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Learning technologies: Affective and social issues in computer-supported collaborative learning

Ann Jones [a,*], Kim Issroff [b]

[a] *Institute of Educational Technology, The Open University, Walton Hall, Milton Keynes MK7 6AA, UK*
[b] *Department of Education and Professional Development, University College, London, UK*

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Abstract

This paper is concerned with *affective* issues in learning technologies in a collaborative context. Traditionally in learning there has been a division between cognition and affect: where cognition is concerned with skills and processes such as thinking and problem-solving and affect with emotional areas such as motivation, attitudes, feelings. Affective issues have been viewed as somewhat problematic in studying learning, so although it is well known that learner attitude, motivation, and emotional state are very important, they have often been excluded from the frame of research, or studied separately from cognitive learning. This position is gradually changing and this paper considers what previous research has been conducted in these areas. It discusses the role of affective factors in three main areas of collaboration: in settings where learners are co-located, in on-line communities and to support and develop socio-emotional skills. It considers relevant developments in these areas, what the outcomes have been and suggests important directions for future research.
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1. Introduction

Much of the research on using learning technologies in education involves some measure of learners' affective state, for example, by means of a questionnaire or interview after they have used

* Corresponding author. Tel.: +44-1908-653296; fax: +44-1908-653744/659791.
E-mail address: a.c.jones@open.ac.uk (A. Jones).

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a particular piece of technology or software. In such questionnaires the researcher often asks the students about their responses to the learning experience, for example, did they enjoy it? In this paper we argue that we need to move beyond this in our research on learning technologies if we are to understand more about affective factors.

First we argue for the importance of considering affective and social issues in learning technologies and to do this we consider how these issues have been treated in developmental psychology because many learning theories that are influential in learning technologies have their origins in developmental psychology, in particular constructivism. In developmental psychology there has been a clear distinction between *cognitive*, *social* and *emotional* development. Each has been studied separately. But the distinctions have been gradually eroding. For example, Barnes (1995), in discussing the rise in interest in children's personal, social and emotional development, relates it to

> "...a major theoretical shift within psychology itself. This has seen moves away from a consideration of the cognitive, social and emotional realms in isolation – with an emphasis on the cognitive – towards a more integrated perspective..." (Barnes, 1995, pp. vi)

Underpinning such change is a belief that cognitive, social and emotional development cannot be viewed separately as parallel activities as each is closely linked and intertwined with the other. The social constructivist approach which Barnes refers to emphasises the social nature of learning. This emphasis is also shared by current approaches to adult learning. For example, Lea (2002) refers to the 'social turn': the shift from an individual approach to a much more socially and culturally based approach. With this shift comes an emphasis on embedding learning in an appropriate and relevant setting (authentic learning) and Wenger's view of the social learner belonging to and being inducted into a community of practice (Wenger, 1998) reflects this well. Such a theoretical shift has meant that increasingly, research on learning with technologies does indeed include social and affective aspects, although we still know much less about these than about cognitive factors.

We have reviewed research which places social and affective factors at the fore. This does not mean that this research ignores cognitive factors; it is simply that the research is aimed at exploring social and affective features of the learning situations. We have not restricted our explorations to any particular view of these features but we do not consider physiological or biological approaches, nor have we considered approaches which aim to detect human emotions (e.g. Picard, 1997). Picard and Klein (2002) emphasise emotional needs, distinguishing between emotional skill needs and experiential emotional needs, the former being a set of basic skills for understanding and handling emotion in oneself and others, the latter being social in nature and usually met via the assistance or presence of others. In our research, we conceptualise affective factors as both behaviours and perceptions and this broad conceptualisation enables us to encompass a wide range of methods for exploring these features.

In the paper we focus on *collaborative* learning with technologies – both in settings where learners are collaborating side-by-side and where the collaboration happens *through* the computer, as in computer mediated conferencing and in on-line communities. The difficulties associated with defining collaborative learning are discussed in detail by Dillenbourg (1999). He discusses the range of interpretations that can and have been made of the very broad definition of collaborative learning as 'a situation in which two or more people learn or attempt to learn

something together.' (page 2, op. cit.). In particular, he discusses the variety of scales (in terms of the number of people collaborating and the length of the collaboration), the range of meanings of learning (from a psychological process to a pedagogical method) and the range of meanings of collaboration (does it apply to a situation or to the interactions or to the learning mechanisms or the outcomes?). We take a broad perspective and consider learning in collaborative situations. One reason for this focus on collaborative situations is the social nature of learning, as we have indicated above. Another reason for focusing on collaboration is that this is an area where there has been some attention given to these factors. This is because when computers are used collaboratively, research gain a 'window' into affective and social processes which are much more difficult to access when individuals are using computers. Within collaborative learning we review research undertaken on the role of affective factors in the areas listed below: we include both adult and children's learning, but this varies according to the area of research in question, as indicated:

- in collaborative learning settings where groups of learners are physically located together (sometimes referred to as side-by-side) (adults and children),
- in on-line communities (adults),
- in supporting and developing socio-emotional skills (children).

We have chosen these particular areas for three reasons: firstly they are areas within which there has been most consideration of affective issues; secondly they are areas within which the authors are currently working and finally, as indicated above, between them they span both child and adult learning. The paper aims to give some exemplars of interesting and representative work in these areas and to discuss the issues raised. The next three sections of the paper review each of the areas outlined above and this is followed by a discussion and some conclusions about the direction of future research.

2. The role of affective factors in collaborative learning settings

In this first section we consider work that has investigated the effects and impact of student motivation and attitudes on their learning. Whilst there has been a concern with understanding more about student motivation in the context of learning technologies for some time, there is still relatively little work in this area. Some early seminal work concerned the domain of computer games (e.g. Malone, 1981), but has had relatively little follow up. Neither this early work nor Malone's slightly later work (e.g. Malone & Lepper, 1987) has a specific concern with collaborative learning. However, it has contributed to the development of models of motivation. Perhaps the most influential model of motivation is Keller's (1987) and he considers the following motivational aspects: curiosity, challenge, confidence and control.

2.1. Curiosity

Surprising the student is central to instructional tactics which aim to arouse a learner's curiosity. This will lead the learner to new areas of the subject in order to find a sensible explanation for such a 'strange' fact.

2.2. Challenge

Instructional techniques based on challenge rely on the view that tasks which are too easy or too difficult are not motivating (Malone & Lepper, 1987). By providing moderate levels of risk and 'uncertain outcomes' the learner is motivated to engage with the materials.

2.3. Confidence

In Keller's model, the concept of confidence is linked to self-efficacy (Bandura, 1977). Instructional strategies in this area involve selecting tasks according to the learners' previous achievements.

2.4. Control

In the context of learning technologies, freedom for the learner to negotiate their own path through the material may be very attractive and motivating. However, it can be argued that to have such control, learners need to have at least some minimal knowledge of the system to make authentic choices. So, paradoxically, guiding instructions are a way of allowing learners to exercise control.

Malone and Lepper (1987) advocate denying learners any degree of control that affects instructional planning in order to prevent them from making inappropriate choices. In relation to learners' feelings of personal control, Lepper, Woolverton, Mumme, and Gurtner (1993) discuss the "physical" control of tools. We take this up later in the context of technologies and input devices. Keller refers to motivation as twofold: the choices the learner makes (of tasks and goals to achieve or avoid) and the degree of effort applied to pursue the chosen goal. He argues that ideally learners should perceive themselves as being in control of their learning process. Thus responsibility and choice are linked to the task's outcome in control-related strategies. Feedback on the task's outcome is also important according to Keller. He proposes strategies that maintain the students' motivation by delivering unexpected and informative feedback and the use of intrinsic, as opposed to extrinsic rewards (such as money, for example). As mentioned earlier, neither Keller nor Lepper was referring to the specific context of collaboration. However, Eales, Hall, and Bannon (2002) also note the importance of the ownership of learning (perhaps the strongest form of control) in their comparison of three different settings of computer supported collaborative learning.

These different motivational characteristics can be thought of as instructional strategies designed to increase the learners' motivation. Several of the tactics defined by Malone and Lepper and by Keller were implemented by Del Soldato and du Boulay (1996) into the instructional planner of a tutoring system. One advantage of models of motivation such as Malone and Lepper's (op. cit) is that implementing them in 'intelligent' computer systems such as tutoring systems can test them out. This forces the researcher to make the theoretical constructs very explicit – in order to program them – and also provides a test bed for the theoretical ideas.

The features discussed above have been identified with individual learners in mind, but in considering collaborative learning, there are other features which are also pertinent. Issroff and del Soldato (1996) discuss six features of collaborative learning settings that are im-

portant for motivation. Whilst their discussion focuses on side by side collaboration rather than collaboration 'on-line', it applies to these settings too. More recent developments and findings which are relevant to this paper will also be considered along with their original arguments.

Their first feature is *Social affinity between partners*. Many early studies of computer-supported collaborative learning used pairs of students who were matched by specific criteria (e.g. cognitive ability) but did not take into account the social affinity between students. By social affinity, we mean a level of respect and a willingness to work together. Issroff and del Soldato argue that social affinity will always have a significant effect on the nature and effectiveness of a collaborative interaction. They refer to a study by del Soldato who found that partners who were used to working with one another had already established ways of negotiating their individual and common goals. However, partners without such a working relationship had to negotiate the rules of the interaction, which was demotivating for some participants.

Recent work by Vass (2002, 2003) has carried out a detailed and longitudinal study of the impact of one important kind of social affinity – friendship. This builds on Jones and Pellegrini's work (1996) which showed the benefits of working with a friend in a collaborative setting when faced with a task that relies on the use of metacognitive skills. Vass studied the features of friends' collaborative dialogues that have the most benefits in the context of creative collaborative writing. Like Jones and Pellegrini, she found that friends did not need to negotiate the rules of collaboration, and furthermore, that they had established ways of working which were implicitly understood rather than explicitly discussed. Friendship brought other benefits too to the creative writing task that the children she studied were engaged in. She found variations in the children's discourse in the level of collectivity and individualism, much of which could be accounted for by the differences in relationships – where friends were able to maintain a high level of collectivity throughout the writing sessions. Friends will also typically have a better grasp of each other's ideas and state of knowledge than acquaintances which is a crucial point for successful collaboration.

Children who were friends could draw on resources and ways of interacting that were part of their friendship and which they used in informal settings, such as humour and acting out and use these successfully and effectively in their creative writing. Vass raises the possibility of the *transferability* of collaborative and discourse skills between informal and formal contexts: the context of friendship and the context of classroom-based creative tasks. She suggests that some of the features and resources of friendship in informal settings may "*filter* into classroom-based creative writing, and as such, can be mobilised for school-based collaboration". This suggestion is in line with Crook's (1999) proposal to apply discursive resources acquired outside school to school-based tasks and with Hartup's description of friends as *better cognitive bridges* than acquaintances (Hartup, 1996).

Issroff and Del Soldato's second feature is *cognitive ability*. They argue that both actual and perceived cognitive ability have an effect on students' motivation in collaborative work. If one student is much more able than the other, they may dominate the collaboration, while the less able student will have less input. This may be a particular problem if the less able student perceives his/her partner as more able and feels that there is no point in trying, or that it would be better for the more able student to complete the task on his/her own. On the other hand, less confident learners might prefer a partnership with more skilled colleagues, to increase their chances of success as a

group. Here, although the matching would not be ideal for collaboration, it could still increase the individual motivation of the less confident partner.

Their third feature is *feedback*, which is crucial to motivation, and features largely in the motivational frameworks that Issroff and del Soldato consider. Del Soldato and du Boulay's instructional planner (1996, op. cit.) implements both the goals of teaching a subject domain and motivating the learner. Issroff and del Soldato suggest that in collaborative settings, this idea should be extended in order to include the third goal of facilitating the collaboration between the partners.

Their fourth feature is the *distribution of control.* A collaborative learning environment can be managed to ensure a balance of control amongst students. This can be achieved in several ways - the instructions given to students can be specific about this or the software can used to artificially manipulate control However, there are two different aspects of control in relation to computer-supported collaborative learning: control of one's own learning and control of the tool. These two aspects do affect each other to a certain extent, since the control of the system's interface has an effect on the accomplishment of the learning activity but they are not interchangeable. For example, Issroff (1994) found that one member of a pair that she studied had control of the mouse – so there was strong hardware dominance (and he initially appeared to be controlling the interaction). However, it is clear from the pair's discussion that the other member of the pair was controlling the entire interaction by telling him what to do with the tool.

One project that has specifically investigated the impact of multiple input devices is the KidStory project (Abnett, Stanton, & Neale, 2001). This team has been developing technologies and interfaces for supporting children's collaborative storytelling. Working with young children (aged 5–6) they have developed KidPad, a drawing and zooming tool to be used with one or more mice to support side to side collaboration at the computer. The issue of multiple input devices is an interesting and important one for collaboration, given that most collaborative work takes place with technologies that were not designed to support it. In this research, the quality of the stories produced were higher for those children using two mice.

The fifth feature is the *nature of task.* Some tasks can easily be sub-divided and distributed between different individuals. However, individuals lose ownership of parts of the task and may become uninterested. This is a particular problem during computer-based tasks which occur over a long time. For example, Issroff (1995) discusses a long-term collaboration in which the students could not all work on the task at the same time. There was a breakdown in the collaboration and this had both affective and cognitive consequences for the learners.

The final feature is *time.* The nature of interactions also changes significantly over time, and this is increasingly being recognised by researchers studying computer-supported collaborative learning. At the start of an interaction, students may feel highly motivated but this may change. How their motivation changes will depend on many factors, some of which have been described above. It is not only motivation that may change over time, however. Vass's research (Vass, 2003, op. cit.) analysed paired discourse in order to study ongoing cognitive, social and affective processes over a period of time. Both friendship and acquaintanceship pairs (AP) were studied and there was evidence of an observable development in the AP discourse, although to a varying extent. In other words, friendship often developed over time. Vass also reports a second change over time: at different stages of the writing process the collaborative partners engaged in different types of talk which were related to different parts of the creative writing process. However, the

process of creating writing was a complex, iterative process where the different stages were not always clearly distinguished.

Eales, Hall and Bannon (op. cit.) distinguish between authentic motivation – related to a focus on the development of robust, long term knowledge and inauthentic motivation– focused on assessment and the tactics of schooling. As noted earlier they emphasise that ownership of the learning problem is a particularly powerful form of motivation – and they see computer supported collaborative learning as a way of virtually deschooling education by bridging educational and outside worlds. This theme of 'bridging' informal and institutional contexts is one that occurs throughout the literature in this area.

Many educational researchers have drawn attention to the particular nature of one institutional context, the classroom environment, and the rules (often implicit) that operate within this context. Vass (2003) whose work on friendship we discussed earlier discusses how in their collaborative work, children interpret and re-construct the constraints of the task, according to the rules they understand to be operating. Mercer's work (Mercer, 1995, 2000) has often focused on the language of the classroom and one of the points he emphasizes is the importance of establishing a shared understanding of what is being discussed. This shared understanding, referred to by Edwards and Mercer (1987) as common knowledge, however, is not just important for a particular lesson or series of lessons, but becomes part of the teacher and children's shared history. Thus, an observer casually dropping inn to the classroom is very likely to hear references to events from not only previous lessons but previous terms' work. Such common knowledge is often a starting point for new work in the classroom. This aspect of Mercer's work, who takes a sociocultural approach, focuses on the importance of shared histories for meaningful learning.

Crook (2000), however, points out that shared histories also have a very important *affective* function. His account focuses specifically on the motivating power of collaborative learning. It is one of the few affective accounts of collaborative learning and Crook develops a number of useful and powerful ideas. Crook's starting point is a concern that cognition is privileged over affect. He argues that the literature fails to represent collaboration as a *motivated* activity even though collaboration has a distinct and important emotional dimension. A particular feature of collaborative settings is that they evoke affective responses. The roots of this dimension are likely to be found in evidence from developmental psychology of the importance and the attraction, for the child (and its partner) of engaging in joint interaction. There is much evidence for the importance of being with and communicating with others from an early age (e.g. Schaffer, 1992), and such activities tend to evoke emotional responses, both positive and negative.

Crook discusses the importance of 'shared meaning' – an idea derived from Schwartz's work (Schwartz, 1999). Although 'shared meaning' sounds like a simple and perhaps obvious notion in collaborative learning, it is a powerful motivator. Crook argues for the potency and the attraction of shared meaning and understanding – both in learning contexts and in the sense of shared histories. Most of us can relate to the excitement engendered by the accidental encounter with someone who turns out to have some very particular shared experience – be it coming from the same village, or sharing an unusual interest. Crook suggests that its power is related to its uniqueness or at least its rarity. According to this account, what on-line learners find so motivating and attractive is that they develop a shared history which is unique to their group, but he notes that such a positive perception may not be so easily gained or maintained:

> The affect arising from this cognitive synchrony is something human beings seem inclined to enjoy. In this setting it can serve to animate and sustain a cognitive exploration – to an extent that might be beyond what could be achieved in solitary conditions of learning. Yet that quality of affect is not an easy or an inevitable consequence of the contract for joint activity.'' (Crook, 2000: 166–167)

In discussing how we might help to engender such 'cognitive synchrony' Crook employs an ecological metaphor – also used by Draper (1998) and Tolmie and Boyle (2000) precisely because it is a powerful metaphor and the notion that various facets of the environment need to come together in the right way nicely captures the challenge of using Information and Communication Technologies (ICT) effectively in education. Draper argues that successful ICT comes from a close fit between a piece of ICT and its situation of use: in other words it fits a niche in the same way as a successful species has an ecological niche – i.e. fits a particular role within its community. Using the ecological metaphor, Crook argues that this implies an approach where the investigator pays particular attention to the features of the interaction and 'the character of the resources that collaborators interact around' – much as ecologists need to study how organisms interact with each other within their natural habitats. It leads to a second line of enquiry too, which picks up on the ecological association with learning that occurs in informal, 'unarranged' environments – outside formal learning institutions. The second area that we consider below includes one such informal environment – an on-line community.

In this section we have considered a number of factors derived from Keller's work that we argue are relevant for motivation, including 4 'motivational characteristics'. We have also argued that a number of features of collaborative settings have an important impact on motivation. Of these features, there is continuing evidence that how control is distributed is also a significant factor, not surprisingly, and we have considered recent research on the impact of social affinity on collaboration. It has also become increasingly clear that in order to understand more about the impact of social and affective factors in collaborative learning, we need to investigate activities over time, as factors such as friendship and motivation, to mention just two, are not static. Finally we discussed Crook's argument about the particularly motivating nature of collaborative learning, and suggest that the ecological metaphor that he employs (which is also used by others) is a very helpful approach and it alerts us to taking a wholistic perspective in our enquiries where attention is paid to features of the interactions themselves and to features of the environment. Such an approach leads to a naturalistic form of enquiry. In the next section we start by considering the use of computer mediated communication.

3. Communities and affect: The use of computers to support and foster on-line communities

Preece (2000) discusses the phenomenal growth of different kinds of on-line communities, their nature and how best to support them and pays considerable attention to social and affective aspects. She emphasises that for on-line communities to be successful, developers and designers need to pay attention to social as well as technical issues. She argues for the importance of sociability in communities which depends on trust, collaboration and appropriate styles of communication. Regarding affect, Preece has a particular concern with empathy and she has analysed the nature of empathic support across a number of on-line communities. In the remainder of this

section we focus on the social and affective aspects of learning communities and start by considering the growth of computer mediated communication.

Computer mediated communication (CMC) was developing at much the same time as the theoretical change to view learning as more socially based and it did force attention on at least some affective factors. Much of the literature and practice on the *affective* impact of being part of an on-line learning community is in this area. The Open University (OU) used computer mediated communication (CMC) from the late 1980's to supplement students' learning experiences and in part to address a known problem in distance education: learners' isolation. However, affective issues needed addressing; it quickly became apparent, for example, that this medium afforded less emotional restraint and sometimes led to emotional, often angry messages known as 'flaming'. It also became clear that the social aspects of building up relationships on-line needed to be considered. Participants needed to feel *safe* enough to enter what could feel like a strange community. For example Wegerif (1998) found that individual success or failure on one on-line course depended upon the extent to which students were able to cross a threshold from feeling like outsiders to feeling like insiders. This relates to the feature of confidence, discussed above.

In describing lessons learnt about CMC at the Open University, Goodfellow (2001) notes that a key advantage is the opportunity for students to work together. These lessons also include affective factors: e.g. that collaborative on-line activity has a significant impact on students' levels of engagement and satisfaction with distance learning. He cites a number of papers that have considered how best to motivate and engage students and keep them on line (e.g. Mason & Weller, 2000; Thomas & Carswell, 2000).

In trying to understand when and why on-line learning becomes productive and what makes on-line communities work, focused investigations into particular aspects of use are needed. Examples of such work include the impact of CMC on the role of teaching staff (Jelfs & Colbourn, 2002; Light, Nesbitt, Light, & White, 2000), and factors that influence its success (Tolmie & Boyle, 2000). The issue of the tutor role has received much emphasis in the discussion of CMC, with predictions and accounts of CMC allowing a shift from leading the teaching to a much more 'equal' and 'peer-like' position. Light et al. (2000) provide a helpful summary of this debate and illustrate the *social* role of the tutor. Whilst early advocates envisaged peer-learning as the dominant mode, too little input from the tutor can also be problematic, both for the quality of the outcome and also because there is a need for intervention if the social dynamics become problematic – where flaming occurs for example.

Earlier we considered motivational features of collaborative settings. Tolmie and Boyle (2000) review the factors influencing the success of CMC environments in university teaching. Some of these are affective factors, and others involve affective considerations. These include the size of group; knowledge of other participants; student experience; ownership of task and the need for/function of CMC. An over large group size may make it difficult for learners to get to know each other sufficiently for enough trust to develop, and, as we saw earlier, developing a community where participants feel safe and trust each other is crucial. Knowledge of other participants is a central part of such a venture. Ownership of the task is one of the motivating features identified in the earlier section on motivation and the importance of having a positive student experience is well known from other contexts (e.g. Issroff, 1995 op. cit.). What might be less obvious is that a clear *need* for CMC (as with other learning technologies) is necessary for learner engagement, otherwise, for time-poor learners, other demands on their time will win out.

On-line *learning* communities usually congregate around formally organised learning activities but there has also been interest in on-line communities more generally. One particular idea about community, Communities of Practice (Wenger, op. cit.) has been taken up enthusiastically in many educational circles, and is afforded by new technologies which can enable 'virtual' communities of practice to develop. These can also allow more contextualised teaching of particular subject areas, where students can access communities of experts who are operating in 'real-world' contexts outside education. In Science teaching for example, students might have access to practicing scientists, or school pupils to meteorologists and be able to post them questions or discuss their projects with them.

At the beginning of this section we mentioned Preece's research on empathy in on-line communities – most of which are adult communities. Computers may also, however, help to develop children's empathic skills by enabling them to see another's point of view. Earlier we noted that Picard and Klein (op. cit.) distinguish between experiential emotional needs and emotional skill needs. In these terms the work discussed so far relates to experiential emotional needs which are social in nature and can be met through social interaction such as working with others. Picard and Klein's second category, emotional skill needs, is about understanding and handling emotion in oneself and others. There is less of a tradition of using learning technologies in this area which is discussed in the next section. This considers how computers might more directly support socio-emotional skills and thinking.

4. Supporting and developing socio-emotional skills

Research on using computers to assess and support the development of social and emotional skills has focused on a range of populations including children with particular needs, such as children with emotional and behavioural difficulties (EBD) and children with autism. One example is the use of Bubble Dialogue, [1] a role playing computer program that has been used by a number of different populations, including children in care and adopted children (Jones & Selby, 1997) and young adult offenders. When using the Bubble Dialogue software, pairs of users collaborate to develop a narrative. Typically this is either two children or a child and adult pair. Bubble Dialogue allows users to represent characters' thoughts as well as their speech, which therefore allows participants, through their characters, to reveal thoughts and views that might otherwise be hidden and very difficult to access. In one sense this can force the child (or at least strongly encourage them) into considering what the other character (as well as their own) is thinking or feeling as well as saying, and may thus play an important part in helping children view a situation from another child's perspective. Early empirical work using the program found that children who are normally reluctant to role play are willing to do so when using the program (Jones & McMahon, 1994). There is also evidence that children readily identify with the characters they portray, thus allowing the program a role as a diagnostic and methodological tool, in

[1] Developed by Bill O'Neill and Harry McMahon of the Language and Communication group at the University of Ulster, Coleraine, Northern Ireland.

addition to its role in helping children develop communication and literacy skills through developing Bubble Dialogue narratives.

Bubble Dialogue is particularly suitable for investigating social and affective factors and can be a way of gaining insights into participants' views that would normally be difficult to gain. In turn this may help populations whose views are often not heard and who can be disenfranchised. Some clinical populations (e.g. children with autism) and children with EBD typically find some social situations hard to negotiate (see, e.g. Crick & Dodge, 1994). Such children may have difficulties in seeing and understanding other people's perspectives. Bubble Dialogue provides firstly a way of gaining some insight into children's views of such situations; secondly it can also provide a forum to rehearse such situations. Finally it can be used to replay, review and reflect on particular real situations and the opportunity to rerun these and take on other roles. It is argued that by attending to the socio-emotional issues that children are dealing with, and supporting the development of social interactional skills, children will be in a better position to develop their cognitive sills.

One study investigated how Bubble Dialogue was used by children with emotional and behavioural difficulties (EBD) compared to a group of children of similar age at a mainstream school (Jones & Price, 1998). The children were asked to role play virtual situations that presented social dilemmas or conflicts that required some resolution. The study investigated the children's strategies for dealing with the conflicts, and found that whilst both groups used a range of strategies, there were differences in their preferred strategies. For example, when issuing a threat, the mainstream group would usually disclose that they did not intend to carry it out, whilst the EBD group often said they *did* intend to carry it out. Unlike the mainstream group, the EBD group also employed physical violence in their role plays as a way of resolving the conflict.

Specifically, these findings indicate the range of different styles of conflict resolution available to the EBD children. Some of these children's preferred strategies (giving orders and physical aggression) are consistent with what we know about such children's difficulties in resolving the kinds of situations presented. However, as an assessment tool for analysing children's social competence, Bubble Dialogue is much richer and more ecologically valid than the tools that are typically used. It also allows us to start getting a view of the child's perspective, and for this to be located in a meaningful context rather than requiring the child to undertake a 'test' of social competence that s/he is likely to fail. Overall the work provides further evidence of Bubble Dialogue's usefulness for helping children to express themselves and communicate.

5. Discussion and conclusions

The preceding sections of this paper have focused on affective factors in three main areas: collaborative learning settings; on-line communities and the role of computers in supporting socio-emotional development. Arguably, though, some of the issues around on-line communities straddle all three areas as communities may be concerned with learning or they may have primarily a social function and also provide emotional support (Preece, 2000). Four motivational aspects were considered briefly early on, derived from Keller's model of motivation (Keller, op. cit.). Of these, further literature suggests that confidence and control appear to have a particular salience in learning technologies, especially in collaborative learning. An important facet of

control is ownership of learning. Issroff and del Soldato also proposed a number of features of collaborative learning settings that were important for motivation. Subsequent research has confirmed and strengthened the importance of *social affinity* and this would also partly account for the importance of a safe welcoming community for on-line learners.

The features of *cognitive ability* and *feedback* in this context have not been further researched to any large extent. However, the importance of the final three features, *time*; *distribution of control and the nature of the task* have been recognised, particularly in work on CMC (see Goodfellow, op. cit.). The nature of the task is particularly important in this environment if there is to be successful team project work. There is strong evidence that collaborative work both on and offline can be very motivating and rewarding for learners, but this depends on many factors being right. For on-line learning this includes the development of a community that is 'safe-for-learning', or, in the case of other on-line communities safe for disclosure, perhaps.

Crook believes that high motivation is a crucial part of successful collaborative learning and suggests that it is largely derived from shared experience of 'unique' histories that 'bond' participants. He also argues that a consequence of perceiving collaborated learning as a motivated activity is that we should consider *informal learning contexts.*

The findings discussed in the latter part of the paper have rather different but equally important implications. They suggest that an advantage in the mediating capacity of technology that can be used to support socio-emotional, rather than cognitive skills and development.

5.1. Investigating social and affective aspects of collaborative learning

We would suggest that focusing on affective and social factors has some implications for how we go about our research. It is particularly important to evaluate the impact of learning technologies in practice. It is through such evaluation that we gain an understanding of the real role that technologies can play in learners' lives: without such evaluations, we only have accounts or promises of the potential.

In considering social and affective aspects we suggest that it is important to focus on three aspects in such evaluations. The first is process. There is much discussion in the literature on evaluating technologies for learning on the need to pay at least as much attention to process as to product. Mercer's research on dialogue and Vass's research on collaborative creative writing (Mercer, op. cit.; Vass, op. cit.) are both good examples of what can be gained from such an approach.

The second important aspect is the features of the interaction. Tolmie and Boyle's work on CMC environments Tolmie and Boyle (op. cit.) and Jelfs and Colbourn (2002) and Light et al. (2000) are good exemplars of this approach in their work on on-line learning. Crook (op. cit.) also, of course, argues for such an ecological approach. Finally, we need more longitudinal studies. Here again, both Mercer and Vass's work, to give just two examples, show how collaborative interactions in settings such as classrooms cannot be understood without some understanding of the longer term context in which they take place.

Attention to these three aspects would be a good beginning in furthering our understanding of the role of affective and social factors when using learning technologies but there is still a need for further development of methodological approaches. Evaluating the use of learning technologies, whether from a cognitive or social or affective perspective is not straightforward. The literature on evaluating the cognitive impact of learning technologies illustrates the complexity and method-

ological issues in this area (for example, Draper, Brown, Henderson, & McAteer (1996), Oliver (1998)). However although there is an established yet controversial approach to evaluating educational technologies from a cognitive perspective, there has been little attention on affective factors. This paper provides some of the groundwork needed in order to conceptualise affective factors in research on learning technologies. This provides a basis for new approaches that will help us to understand the affective factors surrounding the use of technologies in educational settings.

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