

## DISCUSSION, COLLABORATIVE KNOWLEDGE WORK AND EPISTEMIC FLUENCY

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*ABSTRACT: This paper argues for an action-oriented conception of learning in higher education: one which marries higher order learning (coming to understand) with apprenticeship in knowledge work. It introduces epistemic tasks, forms and fluency as constructs that are useful in giving a more precise meaning to ideas about collaboration in knowledge construction. Discussion is seen as central to collaborative knowledge work and we examine the role of discussion in supporting weaker and stronger interpretations of collaborative knowledge construction.*

*Keywords: learning in higher education, learning through discussion, collaborative construction of knowledge, epistemic fluency*

### 1. INTRODUCTION

This paper has three related goals. First, we aim to build upon some ideas about learning in higher education explored in a recent issue of this journal by Effie Maclellan (Maclellan, 2005). Maclellan makes the important point that students are active interpreters of their learning environment and that variations in their understanding of learning, and in their interpretations of the tasks being set for them, result in differences in study behaviours that can, in turn, affect learning outcomes (Biggs, 2003). Maclellan attaches special importance to conceptual learning, arguing that propositional knowledge 'provides the potential for the generation of new knowledge' (p. 144). We extend this analysis by arguing for a richer and more action-oriented conceptualisation of the fundamental learning challenges of higher education. Our account transcends Maclellan's separation of knowledge and behaviour by introducing notions of *epistemic activity* and *epistemic fluency*. These provide a framework for linking knowledge and behaviour. Our second goal is to examine the place of discussion in higher education, paying particular attention to recent

research on students' interpretations of the role of discussion. We argue that discussion is, paradoxically, threatened, valued *and* taken for granted in higher education practice. It is surprisingly neglected in research on learning in higher education. As universities move towards greater use of collaborative online learning environments, in part to protect opportunities for students to engage in discussion within small groups, a better understanding of the nature and affordances of face-to-face and online discussion is becoming a pressing practical issue. Our third goal is to connect the development of epistemic fluency to learning through discussion by arguing that discourse is key to participation in collaborative knowledge work – that epistemic fluency is acquired through *participation* in epistemic activity rather than (just) through reflection on the epistemic achievements of others. The practical implication is that university education should be seen as an apprenticeship in knowledge work. This goes beyond mastery of a body of propositional knowledge created by others and must entail experience of working with others on the collaborative improvement of ideas.

The argument in the rest of this paper runs as follows. First, we offer a high-level synthesis of conceptions of the purposes of higher education to identify a central place for the acquisition of epistemic fluency. We then argue that epistemic fluency can only be acquired through active engagement in epistemic work, and that direct experience of collaboration in the improvement of ideas is an essential part of an apprenticeship in knowledge work. We then turn to discussion and show that what students think about learning through discussion has serious implications for whether and how they engage in collaborative knowledge work. We illustrate some different forms of collaborative knowledge work by drawing on some of our own recent teaching and development activity.

## 2. CAPABILITY AND LEARNING IN HIGHER EDUCATION

Learning is a second-order effect ... it transforms a system capable of certain performances into a system of additional ones. ... The study of learning, if carried out with theoretical precision, must start with a model of a performing organism, so that one can represent, as learning, the changes in the model. ... If performance is not well understood, it is somewhat premature to study learning. (Newell and Simon, 1972)

What should successful university graduates be able to do? Answers to this question underpin much of the debate about graduate

attributes (e.g. Barrie, 2006) and about the nature and purposes of higher education (e.g. Barnett, 1997, 2000; Brew, 2006; Taylor *et al.*, 2002). While it is sometimes possible to build a consensus around some specific answers to this question, for example, in relation to courses that are approved by an external professional body, more general answers tend to dissolve into vagueness and ambiguity, offering little basis for serious discussion about capability or curriculum.

Analysis of the literature on the purposes of higher education reveals three main schools of thought, which can be labelled the traditional academic, the vocational and the critical (Goodyear, 2006).

1. The *traditional academic* perspective on university education asks students to become competent in academic discourse, with its heavy reliance on declarative conceptual knowledge, contemplative forms of analysis and use of textual (including mathematical) representations (Barnett, 1997). Implicitly or explicitly, it acts as if the aim were to induct students into the work and world of the academic and their discipline. Depending on one's orientation to academic work, this can be interpreted as an attempt to share some core values of academia – engagement in the disinterested pursuit of knowledge – or conversely as a lazy, self-interested failure to connect with the changing realities of mass higher education.
2. The *vocational* perspective is pushed heavily by employers and their representatives, and by government agencies concerned about employability and international competitiveness. It values 'workplace readiness' in graduates, as well as an aptitude for life-long learning. It combines an interest in up-to-date, applicable, specialised technical knowledge with a more general set of competencies, such as the ability to work as part of a team, to have good communications skills, be numerate, capable with IT, etc. This perspective can be interpreted in terms of employers, as tax payers, insisting on value for money from their investments in public higher education. Conversely, it can be read as employers striving to externalise some or all their training costs.
3. The *critical* perspective emphasises personal reflexivity – the capacity to go on interrogating one's taken-for-granted universe – seeing this as necessary for dealing with an essentially unknowable modern world. In Ron Barnett's view, higher education needs to support the student in their acquisition of discursive competence: offering a deep understanding of some discursive realm and an insight into what it is like to handle with confidence the concepts, theories and ideas of a field of thought, to handle complex ideas in communication with others. It needs to encourage self-reflexiveness,

by framing the student's initiation into a field of thought such that they see its essential openness and how they may be actors in it. It also needs to encourage informed but critical action: understanding the power and limitations of the field as a resource for action (Barnett, 1997, pp. 22–25). A key part of Barnett's argument rests on a postmodernist conviction that we can have no certain knowledge of the world, and that consequently knowledge and skills become redundant or marginal (*ibid.*, p. 29). This perspective can be read as academia's accommodation with relativism – seen by some as a mature acknowledgement of limitations and by others as an abandonment of reason.

We are not concerned in this paper with an evaluation of the relative merits of these three perspectives. Rather, we want to draw on some of their unexpected similarities, in order to identify some pedagogical implications of this unlooked-for convergence. In short, we argue that it does not matter whether one is driven by an academic, vocational or critical interest in the nature of higher education: some of the pedagogical implications are the same. Central to our argument is the idea that knowledge is both relative *and* difficult. An extreme relativist position – what Mary Midgley nicely describes as 'goofy relativism' (Midgley, 1997) – acts as if relativism implies arbitrariness: as if the realisation that a claim to knowledge is dependent on a set of assumptions means that *any* claims to knowledge could be made within that set of assumptions. Instead, we prefer a position that simultaneously:

- acknowledges that different epistemic cultures each have their own axiomatic systems – that the system of beliefs within each culture depends upon a shared set of assumptions about the world and about ways of knowing: a shared ontology and epistemology,
- celebrates the complex achievements within epistemic cultures, recognising that coming to understand those achievements is cognitively demanding – it involves learning that can sometimes be very difficult.

Without labouring the point, we want to argue that the traditional academic conception of higher education is richer and on firmer ground when teachers within disciplines pay explicit attention to the ways in which knowledge claims within those disciplines depend upon ontological and epistemological assumptions. More of our students spend more of their time working across disciplinary boundaries; greater awareness of the ontological and epistemological shifts entailed in each boundary crossing can help them become more confident and perceptive travellers. The argument is slightly

more complex when we try to apply it to the vocationalist perspective. It is easiest to appreciate when we foreground participation in knowledge work. The growing scale and importance of knowledge work is now well-documented (e.g. Davenport, 2005; Nonaka and Takeuchi, 1995; Stewart, 1998). The creation of new knowledge is no longer dominated by universities, it takes place in many other institutions (Gibbons *et al.*, 1994). Much of the value added by companies in bringing products or services to market consists of knowledge work by their employees (Stewart, 1998). Similarly, in the public sector and professions, there is serious talk about the desirability of policy and practice becoming more evidence-based or evidence-informed. In short, the world of work – or at least that part of it inhabited by the growing mass of graduate workers – is suffused with epistemic activity. But we also need to show that this epistemic activity shares some of the contextual dependencies we have claimed are associated with epistemic activity seen from an academic or critical-reflexive perspective. The creation of new knowledge in the hard-nosed world(s) of business, commerce, government or professional practice may *look* as if it is treated differently – with less epistemological caution, for example. One might argue that ill-founded knowledge quickly leads to bankruptcy or a court case. But this would be to underestimate the complexity of knowledge work in modern times, when traffic in symbols is at least as important as traffic in material goods (Lash and Urry, 1994) and when building a career in a large company depends, in part, on the ability to learn, construct and act upon the complex organisational fictions that allow efficient co-ordinated action (Goodyear, 2006).

Pulling these three perspectives on higher education together, we argue that students benefit from induction into more than one epistemic community (knowledge-building community), such that they can engage in what Lave and Wenger (1991) call ‘legitimate peripheral participation’ in the work of each community and can also come to recognise that different communities have different knowledge-building practices. Such communities may be academic or vocational in their primary orientation, and ideally students should have experience of communities in which both the creation and the application of knowledge have value and are well-understood.

### 3. COLLABORATION IN KNOWLEDGE WORK

A strong element of this socio-cultural view of learning is that participation in authentic knowledge-creation activities, coupled with a growing sense of oneself as a legitimate and valued member of a

knowledge-building community, is essential to the development of an effective knowledge-worker. Action and identity are key. Maclellan (2005, pp. 143–144) is careful to acknowledge that simple dichotomies can be unhelpful. Nevertheless, a separation of behaviour and thinking is central to her privileging of propositional knowledge as key for the creation of new knowledge in a complex ever-changing world. We are happy to acknowledge that different kinds of knowledge are acquired in different ways, such that typologies of knowledge can be helpful in educational design (de Jong and Ferguson-Hessler, 1996; Ohlsson, 1995). Some well-accepted typologies acknowledge the action-oriented or skill-like qualities of some kinds of thinking, for example by recognising the existence and importance of ‘cognitive skills’ (Singley and Anderson, 1989; van Merriënboer, 1997). Cognitive skills do not sit comfortably with a dichotomy between action and thought.

We are not denying the importance of propositional knowledge. However, we are struck by the fact that formal education can be very good at producing what Whitehead called ‘inert knowledge’ (Renkl *et al.*, 1996; Whitehead, 1929). Transforming inert propositional knowledge into ‘working knowledge’ depends upon chances to apply such knowledge in situations that matter to the student and that bear a resemblance to situations of likely future application (Bereiter, 2002; Singley and Anderson, 1989). This helps explain our interest in educational designs that allow students to collaborate in the construction of knowledge, not just observe and memorise the outcomes of other people’s knowledge work. Our interest is neither new nor unique. There is a substantial body of literature in the learning sciences on participation in knowledge-building communities, associated particularly with the work of Carl Bereiter and Marlene Scardamalia (e.g. Bereiter, 2002; Bereiter and Scardamalia, 2003; Scardamalia *et al.*, 1994). This line of work has established a foothold in higher education, particularly in the context of postgraduate programmes for continuing professional development (Brew, 2006; Goodyear, 1995; Goodyear and Steeples, 1998; Knight, 2002).

Learning through legitimate participation in a knowledge-building community is a pedagogical idea that achieves greater substance and specificity when one is able to say more about its characteristic products and processes. To do this, we draw on some ideas of Stellan Ohlsson and Allan Collins – ideas which first entered the literature in the early to mid 1990s but which have not been widely taken up (Collins and Ferguson, 1993; Morrison and Collins, 1996; Ohlsson, 1995; and see also Perkins, 1992). Ohlsson uses the achievements of cognitive psychology in modelling the development of cognitive

TABLE 1: *Ohlsson's epistemic tasks (after Ohlsson, 1995, p. 51)*


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Describing	To fashion a discourse referring to an object or event such that a person who partakes of that discourse acquires an accurate conception of that object or event
Explaining	To fashion a discourse referring to an event or pattern of events such that a person who partakes of that discourse understands why that event or pattern of events happened
Predicting	To fashion a discourse such that a person who partakes of that discourse becomes convinced that such and such an event will happen
Arguing	To state reasons for (or against) a particular position on some issue, thereby increasing (or decreasing) the recipient's confidence that the position is right
Critiquing (evaluating)	To critique a cultural product is to fashion a discourse such that a person who partakes of that discourse becomes aware of the good and bad points of that product
Explicating	To explicate a concept is to fashion a discourse such that a person who partakes of that discourse acquires a clearer understanding of its meaning
Defining	To define a term is to propose a usage for it.

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skills as a lesson for how to tackle the harder problem of modelling what he calls 'higher order learning' – the kinds of learning implicated in *coming to understand*. He argues that an account of 'coming to understand' is best approached through identifying a set of epistemic tasks (see Table 1) and that higher order learning may be conceived as learning to perform such epistemic tasks. The intimate connection between understanding and language is evident in the formulation of task descriptions in this short but comprehensive taxonomy.

Collins's contribution is to extend this notion of epistemic tasks in two ways. First, he points to the existence of epistemic *forms*: defined as *target knowledge building structures* characteristic of, and made available by, a culture. Collins is thinking particularly about scientific cultures and formal education in science and mathematics so his examples of epistemic forms include such things as models (of various kinds, such as systems dynamics models, developmental sequence models), hierarchies and taxonomies. Some interesting excursions in cognitive anthropology will be needed to identify important epistemic forms from other academic and professional cultures. As tasters, we offer: precedents, legal opinions and judgments (from the law) and differential diagnoses (from medicine).

Secondly, Collins develops the idea of epistemic games: the 'sets of moves, constraints, and strategies that guide the construction of knowledge around a particular epistemic form' (Collins and Ferguson,

1993; Morrison and Collins, 1996, p. 109). Epistemic games are ways of representing the approved methods of constructing new knowledge in a culture. In science, we can think of experimental methods, hypothesis-formulation and testing but also a whole panoply of taxonomic and modelling activities. Modelling activity also extends beyond scientific work and is the best way of making the transition to thinking about epistemic games in other areas of professional or commercial work. Epistemic games differ from Ohlsson's epistemic tasks in that the latter are ways of describing individual accomplishments while the former are characteristics of an epistemic culture. Collins also points out that one learns to play an epistemic game by playing the game itself: not by watching others, nor by reflecting on outcomes. To be an accomplished cricketer, one needs to play cricket – though watching and analysing the games of others can help. In Collins's view, one gets better at playing an epistemic game by playing the game with people who are already better at it than you are. Hence engagement in collaborative knowledge-building is essential to the mastery of epistemic games.

We can now give a more precise definition of epistemic fluency, again drawing on Collins. Epistemic fluency is the ability to *recognise* and *practise* a variety of epistemic games. From the days of Plato to the complex societies of late modernity one can see that there are many different ways of knowing, many different kinds of epistemic games. Epistemic fluency allows one to perceive these games and engage in them. Epistemic fluency allows one to recognise, appreciate and understand the subtlety and complexity of a belief system that one has not encountered before, whether that belief system is associated with a religious or ethnic community, or a scientific or professional community. It is important to inter-cultural and inter-disciplinary understanding and capability. It is a long way from 'goofy relativism' – more like an action-oriented form of 'intelligent pluralism' (Midgley, 1997).

Collins's theory of playing epistemic games is closely related to Carl Bereiter's conception of knowledge-building as participation in the collaborative improvement of ideas. In his latest book on education in the knowledge age, Bereiter (2002) draws on the Popperian notion of three distinguishable worlds (Popper, 1972). World 1 is the objective, physical world. World 2 is the subjective inner world of mental states, feelings, and beliefs. World 3 is the world of ideas. World 3 is objective (not dependent on any one individual's mental world) and is home to the ideas, theories, explanations etc. that are made available and shared within cultures (Bereiter, 2002). Bereiter develops the concept of World 3 as a sphere of activity, a productive

knowledge world, a place where ideas are applied and improved. As a way of pinning down the distinctive quality of knowledge work he introduces the idea of 'conceptual artifacts' (Bereiter, 2002, p. 58). Conceptual artifacts are ideas, theories and so on: human, immaterial creations having internal logic and serving purposes such as explaining, connecting, predicting, or applying. Most importantly, conceptual artifacts are objects which can be worked on through being shared and improved. Collins's notion of (abstract) 'epistemic forms' offers a way of classifying Bereiter's (concrete) 'conceptual artifacts'. We introduce Bereiter's use of the Popperian distinction between Worlds 2 and 3 here because it is key to a distinction he makes between knowledge building and learning. Knowledge building, for Bereiter, is a World 3 activity that can have World 2 side-effects. Engagement in collaborative knowledge building can engender learning, but the two are not the same. Learning is personal (World 2); knowledge-building is public (World 3). We return to this important distinction shortly, because it sheds light on two contrasting conceptions of the role of discussion in higher education. We turn to discussion now, but with a particular interest in the ways that students conceive of its nature and purposes. Variations in these conceptions can have significant effects on how and what students learn.

#### 4. LEARNING THROUGH DISCUSSION: STUDENTS' CONCEPTIONS AND APPROACHES

Our focus is on discussion because of the central place that discussion has in collaborative knowledge-building and in epistemic activity more generally. Discourse is central to Ohlsson's conception of higher order learning, and Morrison and Collins (op cit.) see their work as bridging between theories of conceptual change and sociolinguistic theories of language use. There has been surprisingly little research on learning through discussion in higher education. One notable exception is the work of Helen Askill-Williams and Michael Lawson: a study of students' beliefs about learning through discussion that takes data from school students as well as students in higher education (Askill-Williams and Lawson, 2005). The following quotation from a student interviewed in their study nicely illustrates some of the perceived connections between discourse and learning:

... you're actually forming your own ideas and verbalising them. Your sitting there discussing your ideas, and as you're trying to explain it to someone else you're actually getting your ideas as concise as you possible can. So you're actually thinking this is what

I'm trying to say. Oh my God, this is what I've just said, quick let me write it down because this is what we believe, this is my theory, this is what I've learned. (Askell-Williams and Lawson, 2005, p. 96; student interview transcript)

The richness and variability of the knowledge that students have about discussions is evident in the five categories of use of discussion emerging from the interview data (Askell-Williams and Lawson, 2005, pp. 99–103):

- a) Information acquisition
  - Discussions help me gather information
  - Discussions help me to clarify information
- b) Knowledge construction
  - Discussions open my eyes to new points of view
  - Contributing to discussions helps me to formulate my own thoughts
  - Discussions help me to clarify my own opinions
  - Discussions with a mentor help me expand my thinking
  - Discussions facilitate co-construction of knowledge
- c) Motivation
  - Discussions make the lesson more interesting
  - Discussions generate engagement
- d) Remembering
  - Discussions trigger my memory
  - Discussions reinforce my learning
- e) Comparisons
  - Discussions allow me to compare myself with other people
  - Discussions inform self-efficacy beliefs.

Askell-Williams and Lawson's data are derived from students whose experience of learning through discussion has been largely or wholly in face-to-face situations. Robert Ellis, Peter Goodyear and their team at the University of Sydney have been examining university students' beliefs about learning through discussion, where the discussions have been designed to extend across both face-to-face and online contexts (Ellis *et al.*, 2006). This research has been conducted using a phenomenographic approach, in which the focus is on students' and teachers' experiences of learning through discussion. It builds on earlier work in a similar vein (Ellis *et al.*, 2004; Ellis and Calvo, 2006; Goodyear *et al.*, 2005; Light *et al.*, 2000).

The latest studies by Ellis, Goodyear *et al.* involve both in-depth interviews with students and broader, questionnaire-based research.

TABLE 2: *Categories of conceptions of learning through discussions (after Ellis et al., 2006)*

<i>Conception A</i>	Discussions as a way of challenging ideas and beliefs in order to arrive at a more complete understanding
<i>Conception B</i>	Discussions as a way of challenging and improving your ideas
<i>Conception C</i>	Discussions as a way of collecting ideas
<i>Conception D</i>	Discussions as a way of checking your ideas are right

TABLE 3: *Categories of approaches to learning through discussions (after Ellis et al., 2006)*

<i>Approach A:</i>	Engaging in face-to-face discussions to analyse experiences and opinions through feedback Engaging in online discussions to evaluate postings to reflect on key ideas
<i>Approach B:</i>	Engaging in face-to-face discussions to analyse experiences and opinions Engaging in online discussions to evaluate postings to challenge ideas
<i>Approach C:</i>	Engaging in face-to-face discussions to hear other experiences and ideas Engaging in online discussions to use postings to add to ideas
<i>Approach D:</i>	Engaging in face-to-face discussions to fulfill task requirements Engaging in online discussions to read postings to avoid repetition

The aim of this work has been to identify qualitative variations in students' conceptions of, and approaches to, learning through online and face-to-face discussion. It turns out that students have much more to say about World 2 than World 3.

Four categories of conceptions of learning through discussions have been identified, and are summarised in Table 2. They are best read from bottom to top.

Categories A and B refer to discussions conceived as a way of challenging the ideas being discussed to enhance understanding and can be described as *cohesive* conceptions of learning. In contrast, categories C and D conceived of discussions as being about checking the accuracy of ideas rather than developing and reconceptualising them, and can be described as *fragmentary* (Ellis *et al.*, 2006).

Approaches to learning through discussions have also been encapsulated in four categories, summarised in Table 3 and again best read from bottom to top.

TABLE 4: *Categories of conceptions of learning through discussions (after Ellis et al., 2006)*

Category	Description	Representative quotation from student interviewee
A Challenging ideas	Discussions as a way of challenging ideas and beliefs in order to arrive at a more complete understanding	<i>It [discussing] challenges my beliefs, which is always good ... because a belief is something that is based on knowledge and experience and your understanding of the world, and if it is being challenged you are testing it ... If my beliefs are challenged, I believe that my understanding of concepts is more complete.</i>
B Developing ideas	Discussions as a way of challenging and improving your ideas	<i>It sort of gives you different views of what people are getting out of the readings and stuff ... it helps me, I guess, just because I am not getting stuck in just this one mindset, it sort of makes me for a topic to go deeper, and just get other perspectives ... I guess it gives me an appreciation that people do see it differently, that it's not clear cut. It's one thing having my opinion, and it will mean different things to different people.</i>
C Acquiring ideas	Discussions as a way of collecting ideas	<i>It elaborates the readings even more like it sort of expands the readings out a bit ... when you go to the tutorials and you express your ideas, it sort of makes them valid to yourself. Like you sort of remember it a bit more by the end of the tutorial ... you just get to learn a bit more about the other people's ideas.</i>
D Checking ideas	Discussions as a way of checking your ideas are right	<i>Getting the teacher's point of view ... it's good being able to talk and make sure you are really learning what you are supposed to be learning. It is just sort of reassuring.</i>

Categories A and B are approaches showing an intention to come to an improved understanding through analysis and reflection (sometimes referred to as a 'deep' approach to learning). In contrast, categories C and D show an intention which is more concerned with the surface form of the task than with achieving a deeper understanding of the ideas implicated in the task. A parallel quantitative study investigating conceptions of learning in relation to course mark indicated that those students who had a deeper conception did better in the course than those with fragmented conceptions of learning (Ellis *et al.*, 2007).

Table 4 gives a richer flavour of the variations in conception of learning through discussion.

Category D evinces a consciousness of what other people think and the extent to which their ideas have being worked through. As we move up the categories, there is an *inward turn* between Category C and Category B – the higher conceptions are more about internal

change or personal conceptual development than they are about the ideas of others.

This inward turn is even more marked in the classic phenomenographic paper on conceptions of learning by Marton *et al.*, (1993). They described six conceptions of learning, of which the most elaborate are at the top of the following list:

- learning as changing as a person
- learning as seeing something in a different way
- learning as understanding
- learning as applying
- learning as memorising and reproducing
- learning as increasing one's knowledge. (*ibid.*, pp. 283–284)

Marton *et al.* distinguish the top three conceptions by introducing the idea of 'meaning' – that these more elaborate conceptions of learning are characterised by personal meaning-making. We note that these conceptions also have a strong inward focus: they are the stuff of Popper's World 2. The important point to be made here is that these unidimensional hierarchies of conceptions of learning may be conflating two different dimensions of variation. One dimension concerns personal sense-making and personal epistemology. The second dimension concerns the epistemic activity of other people. These conflated dimensions relate to World 2 and World 3 respectively.

##### 5. WEAK AND STRONG INTERPRETATIONS OF KNOWLEDGE-BUILDING

Active engagement in the collaborative construction of knowledge is a core quality and a necessary prerequisite for the development of epistemic fluency. An improvement in students' understanding at the conceptual level without any direct engagement in collaborative knowledge building communities is inadequate for preparing for participation in the knowledge age. Here, Bereiter's use of Popper's three worlds helps us distinguish between weak and strong notions of knowledge building. Recall that World 2 is an inner subjective world: it is the world of individual learning. World 3 is an active, evolving space where ideas are being worked through, applied and refined collaboratively in groups and in communities. Conceptual learning involves the development of personally-meaningful ideas at the individual level and, being less concerned with the collaboratively constructed nature of knowledge, inhabits World 2. But the personal mental flexibility associated with conceptual learning (Maclellan, 2005) is insufficient to prepare students to be able to

create new knowledge in an ever changing world which demands recurring refinement of existing frameworks and their subsequent adaptation to new situations and environments. Epistemic fluency grows from playing epistemic games in World 3.

Within the learning sciences, particularly in the field of computer-supported collaborative learning (CSCL), there is significant interest in supporting collaborative knowledge building through providing scripts for collaboration and other forms of scaffolding (e.g. Schrire, 2004; Weinberger *et al.*, 2005). But on close examination, it turns out that this strand of research is primarily concerned with ‘knowledge-building’ in World 2. That is, it uses the metaphors of building and construction to refer to conceptual development of the individual (‘constructing one’s own knowledge’). It sees collaboration in knowledge building as a means to an end (learning in the World 2 sense) not as something which has an intrinsic (World 3) value. We can therefore see Bereiter’s version of knowledge building in World 3 as a *strong* interpretation of knowledge building. Participation in collaborative knowledge building for the purposes of improved *personal* understanding, rather than for the improvement of conceptual artefacts in World 3, is a weak version of knowledge-building whose consequences persist mainly or only in World 2.

## 6. COLLABORATIVE KNOWLEDGE-BUILDING IN ONLINE COMMUNITIES

In some of our earlier work as educational technologists, we developed conceptions of collaborative professional learning in geographically distributed communities of practice that embodied this strong notion of knowledge building (see e.g. Goodyear, 1995; Goodyear and Steeples, 1998; Zenios *et al.*, 2004). In part of this work, we evolved pedagogical approaches that asked groups of professionals to externalise aspects of their tacit professional knowledge, subject it to collaborative critique and improvement and find ways of ‘re-embedding’ improved conceptual artefacts into their working routines and workplaces. The central pedagogical idea was of creating online repositories of ‘shareable representations of practice’ and of reifying professional knowledge in texts, tools and methods (Goodyear and Steeples, 1998). Using the Bereiter/Popper distinctions, this pedagogical approach used discussion as a way of moving knowledge from World 1 (where it was tacit and embedded in working practices and tools), to World 2 (individual consciousness), to World 3 (ideas represented in shared online documentation, subjected to collaborative improvement) and back to World 1

(embedded in new tools and work processes). In similar work, we have observed trainee teachers using online discussion tools to represent and share ideas about productive learning activities, creating shared repositories of pedagogical ideas reified as online texts and links to useful resources (Zenios *et al.*, 2004).

This interpretation of epistemic activity again marries ideas and action; conceptual knowledge and procedural knowledge. It extends our thinking about the scope of knowledge building in at least two (related) ways. First, it moves beyond the space of scientific modes of knowing – the epistemic games and forms of academic science – to embrace ways of knowing, coming to know, and knowledgeable action that are characteristic of professional communities of practice. Second, it illuminates some paths between Worlds 1, 2 and 3 by acknowledging the importance of knowledge that is embedded in tools, workplaces and professional routines.

We think there is a particular, valuable role for online discussion and collaboration in this regard. Face-to-face discussion can be very good for exploring ideas, comparing perspectives, and establishing the trust and shared understanding necessary for productive collaboration. But it leaves no visible trace. On-line discussion can be clumsy and stilted, but it is *persistent* discourse. While conceptual artefacts inhabit World 3, they have *representations* in World 1 – such as in online texts. This distinction is not very apparent in the literature that provides advice to teachers who want to make use of online discussions. The main point is to recognise that online texts, in the context of collaborative knowledge building, can be both a means for improving conceptual artefacts and a way of representing them. Collins's idea of epistemic forms can be used to help students recognise *how* they should be representing shared knowledge – understanding what is an acceptable way of representing a knowledge claim in a culture. In much of the online discussion transcript material we have analysed over the years, there is no clear separation between text that represents a conceptual artefact and text that emerges from the process of creating or improving a conceptual artifact. Product and process are confused. It will be valuable for these two roles to be distinguished in the guidance teachers provide to their students, as well as in the tools that support online activity.

## 7. CONCLUSIONS

In this paper we have argued for a more action-oriented conceptualisation of the learning challenges of higher education. The notions of epistemic activity and epistemic fluency are pertinent to such an

account and they offer a way of pinning down some of the slippery thinking about the capacity to engage in knowledge work. We have argued that this is possible, and worthwhile, whether one is considering epistemic activity in the natural or social sciences, or in professional practice. Discussion – face-to-face, online or both – plays a major role in epistemic activity when it is seen as collaborative knowledge-building or the collaborative construction and improvement of conceptual artifacts. As higher education institutions move towards greater use of collaborative online learning environments, sharper ways of thinking about discussion and apprenticeship in knowledge work will become important. In particular, the ease of publishing the outcomes of students' knowledge-building activity will soften some of the boundaries around the peer-reviewed 'published' academic literature and create new opportunities for students to act as legitimate peripheral participants in the work of a range of epistemic communities. This raises lots of issues about identity, role, authenticity, the status and ownership of published knowledge, etc. The practical discourse of higher education is suffused with woolly thinking about such matters. We believe that the constructs of epistemic fluency, games and forms, together with some clearer ideas about discussion and collaboration in knowledge work, can help sharpen our language as well as our thinking in these important areas.

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