Versions of computer supported collaborating in higher education

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When young people first started to make use of personal computers, social scientists observed their activity and issued warnings. They advised that this was a compulsive technology and one that could cultivate in the user a rather solitary style of engagement (Levy, 1984; Turkle, 1984; Wiezenbaum, 1976). Accordingly, as computers began to migrate into classrooms, there was an inevitable fear that the experience of teaching and learning would change in ways that echoed this (Bliss, Chandra and Cox, 1986; Lichtman, 1979; Woodrow, 1987). Perhaps learning would become less interpersonal. Perhaps pupil-machine interactions would replace the congenial bustle of classroom talk and activity.

Such fears were unfounded. In fact, matters developed in the opposite direction. Classroom computers became the catalyst for pupils to do work together – not alone. One simple reason was that classrooms had very little of this technology, while pressure on teachers to use it was great. The natural solution was to have pupils share the use of a single computer: in short, to work in small groups. Teachers then began to notice that these groups were quite animated. Indeed, in the UK at least, this allowed teachers to make progress on another professional pressure: namely, encouragement to develop more collaborative work among learners (a policy trend reviewed by McMahon, 1990). Unsurprisingly, educational researchers began to notice what was happening in classrooms and, by the mid-1990s, the field of "computer-supported collaborative learning" (CSCL) emerged to address these developments (Crook, 1994; Koschmann, 1996; O'Malley, 1995).

Any new research field will want to build a relationship with some theoretical tradition. Then, if that field flourishes, it will - in its own way - inspire and progress the underlying theory. That has happened for CSCL research and more will be said about it below. However, there is another relationship to consider. Any new educational research field will also want to influence mainstream *practice:* it will want to influence events beyond the laboratory. Again, there is no doubt that this has occurred.

So, in the present chapter, I wish to coordinate around these three themes. I am therefore concerned with CSCL's evolving synergy between theory, research method, and legacies to practice. However, this practice of education is inevitably lived out in a very wide range of settings for teaching and learning . Such "sites for learning" have their own distinctive ecologies and it is important to expose and understand them. Because, for innovators, learning sites may differ in ways that present a challenge to the design process. It follows that some settings may be more receptive than others to those interventions that are derived from new research and theory – such as CSCL. In particular, some settings may be more resilient than others. They may be more cautious in responding to any such implications for change.

Here I shall consider these matters as they relate to CSCL in typical higher education: that is, full time, post-secondary students living in or around a campus. I shall argue that innovations associated with the emergence of CSCL have proved particularly

challenging to implement in higher education. Yet more recent lines of thinking about the management of collaboration may now offer greater promise. I illustrate this promise with two modest interventions of my own: examples that suggest at least the *spirit* of what might be possible.

The chapter is organised as follows. The first section below sketches theoretical influences that have consistently framed the CSCL venture. This reminds us of what that venture is. In particular, it defines the ambitions for successful CSCL-led innovation in universities. I then turn from theory to practice. The three following sections address contrasting but established designs for implementing computer-supported collaboration, considering the status and fate of each in higher education. I argue that the third of these designs represents the most useful and well-adapted way forward. However, promoting it needs to be properly theorised and this requires a final section of the chapter. Here we return to consider more deeply the very nature of collaboration as an experience of learning. So, in effect, this fifth section comes full circle to re-visit theory, considering again the psychological basis of collaborative configurations for learning.

Theoretical influences of and on CSCL research

Much research in CSCL continues to pitch its analyses at the level of individual learners: characterising their agency and outcomes, and all rather decoupled from broader social and institutional contexts. Yet a significant core of CSCL research has tracked a shifting conceptual climate in cognitive and developmental psychology that contrasts with this individuated approach This shift might be termed an "enculturing" of cognition (Cole, 1996; Markus, and Kitayama, 1991; Shore, 1996; Shweder, 1991). Partly, this requires seeing cognition as inherently shaped by the particular "designs for living" – the culture - in which each individual happens to find themselves. More especially, it requires theorising cognition as "distributed" across the material, symbolic, and social resources available in that specific cultural niche (Donald, 1993; Hutchins, 1991). So, mind, being constituted through its relations with such resources, is no longer best studied by considering the individual actor in isolation. Cognition is not to be theorised as something private: not as processes circumscribed by the skull.

This implicit prescription about how we best *study* cognition is the important one for an enculturing perspective. If the claim is merely that thinking is "shaped by culture", or that it tends to "engage with" the artefacts and members of a culture – then surely no cognitive psychologist can object. And formulations frequently can be as benign as this. So much so, in fact, that a cognitive theorist of any persuasion can surely accommodate them. However, this will often mean treating culture as a set of "independent variables" acting on the "dependent variable" of learning. This is not what is expected by theorists who really put culture at the centre. By insisting that cognition is actually *constituted* within culture, this theoretical tradition requires that any occasion of thinking or learning is studied only and always with careful attention to its context. Problem solving is studied as something realised through engagements with *particular* worlds at *particular* moments.

The practice of CSCL squares up nicely with such a cultural theory of cognition. This is because its practical focus always entails a human agent acting with a cultural member (collaborator) and a cultural artefact (computer) in the (cognitive) interests of

learning. As a research agenda, this is an almost canonical case for inviting the integration of culture with cognition.

As well as tracking evolving cognitive theory within Psychology, CSCL has also emerged alongside shifts in our *everyday* conceptions of thinking and problem solving. There is now a popular belief that the modern workplace demands from individuals a willingness and ability to coordinate mental effort with others (Schrage, 1990). In particular, working in the new digital economy requires a style of thinking that is comfortable with the social structures of networking and teamworking (Brown and Duguid, 2000; Nardi, Whittaker and Schwarz, 2000). Faced with this changing societal and political context, educators have welcomed CSCL as a force for shaping classroom learning in work-relevant ways.

This resonance of CSCL with both cultural theories of cognition and with societal trends is captured within two quotations taken from seminal contributions to a recent handbook of learning science (Sawyer, 2006). The first reinforces the previous point about the corporate demands of thinking in workplace settings. It notes how a more cultural ("situative") approach to cognition is better adjusted to this reality than traditional theories:

> *"A situative approach, in contrast, begins by noting that problem solving often occurs in group settings"* (Greeno, 2006, p.85)

The second quote borrows this "situative" term, builds upon Greeno's observation of the natural or everyday conditions for problem solving, and thereby aligns CSCL with a *radical* tradition of theorists who:

> *"..aspired to construct a new view of learning and knowing, one that properly located it in the world of everyday affairs. CSCL embraces this more situated view of learning, thereby rejecting the foundations of conventional educational research. CSCL locates learning in meaning negotiation carried out in the social world rather than in individuals' heads"* (Stahl, Koshmann and Suthers, 2006, p.416)

This allusion to "the world of everyday affairs" offers a useful reference point for relating the methods and theorising of CSCL to designs more intended for sites of formal learning. Insofar as locating learning and knowing in everyday affairs entails talking and tool use, then CSCL certainly offers a credible scenario. It positions learners to *negotiate* meaning while acing in a richly *mediated* environment. . Yet there remains something to be scrutinised in the CSCL position articulated above: namely an insistence in this community that meaning making is *inevitably* a (social) "negotiation" and, thereby, a resistence to recognising any private forms of such achivement. This point will be returned to later.

From the outset, the almost exclusive empirical formula for CSCL researchers to pursue their concerns was through short episodes of pupil interaction around some computer-based problem. Such scenarios can be studied either through the lens of learning-as-acquisition or through the lens of learning-as-participation (Sfard, 1998). An acquisition view might encourage framing these collaborating episodes with pre-

testing and post-testing of learners' domain knowledge. In which case, the CSCL scenario becomes a kind of educational method or learning procedure through which individuals might be shown to *acquire* new knowledge. Alternatively, a more participative view on learning might invite analysing the discourse of collaboration itself. In which case, analysis of these episodes could reveal how far the interpersonal process of collaboration created a sense of learners *participating* in the construction of new knowledge.

So far, the following claims have been made. First, in terms of theory, CSCL has offered a view of learning that prescribes it to be strongly interpersonal, mediated, and active. Second, in terms of research method, an early (and still central) strategy has been to analyse pairs or trios of pupils solving some problem around a computer. Finally, in terms of educational practice, CSCL has resonated with teachers' interest in using computers to facilitate small group work. This kind of group work is sometimes termed "synchronous" collaboration. The collaborators are convened at a common time and place – within which their joint activity proceeds to completion. However, it was noted earlier that research-led designs for educational practice – such as synchronous collaborating - do not always fit neatly into the ecologies of particular educational settings. That tension will be explored next in two chapter sections that evaluate CSCL designs within higher education. Two further sections then attempt to resolve the tension. In them we explore neglected aspects of CSCL in relation to first, practice and, second, theory.

Higher education and synchronous collaborating

Universities place learners in rather different settings to the school environments in which much CSCL research has been carried out. We may derive some sense of this from natural history research on how undergraduates actually spend their time as learners. Figure 1 provides data from one such study (Crook, 2002a) in which 45 students stratified across teaching faculties kept detailed activity diaries for a week. Across the day, they recorded engagement in a variety of study (and leisure) activities down to a resolution of 15-minute blocks.

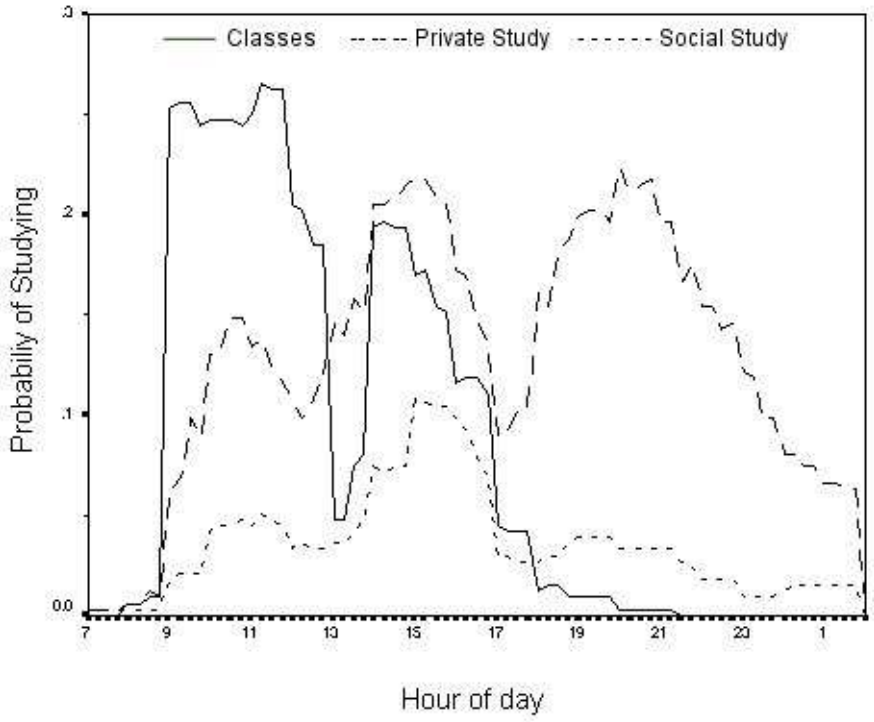

Figure 1: Average probability that an undergraduate will be engaged in various types of study as a function of time of day. Data from 45 students keeping diaries over one week.

The rather low probability of social study in the evenings (when no classes are timetabled) reminds us that collaborative study is not a very favoured way for students to organise their independent learning (cf. self-report data from undergraduates documented by Crook (2000, 2002b)). Moreover, interview data suggested that this "social" study might often involve merely a decision to share a local study space. Exploratory learning conversations on such occasions might be fairly intermittent and low level. Sociometric data from one representative class suggests that *recreational* connections between peers were very well developed, yet convening outside of class for the sole purpose of *study* was rare (Crook, 2002c). This is the situation even though all these students were resident and studying on a large, geographically continuous university campus (with very high standing in government teaching audits).

This pattern characteristic of *self*-governed study is reproduced for study governed by *classes*. So, we note from Figure 1 that classroom time was infrequently experienced as a social or collaborative occasion of peer interaction. And when it was, it tended to be as rather tightly-orchestrated (afternoon) lab work. Other data from this project revealed that computers were heavily used by these students, yet it seems that computer-supported collaboration was not a significant part of their learning – at least in the traditional format of CSCL research. For these students, co-present social studying remains an irregular experience (with our without computers).

It is necessary to reconcile the observation that "problem solving often occurs in group settings" (Greeno, 2006, p.85) with the observation that the problem solving of undergraduate learning is most likely to be rather solitary – at least if we take "group"

to imply occasions of directed conversation. This in turn invites careful specification of what follows from the claim that "CSCL locates learning in meaning negotiation carried out in the social world rather than in individuals' heads" (Stahl, Koshmann and Suthers, 2006, p.416). Such claims can usefully stand, as long as we recognise that "social" is not to be innocently equated with its everyday connotation of "conversational". A lecture (or even the reading of text) could be termed a "group setting". But this can be done only if we allow that there is an implicit dialogue between the learner and the lecturer/author (at least if the latter is engaging in ways that the art of teaching demands). A lecture thereby becomes "social" by virtue of the encultured modes of (private) conversation that are evoked by the successful lecturer.

By the same token, commitment to social theories of learning should not suggest that there is simply no such useful thing as a process of solitary reasoning (albeit drawing on socially-encultured categories of thought). We must confront the reality that such processes do indeed take place – even outside the dialogues of reading, listening, or talking: going on, if you will, in "individual's heads". The problem is not that this restriction of view about learning is what is being actually promoted in, for instance, the quotations discussed above. The problem is that the CSCL project in general may too easily get interpreted this way. What may then follow is an insistence that learning must, wherever possible, be optimised into a form of synchronous conversation, a kind of vigorously-resourced group work. Such a view tends to be forever chasing the collaborative episode as the preferred scenario of learning: that is, a circumscribed problem-solving occasion which is governed by live conversation.

The fieldwork observation above – that collaborative study of that sort is, in practice, rather rare among undergraduates - does not, of course, imply that this is how things inevitably have to be. Perhaps one message of the CSCL experience is that we should intervene to make collaborative study episodes simply more commonplace. Yet what has actually taken place in the CSCL research community is a different strategy. It involves a broadening in the understanding of "collaboration", so as to allow that circumstances of joint activity need not be synchronous at all. This has not simply been a response to inertia in the rather solitary study practice among undergraduates. It has been a response to the emergence of a very different mode of configuring higher education: namely distance learning. It has stimulated visions of a more "virtual" kind of university.

Higher education and asynchronous collaboration

Societies dependent on an information and communication technology (ICT) that evolves so rapidly need a workforce that adapts to these changes. In short, a workforce receptive to lifelong learning must be cultivated within such societies. They may even identify themselves as "learning societies" (Blair, 1999). In such a situation, it may seem that access to university learning through the traditional age-governed route can never be sufficiently flexible. Lifelong learners need to pace their studying according to individual needs and opportunities. Perhaps what they seek is "personalised learning" (DfES, 2004) What is certainly clear is that they may not appreciate being disciplined into periods of study that must occur at defined times and in set places. Yet if "personalising" entails not having to congregate in this manner, then learning through collaboration looks rather difficult to provide. At least it does if

we persist with a sense of “collaborating” that requires convening students into synchronous conversations.

The architects of virtualised distance teaching at university level are probably sensitive to educational theorising that stresses the significance of social interaction for learning. Certainly, e-learning designers (of virtualised distance learning) have embraced the collaborative ideal. Indeed if ICT has proved a gift to lifelong and distance learning, it is not simply because ICT provides an effective delivery vehicle for course content – which it certainly does. It is also because networked computers provide a vehicle for distance learners to exercise a form of conversation and, hence, participate in a form of collaboration.

For the most part, such discussion will be text-based. Although, being geographically distributed does not mean that it can not therefore sometimes be synchronous. So-called “chat” systems can furnish that synchrony. However, for the formal designs of most distance learning, asynchronous communication is a better understood and more widely used medium. Such communication will, again, be largely text-based. Clearly, collaborating through an asynchronous text-based discussion is not going to feel the same as collaborating through synchronous verbal conversation. Achievements that arise from the fast pace and rhythm of talk will be lost. Achievements that depend upon visual contact with the paralinguistic correlates of talk will also be lost. On the other hand, new opportunities will arise from being able to measure and plan one’s individual contributions. Or from being able to revisit and reflect on the (written) turns in an unfolding exchange. All of which variety reminds us that collaborating – as a format for learning – can never be mediated through any singular technical design. The manner in which contributions are given and received within joint activity can be made to vary considerably, depending on the tools that support such exchange.

The growth of e-learning inevitably stimulated CSCL researchers to shift their interests towards these new contexts for computer-supported collaboration. However, the concern of this chapter is less with distance learners and more with collaborative frameworks for traditional, campus-oriented university populations. In that context, there is little evidence that computer-based asynchronous designs are being widely adopted. The fact that these populations often furnish the participants for small-scale research on such communication does not mean that the practice is commonplace within their own experience as learners.

Again, the campus furnishing the data in Figure 1 above provides a compelling example. Here, a locally-designed virtual learning environment (VLE) has been in operation for eight years (at the time of writing). It comprises a web-readable filespace that offers a hypermedia arena for every module taught. Moreover, the frame in which staff may store their course-related materials includes a prominent link to a user-friendly, threaded, text-based discussion forum for each module. This is visible to any student taking that module and any student may make entries from any internet-enabled computer. The maturity of this VLE means that it is extensively populated by staff (posting their course materials) and widely accessed by students. However, studying the use of the discussion boards on this system, reveals that, at the end of the year, less than half of the module boards have any postings on them at all. Moreover, the median number of postings on those that do is less than 10. These are

short, frequently playful and, very often, they merely seek clarification on routine matters to do with coursework or examinations. Only very occasionally did one find an exchange that seemed to illustrate a real effort at collaborative meaning-making.

It is interesting that students do not find this mode of communication a very convivial prop for informal collaborative learning. That in itself is a useful discovery and a worthwhile challenge. Enthusiasts for asynchronous text collaboration will argue that its success on campus will depend on a more orchestrated effort of interaction *management*. In particular, that staff will probably need actively to prompt such exchange – and actively to coordinate it. Again it is interesting that this did not seem to be happening in this particular environment. It reminds us of other obstacles to be tackled. These will, for instance, concern the time and effort that such coordination demands of staff. Moreover, documented experience of doing such communication management suggests there is as uncertainty which students still bring to the initiative (Tolmie and Boyle, 2000).

Of course networked computers can support collaboration that is not structured by the designed spaces of VLEs and which is not initiated by the encouragement of tutors. But again, in this representative campus we found that use of the medium in this spirit was scarce. For instance, when email content was tracked across a single week (by students' self-coding), it was found to include very little content that would pass for collaborative study-related discussion (Crook, 2002b). If computer-mediated collaborative exchange was going to occur among these students at all, it was rather more likely to do so in desktop chat systems than in the formalised (and more public) structures of the local VLE.

Once again, invoking fieldwork observations from higher education has been rather dispiriting to the promise of CSCL in this sector. Despite a rich infrastructure of personal and institutional computing, there is little evidence that the technology is routinely supporting learning that is collaborative. This judgement arises from reflection on the two major realisations of CSCL discussed above: first, organised occasions of synchronous interaction *at* computers and, second, more extended threads of asynchronous interaction *through* computers. Yet there is a third approach to design that is more far-reaching and, consequently, less well tested. I turn to this next in order to explore its potential.

Higher education and blended, progressive collaboration

Earlier, reference was made to Sfard's (1998) distinction between conceptions of learning based upon the metaphor of acquisition versus the metaphor of participation. However, there is now encouragement to go beyond the acquisitive and the participative learner to consider the "creative" learner. This proposal is based on the idea that human learning should have at its core the building of "knowledge objects" (Bereiter, 2002). Such a proposal usefully foregrounds the material and conceptual "objects" that – it is argued - should arise within any environment where learning is being stimulated. The proposal then supposes that the learner work of creating such objects is typically infused with collaboration. These objects exist within communities and learners must encounter them within community experience. This may seem merely to evoke again the "participative" learner. Yet it is different. The

"participation" within this learner knowledge building requires of us an environment for interaction that is carefully designed. In particular, the design must be one that reproduces some of the material resources and communicative structures that characterise knowledge building in more authentic but non-educational contexts (studios, laboratories, workshops, marketplaces, and other sites of creative labour).

This formulation of collaborative learning is appealing for a number of reasons. First it involves theorising learning in terms of a broader culture of (collaborating) practice and less in terms of managing circumscribed episodes (or threads) of social interaction. A CSCL inquiry is thereby less about the construction of "a" collaboration and more about the design of contexts in which knowledge-building interactions can flourish and evolve. If you will, it is more about cultures and less about episodes. As Lipponen, Hakkarainen and Paavola have commented in advocating this approach: "Creative collaboration is .. distributed across time and requires a relatively long timescale" (2004: 41).

Second, and related to this, the "knowledge building" perspective defines collaboration as unfolding. It involves an experience of progression: a trajectory of intellectual growth, upon which learners are moving forward. This suggests approaching collaboration as something that is "progressive" in the temporal sense.

Third, although within these proposed systems of learning the collaborating is pervasive, it is not always rigidly managed and not strongly episodic, nor is it the only mode for learner activity. We might therefore say that the social engagement of knowledge building becomes "blended". The social experience of collaborating is integrated with strategies of *private* investigation - perhaps in a rhythm, pace, or pattern that suits the context, history, and needs of the individual learner. This suggests approaching collaboration as something that is "blended" in the structural sense.

The viability of this context for learning and the central place of technology within it have been documented through secondary school interventions (Bereiter, 2002). One challenge is to consider how it might be imported into a higher education context. – through recruiting technology to the progressive and blended spirit of corporate knowledge building. The attraction of the university context is that it already has in place much of the necessary networked computer infrastructure. But in what particular ways might this be made to happen?

The strategy may be to innovate first on a modest scale. That is, pursue interventions that could recruit existing technologies to re-mediate existing arenas of student learning. The outcome should *feel* like doing something that is familiar but doing it a little differently. Rather than doing something new. Moreover, the ideal intervention should be achieved at low financial cost and at low cost to staff time. If something useful was observed to arise from this, then the intervention might be scaled up. However, to earn a sympathetic response, this should probably happen without disturbing the existing curriculum or its regimes of assessment – only re-mediating the experience of learning within them. What are the existing "arenas" of student learning that might be approached in this slightly subversive way? The ones that I have addressed are central to undergraduate experience. They are the practical class, the lecture, and the small group discussion (the seminar or tutorial). The two

intervention examples sketched below refer, first, to the practical and, second, to the lecture-tutorial configuration. The academic context is a Psychology degree programme.

The practical class is the easier challenge. The CSCL goal was to design conditions where students might derive a sense of creative knowledge building through the class-wide coordination of investigative studies – although these may themselves be conducted in groups or alone. First, the practical activity was released from the traditional three-hour classroom session. Students took responsibility for pursuing the fieldwork in their own time. For example, one topic concerned cognitive interpretations of how children's drawing develops. A class of 100 students can encounter collaborative knowledge building if they are each charged with recruiting a child participant, collecting materials, and composing field notes from their experience. These are emailed to a class assistant who organises and displays it in web-readable formats. Small student groups are then convened to build interpretations of this material from differing perspectives.

The experience proves engaging and productive [http://www.deveurope.com/research/drawing/]. It is collaborative but not in the strong sense of orchestrated episodes of group work. It requires a degree of coordination and collation that leaves the student alert to the knowledge building opportunities and sensing participation in a community of shared research practice. In this way, the standard arena of practical work is re-mediated to be experienced in collaborative terms. As an isolated case, such a modest intervention must be limited in its impact. If there is promise here, it can only be properly be realised if such activity is scaled up to be more typical of *all* practical exercises associated with the study programme.

My second example develops the same technology (networked email and web servers) to achieve a similar sense of community knowledge building but around the lecture and the tutorial. Traditionally, the university tutorial is an infrequent adjunct to the core (and probably weekly) experience of the lecture. However, in the present intervention, these occasions were to be integrated more closely. Students would take from this coordination a sense of both progression and construction. First, tutorials should occur weekly in order to complement the lectures. However, if this was to involve the same number of staff continuing to work one tutorial hour per week, then such expansion could only be achieved if the individual tutorials themselves were very short. Twenty minute sessions would permit four staff to service three groups an hour, while keeping the groups intimately small.

Such "speed tutoring" seemed only likely to work if two things could be achieved. First, students arrived on time and in the right place. Second, they arrived primed to have an intense and goal-oriented discussion. Technology looked after both needs. The mapping of groups onto times and tutors was constructed at the start of the semester as an excel database. This tool generated personal emails that automatically constructed a reminder of time, place, and purpose. "Purpose" was managed by having the email include a weblink to material that required students to do interpretative work - exercising the language of the discipline they were studying. As this happened to be Child Development, the material might include photographs of everyday interactions, diagrams of research findings, or other artefacts that demanded

some analysis for closure. Individual interpretations were then aired in the tutorial discussion which was required to converge on a set of psychological questions the students would like answered. Finally, the reminding emails would have nominated a scribe for each group. This student took notes of what was said and the questions derived. These notes they uploaded to a web page for viewing by the class.

The discussion images were chosen to relate to the next topic in the course syllabus. This meant that the lecture following each tutorial could be grounded in the questions that came out of the tutorial discussion. In short, that lecture was built around the central task of answering those emerging questions and elaborating their concerns. In this way the participating students experienced the lecture series as meaningfully related to the evolving character of their own understanding – in part, collaboratively negotiated in tutorials. Moreover, such coordination seemed to cultivate a stronger sense of corporate involvement.

These two examples (and certain others like them e.g., Arnseth and Ludvigson, 2006; Ivarsson, 2004) capture a looser sense of "collaborative learning" than would normally be embraced by CSCL research. Yet they worked well and they do seem to illustrate the way in which the ecology of university teaching and learning can creatively adapt to the prescriptions of a more collaborative climate of study. As to *why* one should aspire to do these things: two general reasons need considering. First, arguments already rehearsed here suggest that confidence in practicing collaborative knowledge building will serve learners well in the wider world. The demands of intellectual work outside of school will require such coordination with others. Second, we should entertain the idea that the experience of collaborative learning is - at least at its most effective - a strongly *motivating* force within learning. This claim is more controversial. Yet it deserves reflection and I do so in the next section.

Theorising the collaborator: the cognition and affect of intersubjecitivty

Typically, the case for cultivating CSCL will be argued from theoretical claims about the nature of learning and cognition - such as those sketched earlier. These claims certainly include a conception of learning as *social*. But I am arguing here that designing this social experience as *collaboratong* is not straightforward. Moreover, neither is it a universal imperative. So, to justify this position, in the present section I return to theory and suggest considering collaboration in more motivational terms. Designing better interventions may depend on a firmer grip on two possibilities. First and put quite simply, collaborating can be difficult and unwelcome. Decisions about entering such arrangements need to be strategically made. So, learners may be best served by designs and ecologies that integrate social interaction with solitary reflection. Second, collaborating has an *affective* dimension and it not a purely cognitive matter. So we need to understand how the attractions of collaboration we *want* to take part in arise from the emotional quality of the experience.

All of these concerns can be anchored down to the consideration of a single observation: collaborative learning does not always "work". In promoting this way of supporting learning, some CSCL advocates will stress pretest-posttest gains showing that collaborating tends to benefit individual collaborators – compared with learning alone. However, fine-grained studies of interaction within such joint activity reveals

great variation in how things are said and done. This can be so even when individuals convened into problem solving groups are well matched in terms of domain knowledge (Barron, 2003).

Put simply: orchestrating a joint activity is not the same as orchestrating a collaboration. Variation in what happens – including disappointing products or outcomes – requires us to scrutinise and theorise the dynamics of the social interactions that take place. Edwards and MacKenzie (2005) develop similar ideas in theorising the "relational agency" that defines an individual's "learning trajectory".

If we ask what interpersonal process directs the effort of constructing shared knowledge (that is, the effort of *collaboration*), the answer must be that peculiarly human striving for intersubjectivity (Rommetveit, 1979; Trevarthan, 1980). This refers to jointly-acting partners exercising a capacity to read the mental states of the other (their beliefs, desires, expectations etc). To say knowledge becomes "shared" is to say that you know what the other knows but, more especially, you know that they know you know this (and so on, in hall-of-mirrors fashion). Awareness of this reciprocity then offers a powerful platform on which to build yet newer understandings. It is "powerful" not just because it resources an evolving conversation with the other (drawing on an archive of jointly-established understanding) but also because of how it makes it increasingly *un*necessary to say certain things at all (drawing on a history of mutually monitoring each other).

Inevitably, psychologists have considered individual differences in how fluently this intersubjectivity is managed. So, faced with collaborative interactions that fail to deliver their promise, researchers are likely to explain such shortfalls in terms of individuals lacking intersubjective "skills". Such sorry collaborators may be poorly prepared to regulate the conversation within which shared understanding is constructed (e.g., Barron, 2003). This could be termed a "cognitive" perspective on the varying fate of collaborations. However, collaborating involves emotion as well as cognition. We will all surely recognise the experience of being frustrated or irritated by the overheads of having to solve some problem as a team or in a group. Some of the earliest educational research in this area acknowledged such problems (Bos, 1937). More recently Salomon and Globerson (1989) have discussed teams that are "not functioning as they ought to". Finally, the possibility for a collaboration to have inhibiting effects on reasoning has long been acknowledged (and studied) in the social psychology of groups (e.g., Weldon, 2000) – a research tradition that seems rarely to intersect with CSCL.

Elsewhere, I describe collaborative exchanges among young learners that illustrate a shortfall in the intersubjective quality of the communication (Crook, 1994, chapter 7). However, there the analysis of discourse stressed troublesome *affect* rather than inadequate cognitive skill. In short, it highlighted a lack of participant engagement. So a collaborator might display a relative indifference to the task, effectively obstructing or distorting any effort to mobilise intersubjectivity. The character of that talk tended to imply participants had personal ambitions at odds with any useful commitment to collaborate. Perhaps they resented being put into this relationship, or they had independent motives to dominate it, or they wanted to complete it swiftly in order to move on. All such motives undermine exercising the intersubjective possibility – even though it was available to these partners as a cognitive skill.

I suggest we notice three psychological strands to the intersubjectivity that underpins collaborating. First, there is intersubjective *knowledge*: that is, a set of communication resources that individuals may call upon to manage shared problem understanding. Second, we have what might be termed an "intersubjective *attitude*": that is, the individual's willingness to recruit such resources and/or to direct them sympathetically towards constructing some desired product. But there is a third psychological dimension of intersubjectivity: that is, its status as an *outcome* of the collaboration – something sought and valued in its own right. If we regard collaboration as a kind of "dance" (Argyle, 1991), then we must entertain the possibility that the achievement of such coordination is itself a satisfying endpoint (rather like fluent dancing) and may be strived for as something precious for itself.

This notion that collaborative achievements carry with them an affective quality has been neglected within CSCL (Crook, 2000). It is not that motivation and affect are missing in studies of learning more generally. These are often factored in as independent variables. However, where they are pursued, they are more likely to be treated as relatively stable trait variables rather than as more transient state variables – that are activated for and within particular occasions of joint problem solving. The affective intensity of a given occasion of collaborative learning is not something that is typically evaluated by researchers. Yet everyday reflection must surely remind us that there is often a deep pleasure to be found in recognising the growth and achievement of jointly-constructed shared knowledge (particularly, where the "private-to-us" conditions of that construction impart to it a kind of *intimacy*).

How does this line of interpretation aid my earlier wish to justify the effort (and the outcome) of cultivating collaboratively "progressive" knowledge building in an undergraduate class? First, it may usefully enrich our conceptualisation of joint activity for learning – so as to accommodate my examples. This extending of the concept may, in turn, render institutions more receptive to certain forms of CSCL intervention.

Identifying motivational and affective aspects of collaborating serves to extend its psychological complexity. Previously, I have found it helpful to speak of the "collaborative experience" of learning. To cast collaborating as a certain *experience* may be more helpful than thinking simply of "a" collaboration – either as an episode or as a thread. It invites us to think of the activities of learning as variously infused with this collaborative *quality*. So, in my example, our university tutorial may be a collaboration not simply because it involves live (synchronous) discussion but because that discussion is fed out into the wider learning arena in which it is timetabled. The tutorial discussion is captured and made visible to the class beyond the class-room. In particular, it is used to ground and guide the content of lectures. This simple joining-up of the traditional occasions of teaching and learning is achieved by utilising technologies to make local perspectives and debates visible and shareable – and, ultimately, generative of new knowledge

The joining-up allows students to understand learning as being about progression – a creative and corporate process of knowledge building. Moreover, my two case studies sketched in the previous section also respect the preferences that individual students may have as to how they participate in learning at particular times. Thus, the

collaborative experience (as groupwork) is not strongly prescribed. Thinking alone or thinking in groups becomes a choice that students make as circumstances determine. Solitary and social periods of thinking are thereby "blended". The challenge is to engineer a course design that allows the products of those occasions to be integrated into an evolving process of knowledge building: something that becomes for the class a collaborative (and engaging) experience of learning.

Conclusion

I have converged on the vocabulary of collaborative experience in order to stress that solving problems with others is an arrangement that can be driven by emotion as well as cognition So, particular occasions of joint activity may be more or less motivated and, thereby, more or less successful. But joint activity also *generates* emotion. The intersubjectivity that is characteristic of more motivated social interaction has an affective dimension. Research must confront the realities that orchestrated collaborative learning is not always adequately motivated in this sense and, moreover, its conduct may not always generate the affect that makes it attractive to learners.

It is surely important to persist in seeking opportunities for realising the learning designs so far inspired by CSCL in higher education: that is, episodes of communication *at* computers and threads of communication *through* computers. Yet if this is all we do, there is a danger that we are simply bolting on singular instances of a learning method to the bigger structure of a curriculum. That bigger structure needs itself to become more deeply collaborative. In particular, I have argued here, it needs to mobilise technology so as to coordinate for learners a stronger and pervasive sense of progressive knowledge building. At the moment, higher education rarely does this. However, the direction of movement I have illustrated is one that admits and respects the complementary attractions of solitary thinking - while seeking ways to creatively blend such reflective occasions with group work. In short, universities need to evolve a better understanding of the collaborative *experience* of learning and thereby exploit the affect that successful social coordinations can inspire.

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