as the product of disciplinary inquiry, where well-established conventions allow the accumulation of coordinated data, but also as the product of ongoing discourse, where different perspectives lead to a higher integration of understandings. This version of literacy emerges from a well established philosophical view that language is neither a monologic system of conventions nor the monologic expression of the individual self.

 To speak of literacy in all the senses used here implies that people may possess it in varying degrees, that it is continuously improvable, that it is inextricably interwoven with thought and that its development takes place in the social world. Indeed the 'literacy hypothesis' posits that "knowledge in any domain is altered by constructing written representations and then operating on these representations as a means of thinking about the domain represented" (Olson 2001, p.2).

Pedagogical literacy is therefore the fundamental competence of being able to read, understand and criticise the documents that make up the professional knowledge base of teaching and learning. Furthermore, because reading material is better understood when it requires to be manipulated through situated writing tasks (Langer & Applebee, 1987) the construction of written representations about teaching and learning can be powerful catalysts for teacher education students' own learning.

Learning, Teaching and Learning to Teach

In the current characterisations of learning, emphasis is given to its constructivist nature. The learner's construction of knowledge is a self-regulating process in which individual cognitive organisation allows learners to establish an orderliness and predictability in their worlds. When experience does not fit with the individual's organisation, cognitive disequilibrium results. This disequilibrium leads to adaptation in which the individual aims to produce coherent, non contradictory organisation. Thus from a constructivist perspective, knowledge is actively constructed by each individual as a function of adapting to and making sense of their experiential worlds. While the significance of the learner is not at issue, the focus on constructivism has led to obfuscation between learning and knowledge-building (Bereiter, 2002). Learning is activity directed at improving one's own personal knowledge or competence while knowledge-building is directed at creating conceptual artefacts which are in the public domain (as distinct from the private domain of the individual learner). This distinction is also made by Bowden & Marton (1998) who hold that learning is the individual's efforts to alter his/her own balance of knowledge and ignorance while research is the collective effort to alter the balance between what is/not known in the absolute sense. Thus, learning and knowledge-building (or research) are different activities though through engaging in research, the individual has the opportunity to engage in particular learning. Indeed there is considerable intellectual press to enable learning *through* knowledge-building activities as in pedagogies for authentic academic achievement (Newmann & Archbald, 1992; Bereiter, 2002). Such pedagogies typically privilege collaborative and social practices. However, even within a knowledge-building pedagogy as might be implied by constructivism, there would be an expectation that learners would learn through reading (Hickey & McCaslin, 2001), to allow not only the acquisition of domain knowledge but to allow the growth of decoding skills (increased vocabulary and richer representations of word meanings) and of language skills (identifying propositions and representing these in a coherent organisation) (Kintsch, 1998). It is the interaction of decoding skills, language skills and domain knowledge that allow people to learn from text, though activities designed to support such learning require

active cognitive processing on the part of the learner (Kintsch, 1998). In other words, reading material will only be efficacious when the learner *intends* to learn (Bereiter & Scardamalia, 1989).

Although teaching is the institutionalised task that is designed to support formal learning, learning and teaching *are not the same*; a point that Moon (2004) makes forcibly. So while the teaching task intends that learning takes place, teachers cannot either guarantee learning or learn on behalf of others. The teacher's task is to enable learners to refine their powers of reasoning and judgement through making use of publicly developed bodies of knowledge (Pring, 2000). What is considered critical to the teacher's task is pedagogical content knowledge (Shulman, 1986, 1992): that instructional expertise which is a synthesis of subject matter knowledge and pedagogical knowledge. Pedagogical content knowledge is unique to teachers insofar as it represents the capacity of a teacher to transform content knowledge into forms that are pedagogically powerful and yet adaptive to the variations in ability and background of learners Shulman (1987). It is this knowledge that separates the content specialist from the teacher (Cochran, King, & DeRuiter, 1991). While the content specialist's knowledge is structured from a research perspective and is used as a basis for the construction of new knowledge in the field, the experienced teacher's knowledge is structured from a teaching perspective and is used as a basis for helping learners to understand specific concepts (van Driel, Verloop, & de Vos, 1998).

Thus far, pedagogical content knowledge is reported as a descriptive reconstruction of successful classroom instruction. However, Shulman and his colleagues noted that pedagogical content knowledge is not reducible to behavioural repertoires of the subject matter to be taught. Rather it is a way of thinking that allows teachers to transform their subject matter knowledge into forms that learners can understand. This way of thinking was labelled 'pedagogical reasoning' (Wilson et al., 1987, p.118); was central to Shulman's (1987) model of teaching; and allegedly develops as teachers plan lessons, teach, adapt instruction to meet learners' needs, and reflect on teaching. This fusion of pedagogy and content, which so characterises teaching, would seem to be interpretable at two different levels. One level would be through the didactic tools that teachers deploy: the way they present the subject matter and in the way they take learners' comments and previous knowledge into consideration in class. This representation of pedagogical content knowledge is potentially observable and although well documented in the teacher education literature is not the focus of this article. Another level of representation (Bruner, 1966; 1974), however, would be symbolic where the teacher reasons about what is academically, situationally and subjectively appropriate in the particular teaching situation. This symbolic mode allows

words to be treated as if they were objects in their own right, allowing mental actions without any accompanying observable behaviour. Disciplinary content would thus be being contextualised and adapted to particular pedagogic demands, but at a symbolic level only. Such representation cannot be observed easily or directly but is nevertheless of fundamental importance because it is at this psychological level that various cognitive processes transform the content knowledge to make it ready for effective instruction (Shulman, 1987: 1992). Symbolic representation depends upon language and for Bruner is powerful because reading gives private access to information that would be out of reach, and writing allows one distance from one's own thoughts. The importance of this symbolic representation is in letting us achieve voluntary control over our own thoughts (Hiebert & Lefevre, 1986). Because symbols can represent complex concepts, they can both reduce the cognitive effort involved in dealing with dense thinking and produce further conceptual knowledge. None of this argues against the widely held view that the context and manner in which professional knowledge is learned is supremely important (Eraut, 1994); nor does it argue against the multiplicity of meaning implied by the term literacy (Olson, 194; 2001; 2003). However, because the means by which human beings represent their experience of the world (Johnson-Laird, 1983) are conceptual resources which are discursive in origin and which are brought to bear in contextually-appropriate ways (Säljö, 1995), and because such representations are mediated through the cognitive structures of beliefs, perceptions and 'ways of thinking' (Pring, 2000), the process of learning to teach is a process of changing one's representations. These representations are abstract knowledge, which is the basis of understanding (Ohlsson, 1995), and while understanding will not guarantee successful observable performance, it is a necessary condition for making sense of the performance of others. In other words, the teacher may enact particular (observable) practices within the class such as lowering her voice when pupils are talking loudly or giving gold stars for good work, not because she understands why such practices might have a desired effect but because she has always experienced such practices 'to work'. But without accessing the literature on the practice and theory of education; and of integrating such literature into extant frames of reference, the teacher will remain pedagogically vulnerable on the occasions when tried and tested practices fail 'to work'. To be pedagogically literate, teachers must be able to access and use the specialised written documents of pedagogic knowledge (Olson, 2001; 2003), thereby allowing them to hypothesise as to reasons for the success or otherwise of pedagogical practices. Fundamentally, what is being argued here is that teaching, and learning to teach, with understanding requires teachers to construct a corpus of abstract knowledge - not 'inert' knowledge (Whitehead, 1929) - which is a conceptual resource. Such resource reflects teachers' understanding of their own

practice and is evidenced in their written discourse. The melding of abstract knowledge with observable practices in the domain of professional learning has been an ongoing concern (Achtenhagen, 1995; Desforges, 1995; Leinhardt et al, 1995). However, the evidence for the transformative effects of certain types of writing offers a mechanism for 'doing' and 'understanding' (Ohlsson, 1995) to become better integrated.

Becoming Pedagogically Literate

Literate persons have different types of knowledge that they use both to comprehend and compose text (Freebody & Luke, 2003). At the level of code, they understand the relationship between spoken sounds and written symbols, the grammar of texts and the structural conventions of texts. At the user level, readers and writers make meaning by drawing on their own experiences and prior knowledge of the world and on their experience and knowledge of similar texts, thereby constructing textual meaning that is in some sort of relationship to available knowledge. Finally, at the ideological level, texts are not neutral but are crafted to represent the views and interests of the writer. The information, ideas and language in texts influence readers' perceptions; allowing literate persons to critique and construct text that can transform both their own and others' thinking.

That there is a link between thinking and writing is intuitively plausible. Thinking would appear to be at least a necessary condition though, without further clarification as to what might be meant by thinking, possibly not a sufficient condition given the concerns expressed in the literature about difficulties in writing. Beyond the prosaic, however, there is a fairly coherent literature (as summarised, for example, by Bereiter & Scardamalia, 1987 and Kellog, 1994) that points to the reciprocity of thinking and writing. Through writing, one's thoughts are represented in ways which can be examined, clarified or explored by self or others. The written representation of thought enables the co-ordination of extant understanding and (new) evidence to create (new) knowledge (Kuhn, 1992) rather than the mere accumulation of new factual information (Tynjälä, 1998). The written output can then be the focus for metacognitions on the development of understanding of domain knowledge (Emig, 1977; Rosaen, 1989). The potential offered by writing to synthesise, analyse and evaluate domain knowledge (Applebee, 1984; Emig, 1977; Langer, 1986; Newell, 1984; Newell & Winograd, 1989) is what makes it such a potent tool for developing and revising pedagogical content knowledge. "Writing is central to the shaping of certain modes of cognition" (Hildyard, 1996, p.579), but it cannot be assumed that such writing develops in the absence of specific instruction (Björk et al, 2003). While writing is

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regularly used as vehicle for the expression of finished thought, it is much less often used as the mechanism through which explore thinking, to develop questions, or to manipulate information in different ways (Mitchell, 2003). By situating and contextualising (Boscolo & Mason, 2001) the writing task in a discourse specific to teaching and requiring the writer to manipulate, integrate and restructure knowledge, writing is harnessed to the teacher's developing understanding of pedagogical content knowledge.

Writing activities to promote learning in teacher education are typically referred to as reflection, and are hugely various (Kember, 1999; Moon, 1999; Bolton, 2005), not least because the concept of reflection is elusive. Moon (1999) described it as "a form of mental processing with a purpose and/or anticipated outcome that is applied to relatively complex or unstructured ideas for which there is not an obvious solution" (p.23). Reflective writing can therefore be about almost anything: from prospective teachers' awareness of the consequences of particular pedagogical actions (Harrington & Quinn-Leering, 1996) to enabling teachers to appreciate how their experiences have shaped their identities (Braun & Crumpler, 2003). Furthermore, the sheer range of purposes for reflective writing - from the personally therapeutic to the self-developmental (Moon, 1999) - together with the many levels of analyses which can constitute reflective writing (Kember, 1999) render the concept of reflection to be all-inclusive and very fuzzy. Moon herself (2004) recognises reflection to be diffuse, "somewhere around the notion of learning and thinking" (p.80). Davis (2006), however, argues that for reflection to be a mechanism for learning in teacher education, the writing activities should require both the analysis and integration of ideas *and* that the ideas should comprise: learners and learning, subject matter knowledge, assessment and instruction. This is not inconsistent with the contention that experience of itself does not guarantee learning and that to learn optimally from experience, one needs to engage in intentional learning (Desforges, 1995), with all that this means for cognitive activity of comparing, analysing, synthesising, and evaluating on the bases of criteria (Bereiter, 2002). Thus while reflection may increase the learner's awareness of the content and structure of a knowledge domain (Ohlsson, 1995) it is not a sufficient condition for pedagogical literacy, if it does not challenge extant conceptions (Klein, 1999). In other words reflective writing does not automatically mean improvement in learning and will only do so when it requires teacher-education students to be involved in transforming rather than just reproducing knowledge; with content that is concerned with learners and learning, subject matter knowledge, assessment and instruction. So while it may be that teacher-education students can learn through reflective writing, reflective writing is not necessarily synonymous with pedagogical writing.

Knowledge-transforming writing as a cognitive tool

Regardless of the observable writing product that may be derived, the process of writing is clearly a cognitive one in which authors draw on two components: information in long-term memory (knowledge of the domain, of how to write in a particular genre and of themselves as writers) and of the writing task environment (the authorial motivation to write, the likely readership, the resources to support the task and the author's evaluations of the text as it progresses (Bereiter & Scardamalia, 1987; Flower & Hayes, 1980). It is the deliberate, strategic interaction of aspects of the two components – the generation of content and the shaping of the content to suit a particular purpose/reader – that allows the writer to generate new links and develop deeper understanding (Scardamalia & Bereiter, 1991). This knowledge-transformation view renders writing not as 'easy', as 'natural' or indeed as a tool skill but as pro-active, effortful, self-regulatory engagement of the writer (Butler & Winne, 1995; Tynjälä, 1998) to clarify views, expose beliefs, illuminate convictions and through this learn what is important to us (Murray, 2001). Examples of the interaction of the content in long-term memory and its clarity/appropriateness/accuracy for the reader offered by Scardamalia & Bereiter (1991) include:

- the need to reduce text: triggering a critical appraisal of what to include/discard;
- the need to make a transition between subtopics: triggering the construction of a previously unrecognised relationship;
- the need to justify a position: triggering the uncovering of new knowledge or the appraisal of dearly-held untenable views;
- the need for precision in language: triggering clearer conceptualisation and deeper, analytic distinctions

In other words concern to achieve the overall aim of higher literary quality (of reducing text, of linking subtopics, of justifying a position, of improving language precision) triggers the opportunity for further cognitive activity (to determine criteria, to develop a new relationship, to learn new knowledge, to think more clearly/deeply). The teacher educator's deliberate design of writing tasks to trigger the interaction of pedagogical content and its representation cautions both the educator's proclivities to clarify the subject matter, offer examples, or suggest arguments for or against a point of view and properly locates learner thinking as the learner's task (Vermunt & Verloop, 1999). Additionally through attenuating writing which is no more than knowledge-telling (Bereiter & Scardamalia, 1987), students make explicit their own understanding, providing the opportunity to remedy incomplete or distorted learning (Moon, 2004).

It has been argued that the essence of knowledge-transformation is rooted in the manipulation of knowledge at a symbolic level. For Ohlsson (1995) the manipulation of abstract knowledge can be characterised in terms of seven epistemic activities:

1. Describing: providing an accurate conception of an object or event
2. Explaining: making clear why an event happened or how an object works
3. Predicting: outlining the circumstances in which a particular event *will* happen
4. Arguing: stating reasons for and against a particular position, either about what to believe or about what to do
5. Critiquing (evaluating):identifying good and bad points of a description, explanation, prediction argument or even another critique
6. Explicating: making clear the meaning of concepts
7. Defining: proposing a usage for a term (not always easy to distinguish from explicating).

Ohlsson (1995) is of the view that these epistemic activities essentially comprise what is involved in understanding. To the extent that any of these tasks is executed by an individual, each represents the individual's cognitive accomplishment. These activities are engaged to create epistemic forms (Collins & Ferguson, 1993): ways of organising information into meaningful and recognisable structures (such as maps, calendars, equations, recipes, graphs, theories, models). Such structures show how knowledge is organised or concepts are classified, as well as illustrating the relationships among the different facts and concepts. The completion or creation of the structure is the object of the epistemic game. Writing an academic essay, a journal article or keeping a professional log could all be considered epistemic games as each has its own sets of moves, conditions, constraints and strategies (Sherry & Trigg, 1996). Through participating in epistemic games such as academic essay writing, the rules for which are generally:

- identifying a problem or issue
- establishing a clear perspective on the issue
- recognising alternative perspectives
- locating the issue within an appropriate context(s)
- identifying and evaluating evidence
- recognising fundamental assumptions implicit or stated by the representation of an issue
- assessing implications and potential conclusions (Chandrasegaran, 1996),

the 'player' can learn and/or build knowledge; in Bereiter's (2002) terminology. Furthermore, because the way to learn to play the game and develop fluency in the game (Collins & Ferguson, 1993) is actually to play the game itself, student teachers (at whatever level) required to engage in epistemic activities can construct and organise their own knowledge. Through playing the game of academic essay writing, for example, student teachers have the opportunity to analyse material and synthesise new structures for themsleves. Such restructuring is the most difficult part of learning (Norman, 1993) but is supported through fitting facts, concepts and ideas together (and thereby building more sophisticated cognitive organisations). By requiring these cognitive activities to be represented in writing (Condon & Kelly-Riley, 2004), as necessitated by the game's rules, the writer's cognitive complexity can increase. Organising one's thinking in writing is important not only for persuading readers but also because writing creates conditions through which extant representations may be reformulated to allow better/other understanding (Klein, 1999; Kuhn, 1992; Ohlsson, 1995).

Conclusion

Within the currently dominant constructivist perspective, teachers at different times in their professional careers, in different contexts and for a range of professional purposes, need to grapple with the questions of what it means for them to comprehend subject matter, transform their knowledge of subject matter into forms that learners can attain and demonstrate that learning has taken place. Such pedagogical issues are not unproblematic. The pedagogically literate teacher can analyse and synthesise pertinent literature to address what is problematic. This is what the process of learning to teach means. The task of writing in a knowledge-transforming way is a powerful means of equipping teachers with the kind of theoretical knowledge that allows them to take continuing responsibility for their own professional development. While reflection and reflective writing may be a part of this, the interactive relationship between domain knowledge and expert writing, as posited by Scardamalia & Bereiter (1991) refines the notion of pedagogical literacy to focus on the multiple and interacting pedagogical concerns of learners and learning, subject matter knowledge, assessment and instruction (Davis, 2006). Further, because a conceptual grasp (as distinct from procedural enactment) of pedagogy is rooted in the seven epistemic activities outlined by Ohlsson (1995); a symbolic mode of learning (Bruner, 1966; 1974) becomes central to the teacher's learning. Developing professional knowledge in the context of a pedagogically literate approach through the interaction of domain knowledge and writing may prove more useful than denying the modes of thought that will become increasingly required of teachers; which is always a distinct possibility in models of teacher-education that

place excessive emphasis on observable behaviour and attenuates the importance of teachers' beliefs and professional identity. (This is not to suggest that teacher's observable behaviour is unimportant; merely to point out that their psychological reasoning has received much less attention in the literature). This type of engagement by teachers is cognitively effortful and demanding of time. The desire by politicians and others that as teachers we increase our expertise in promoting and assessing learning points to the unequivocal need for us to capture our emerging awareness of the educational phenomena with which we are grappling, in writing. Through engaging in knowledge-transforming writing we can deepen our understanding, revise our misconceptions and build up an increasingly sophisticated corpus of case knowledge, thereby extending our expertise.

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