

CHAPTER 4

PEER COLLABORATION AND LEARNING IN THE CLASSROOM

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Introduction and overview

In literacy-based societies children are segregated from adult communities, spending most of their time with peers in child-care settings and educational institutions specifically organised for them (Rogoff, Paradise, Arauz, Correa-Chavez and Angelillo 2003). The significance of peers in children's social and emotional development is undeniable in such contexts, and has been a central theme in developmental psychological research (Corsaro 1998; 1985; Dunn 2004; 1993; 1988; Göncü 1998; Gottman 1986; Hartup 1996b; Schaffer 2003; 1996).

However, academic concern about the benefits of peer relations and peer interactions for learning (and the associated conceptualising of peer facilitation effects) is relatively recent. The emergent interest in the cognitive benefits of peer interactions in educational research is linked to considerable shifts in educational theorising: changing perspectives concerning the child (from passive recipient of knowledge to active meaning-maker), the role of the teacher (key source of information or partner in learning) and the process of learning itself (transmission of knowledge from expert to novice or shared meaning making). Thus, educational theorising has gone through significant transformations from a *deficit view* of the child - characterised as an incomplete adult, lacking knowledge and understanding as well as the skills to reflect on and manage their learning - towards the recognition of the

child's agency and active role, powerfully captured in the learning theories of Jean Piaget and Lev Vygotsky. Equally, the recognition of the importance of the social context - a fundamental premise of the socio-cultural tradition - has led to an increasing interest in examining the diverse ways in which various relationships constitute contexts for knowledge building. Thus, complementing conceptualisations of teaching and learning as organised and led by adults, the last few decades have seen the emergence of a rich array of work on *peer tutoring*, *cooperative learning* and *peer collaboration*, including studies outside the socio-cultural tradition, such as the work of Piaget and the neo-Piagetians.

Although recognising the significance of the literature on peer tutoring and cooperative learning, our focus in this chapter is on peer collaboration. In contrast to peer tutoring - which builds on the shared work of pairs with asymmetrical abilities - and peer cooperation - which typically involves the subdivision of tasks for a shared goal, with each participant responsible for one particular aspect of the activity - peer collaboration assumes the relative symmetry of abilities and sharedness in respect of both the process and the products of learning. In collaborative contexts, children bring together a range of perspectives or knowledge bases arising from the diversity of individual histories, experiences, interests and personalities. But the relationship is conceptualised as being symmetrical, and the aim is to reconcile - share as well as compete - these perspectives in order to achieve a common learning goal. For instance, Dillenbourg (1999:2) defines collaborative learning as 'a situation in which two or more people learn or attempt to learn something together.' In this sense, the *togetherness* of the process is just as important as that of the outcome, and the collaborative dialogue that mediates the process of shared meaning making is envisaged by some as *interthinking* (Mercer 2000). Mercer and Littleton elaborate on this conceptualisation of collaboration as follows:

participants are engaged in a coordinated, continuing attempt to solve a problem or in some other way construct common knowledge. Crucially, we see collaboration as involving a coordinated joint commitment to a shared goal, reciprocity, mutuality and the continual (re)negotiation of meaning (2007: 25).

Such intensity of connectedness, the coordination of thought and action, can be linked to what Ryder and Campell (1989) describe as an experience of *groupsense*. It is resourced by the emergence and maintenance of intersubjectivity (Rogoff 1990; Wertsch 1991): the participants' in-depth knowledge of one another, a common frame of reference and the resultant ability to think together effectively.

At this point it is important to note that research on collaborative learning is diverse and multi-disciplinary, and is not restricted to collaboration between people in physical proximity or to human-human interaction. It ranges from work in computer science and cognitive science (e.g. distributed artificial intelligence, DAI and computer-supported collaborative learning, CSCL) to developmental psychology and educational research. The detailed account of all the diverse approaches is beyond the scope of the chapter. Instead, this chapter discusses central issues with regards to collaborative learning and peer collaboration in the classroom as identified and addressed specifically within current socio-cultural literature.

The chapter will start with a brief outline of the history of collaborative learning research: how this rapidly growing line of work has emerged and is situated within the larger socio-

cultural (or neo-Vygotskian) framework. This section will also include a brief account of the Vygotskian and Piagetian conceptualisations of cognitive peer facilitation. We will use this account to explicate how, within contemporary socio-cultural approaches to peer collaboration, these two seemingly distinct conceptualisations have converged. Following from this, the chapter will continue with a discussion of current efforts and initiatives in collaborative learning research, including extensive work on collaborative dialogue and educational thinking in the classroom; studies examining the role of contextual factors in shaping the processes and outcomes of peer collaboration and research investigating the extent to which different types of tasks (e.g. open-ended vs. single solution) or subject domains (e.g. scientific problem solving as opposed to the creative composition of text or music) invite different cognitive strategies, resourced through various discursive and interactional styles. Our review of the rich array of socio-cultural literature on peer collaboration and learning concludes with a brief outline of future avenues for research in the field.

The emergence of collaborative learning research

Social interaction and learning

Socio-cultural theorising has a distinctive interest in social interaction, considering learning and development as fundamentally social processes (for a comprehensive review of current socio-cultural approaches see Daniels 2001). In this view, the child is a social being from the very beginning, innately adapted to social communication (Göncü 1998; Trevarthen 1998). At the heart of such descriptions of *the social basis of mind* (Rogoff 1999) is Russian theorist Lev Vygotsky's influential model of human learning and development. Vygotsky, in sharp contrast with traditional individualistic approaches in Western developmental literature, argued that *higher mental functions* – such as thinking, learning and problem

solving – or the awareness and understanding of self could only be acquired through social interaction. Therefore, interpsychological thinking is a prerequisite for intrapsychological thinking: it is through speech and action with others that we learn to reason and gain individual consciousness.

Although we can readily accept the idea that developing social skills requires social interaction (depending heavily on the availability of rich interpersonal contexts), the proposition that the same requirements hold for cognitive development may not have the same intuitive appeal (Schaffer 1996). Yet, the Vygotskian model inspired a whole new strand of psychological-educational inquiry into the social nature of cognition, and has shifted the research focus from a concern with the intra-personal towards an interest in interpersonal processes: from individual meaning making towards the shared construction of knowledge and understanding. An overarching theme of the socio-cultural approach is to explore the ways in which communication structures thought and social interaction during joint activities mediates learning and knowledge building.

As Trevarthen explains, ‘conversational intelligence is the hallmark of a human mind... It is an intelligence that tries to negotiate with other minds to share the process of conscious awareness and purposeful thinking itself’ (1998:90). In this sense, knowledge itself is a socially mediated activity ‘rather than as a stored property of the individual’ (Crook 1994:47). According to more radical *situated cognition* accounts ‘discourse *is* cognition *is* discourse’ (Resnick, Pontecorvo and Säljö 1997:2), implying that knowledge is not only jointly constructed but distributed in time and space among individuals. In more moderate accounts (e.g. Light and Littleton 1999) knowledge is seen as a social construct developed through interaction and recreated in each situation. However, in this account, the agency of

the individual in actively interpreting, re-organising and drawing upon collectively developed knowledge is maintained.

Symmetrical and asymmetrical relationships

Vygotsky emphasised the importance of asymmetrical relationships in learning and development, arguing that children need guidance and instruction by more competent individuals (typically adults), who can assist the learning process by providing the right amount and nature of help, and who can control and co-ordinate the child's activities. As Schaffer sums up, cognitive skills 'must first be performed jointly with an adult before they come under the child's control' (1996: 235). Effective instruction thus needs to take the emerging competencies of the child into consideration, which will shape the interactive relationship between the more competent partner and the child. The neo-Vygotskian tradition uses the concepts of *contingent instruction* (Wood and Middleton 1975) and *scaffolding* (Wood, Bruner and Ross 1976) to define such sensitive guidance and has a rich body of research exploring learning-teaching processes involving adults (e.g. parents and teachers) and children (e.g. Wood 1998; Hoogsteder, Maier and Elbers 1998). (For a recent compilation of classroom-based explorations of scaffolding, see Volume 13(3) of the *Journal of the Learning Sciences*, which is a special issue edited by Davies and Miyake and published in 2004).

Although less extensive, socio-cultural research into peer tutoring has provided strong evidence of benefits in terms of cognitive gains for both tutor and tutee (Light and Littleton 1999; Howe and Mercer 2007, Littleton and Howe 2010). Complementing this work, in the last 20 years or so, there has been a growing interest among socio-cultural researchers in symmetrical peer collaboration, conceptualising peer facilitation effects in such

relationships and extending the concept of joint construction of knowledge to this facet of the learner's social world. Initiatives in peer collaboration research were also inspired by the Piagetian and neo-Piagetian school of thought, which values interactions with peers above those with adults. Therefore, it is essential here to provide a brief outline of the distinct yet potentially complementary (Light and Littleton 1999) accounts of cognitive peer facilitation by Vygotsky and Piaget, both of which have contributed to the more complex conceptualisation put forward by later socio-cultural scholars.

Piaget and Vygotsky on peer relationships

Although both Vygotsky and Piaget recognised the role peers may play in the process of knowledge construction, their accounts were markedly different on the subject. Piaget defined the facilitative effects of peer relationships in conflictual terms, building on the notion of *symmetry*. Piaget's main argument was that preschool-age children are *egocentric*: they are unable to consider points of view different from their own. A major aim at this stage is to overcome this developmental obstacle, and move towards more advanced forms of cognitive functioning. Although Piaget saw cognitive development as a solitary discovery process characteristically induced by encounters with the physical world, he attributed a central role to peers in learning to *decentre* and overcome egocentrism. He argued that, through social interaction with equals, egocentric children are confronted with alternative viewpoints. The context of working with a peer makes children strongly motivated to consider these slightly different viewpoints. In contrast, he argued, confrontation with adults' viewpoints would lead to complete disregard or submission as a result of the asymmetry in power relationships. Piaget saw the benefits of peer collaboration in terms of *socio-cognitive conflict*, triggering the reconstruction of knowledge through decentration and through the incorporation of competing views.

A wealth of research in the neo-Piagetian tradition has been carried out to investigate the facilitative effects of socio-cognitive conflict in collaborative problem solving tasks, notably, by researchers in the *Genevan school* (e.g. Doise and Mugny 1984; Doise, Mugny and Perret-Clermont 1975; 1976; Mugny and Doise 1978; Perret-Clermont 1980). The central aim of these studies was to investigate the effects of peer conflict on five-to-seven year old children's logical reasoning skills such as perspective taking, and thus to explore ways in which peer conflict impacts on children's transition to the next cognitive stage. (For a comprehensive overview, see Light and Littleton 1999, Mercer and Littleton 2007 and Howe 2010.)

When reviewing this body of research, Perret-Clermont (1980) concluded that the studies provided plenty of empirical evidence for the positive effects of socio-cognitive conflict on cognitive progress. She argued that socio-cognitive conflict was most typical in settings where partners who held moderately different perspectives were asked to reach a consensus. Nevertheless, the Piagetian (and neo-Piagetian) approach to examining the role of peer collaboration in cognitive development has been under much scrutiny since the emergence of these original findings. First, as Forman and Cazden (1985) indicate, these studies did not directly observe the participants' interactions during collaborative problem solving but focused on the collaborative outcomes instead. In order to identify the social conditions that are the most accountable for the cognitive gains, Forman and Cazden (1985) argue, one needs to examine the processes of social co-ordination in detail, through the analysis of collaborative discourse. Similar considerations have since led to a shift in focus in collaborative research from the study of the outcomes of collaborative activities to the

exploration of the collaborative processes. This process-oriented approach is especially strong in research embedded in the socio-cultural tradition, as will be detailed later.

Second, the primacy of conflict has been questioned by several authors. Donaldson (1978), for instance, suggests that working with peers actually changes the way children understand the problem at hand and helps them make sense of it. Other authors see the concept of conflict as defined by Piaget as insufficient to determine the effectiveness of peer interaction. For instance, Hoyles and colleagues (Hoyles, Sutherland and Healy 1990) posit that a broader view of conflict – i.e. the expression of different opinions that are then discussed, analysed and negotiated in order to arrive at a jointly accepted view – leads to a better understanding of what makes paired activities facilitative to children's learning. Similarly, Howe (2010:35) argues that 'discussing contrasting opinions cannot be sufficient to guarantee growth. Children must also resolve their differences in a progressive direction'. It is apparent that these reformulations incorporate aspects of both the Piagetian notion of *decentring through conflict* and the socio-cultural concept of *joint construction of understanding* (Light and Littleton 1999; Littleton 1999), a term used to describe productive social interactions in general.

Indeed, there have been some attempts to reconcile the Piagetian notion of socio-cognitive conflict and the Vygotskian perspective of co-construction of knowledge to provide a better understanding of the underlying processes and cognitive effects of collaboration between partners of symmetrical ability. One of the first examples of such attempts is the aforementioned study by Forman and Cazden (1985) on the collaborative problem solving of 9-14 year old children, following the neo-Piagetian three-step experimental design (pre-test, experimental situation, post-test). Forman and Cazden expanded the focus of inquiry by

examining both the processes and the outcomes of the collaborative activities, through the analysis of paired discourse. On the basis of these analyses, Forman and Cazden concluded that the Vygotskian and the Piagetian approaches are equally helpful in describing the cognitive consequences of peer interaction. They argued that, in the observed collaborative situations, constructive conflict resolution and mutual guidance and support were of equal importance. They claimed that the mutual support and guidance observed between equally capable partners was a form of scaffolding, and that the complementary roles of *observing, guiding, and correcting* and *performing* enabled the partners to carry out a task together which they may not necessarily be able to perform individually. Similarly, Mercer and Littleton (2007) identify mutual scaffolding as a characteristic feature of productive classroom-based collaborations, but note that such mutual support may not be deliberately undertaken by children. Rather, they describe such scaffolding as an inherent feature of the kind of collaborative work that is resourced by the careful consideration of the ground rules for effective collaboration (see Mercer 1995, 2000 for a discussion of such ground rules).

Forman and Cazden's study demonstrates the complementary strengths of the Piagetian notion of socio-cognitive conflict, and the Vygotskian concept of co-construction of knowledge in describing the cognitive effects of peer collaboration. Their study also leads us to a very important distinction between *collaborating to learn* and *learning to collaborate*, as described by Grossen and Bachmann (2000). Grossen and Bachmann note that the earlier experimental work (including the neo-Piagetian studies referred to previously as well as early socio-cultural research) was mainly concerned with ways in which children collaborate to learn, hence their sole focus on cognitive outcomes. However, the reasons for the facilitative effects of peer collaboration - as well as the reasons for the breakdown of such collaborative work - can only be fully understood through the study of

the dynamics of the collaborative process. Dillenbourg (1999) notes that both solitary and paired activities build on the same learning mechanisms (e.g. reading, building or predicting). In his view, the advantage of working in pairs is not being two, but that the interaction generates extra activities (e.g. explanation, disagreement or mutual regulation) which in turn trigger unique cognitive mechanisms (such as knowledge elicitation, internalisation or reduced cognitive load).

As Grossen and Bachman (2000) point out, the shift in focus to collaborative dialogues (as shown in the Forman and Cazden study) corresponds to a growing interest in exploring how children learn to collaborate, and the recognition that the *mode of collaboration* is a crucial factor determining the outcomes of paired activities. This new approach converges with situated approaches to learning and cognition, and reflects a movement to the study of *processes* as opposed to the *outcomes* of collaborative activities when assessing peer facilitation effects.

The following questions encapsulate the emerging dilemmas and challenges in collaborative learning research:

- How can the documentation and analysis of collaborative processes help us capture the affordances and constraints of peer collaboration for learning, and conceptualise productive forms of peer collaboration?
- How is context (such as the social and cultural setting, task design, subject matter, or the cultural tools used) implicated in the processes and outcomes of collaborative work?
- How can we facilitate and support productive forms of collaboration?

The following sections will discuss contemporary efforts in collaborative learning research addressing these questions, starting with studies on the effects of classroom discourse on children's thinking and knowledge building.

Peer collaboration and knowledge building

The study of educational dialogues

Scholars have gained from Piaget and Vygotsky (and the researchers who have subsequently extended their work) an affirmation of the importance and value of social interaction for learning and development, be this interaction between learners of similar levels of understanding or people in the position of learner and guide (see Mercer and Littleton 2007). From a Piagetian perspective, the germs of intellectual progress are to be found in the socially motivated resolution of conflicting perspectives arising through discussion between peers (e.g. Piaget 1932). In contrast, it is the *guided* construction of knowledge that is underscored in Vygotskian (e.g. Vygotsky 1978) and neo-Vygotskian accounts. The apparent *gap* between what theory construes as being of significance, and the apparently bleak picture emerging from actual classroom practice, gives pause for thought. This is because it exposes the limitations of this theorizing when applied to educational contexts.

Consider for example the work of Vygotsky. Whilst his seminal ideas have informed, and continue to inform educational research, there is a significant disjunction between his account of sensitive guidance (or contingent support) and the kinds of teaching-learning encounter that are feasible in classroom settings. Moreover, language is written about in very general terms - as a single homogeneous tool or mediating artefact. Researchers have suggested that 'it is now necessary to move beyond a conception of language as a unitary

tool suggesting that what is needed are research-based accounts of educational dialogues, and productive interaction, that are sensitive to the variety of forms and functions of language as used in pursuit of teaching and learning in classroom settings' (Littleton and Howe 2010:6). Plurality and complexity are ignored at our peril. If we are to be able to conceptualize, resource and promote productive educational dialogues, then we need a secure research evidence base from which to develop practical theories of educational dialogues rooted in classroom realities.

The next section looks at two important ways of characterising and conceptualising productive educational dialogues, followed by the discussion of research efforts to promote and support productive classroom interaction.

Classrooms: the analysis of collaborative discourse

Exploratory talk: a typology of educated discourse

In order to explain how school-based peer interaction supports children's intellectual development – and thus examine the 'relationship between language and thinking' (Mercer and Littleton 2007) – Neil Mercer and colleagues have carried out extensive research on classroom discourse (Mercer 1995, 2000). Their studies have provided ample evidence that the quality of children's talk has a strong impact on the quality of learning (see Mercer and Littleton 2007, for the most current overview).

Based on the findings of an extensive project (Spoken Language and New Technology – SLANT), Mercer and colleagues (Mercer 1995; Mercer and Littleton 2007) distinguish three discourse types predominant in children's collaborative activities: *disputational*, *cumulative* and *exploratory* talk. Disputational talk is characterised by disagreement and the

lack of cooperation in decision making. The exchanges are short, consisting mainly of assertions and counter-assertions, and there is a lack of clear resolution. Cumulative talk, on the other hand, contains exchanges that build positively but uncritically on each other, including repetitions, confirmations and elaborations. Third, exploratory talk reflects the constructive and critical negotiation of views, offering constructive criticism and building on challenges and counter-challenges (which identify reasons for assertions and give alternative hypotheses).

On the basis of the extensive analysis of classroom-based collaborative dialogues, Mercer and colleagues developed a *typology of productive talk* arguing that *exploratory talk* leads to the highest cognitive gains in paired learning contexts (Mercer 1995). Exploratory talk has been found exceptionally useful in shared critical thinking, collective reasoning and perspective taking, signifying a ‘distinctive social mode of thinking’ that is invaluable in schooled discourse communities (Mercer and Littleton 2007:66).

Note that elsewhere Mercer (2000) develops these arguments further. He elaborates upon the complexity of language use, and talks about the usefulness of cumulative talk in getting things done together. However, in his framework, the benefits of cumulative talk are mostly linked to the *social uses of language* (which are contrasted with *intellectual purposes*). For example, he notes that cumulative discourse may support the maintenance of relationships, may be used to demonstrate friendship or to facilitate the process of bonding between partners (Mercer 2000). Mercer’s description of the multifaceted functions of language – that collaborative discourse serves both social and intellectual purposes – is crucial for analytic work on educational dialogues of any sort. However, in Mercer and colleagues’ research the emphasis is placed on the exploration of the intellectual purposes of discourse

in the area of problem solving and academic debate, where the goal is to take a ‘relatively detached perspective that is aimed at the joint but impersonal construction of explanations, answers and solutions’ (Mercer 2000:103). Thus, although they acknowledge that cumulative or disputational talk may just as well be *socially appropriate* or *cumulatively effective* in other settings, Mercer and colleagues concentrate on discursive strategies which are specifically useful in the mastering of skills linked to educated discourse, such as *logical reasoning, rhetoric skills (argumentation), rationality and analytical thinking*.

Also, Mercer (2000) indicates that in creative contexts – such as the collaborative writing of a newspaper article – cumulative talk is a legitimate and successful means to achieve both social and intellectual aims. Although the elaboration of this line of enquiry is not his main focus, Mercer’s comments give rise to very interesting questions. What makes creative contexts different from scientific problem solving when it comes to typical or desirable discourse strategies? How are the intellectual purposes in creative tasks served by the uncritical accumulation of ideas or by detached perspective taking? Or simply, what are the differences and similarities in the discourse styles predominant or desirable in different subject areas? The section on subject domains and collaboration will pick up on these important, topical issues.

Transactive talk

An alternative and highly influential account of productive forms of talk is presented by the line of research on transactive discussion (Azmitia and Montgomery 1993), which links patterns of talk to measures of outcome (for example success in solving a scientific problem). Azmitia and Montgomery define *transactive talk* as the use of explicit statements that operate on either partner’s previous *reasoning*. Transacts include *transactive*

statements (restate, clarify, elaborate, critique and integrate self and the other) *transactive questions* and *transactive responses*. Azmitia and Montgomery also identified a fourth analytical category of conflicts, which can either be transactive (including transacts) or non-transactive (e.g. cases of insistence).

Transactive coding has been used extensively to study paired discourse and explore the links between the nature and effectiveness of the discourse and the quality of the relationship. For instance, using transactive coding, Azmitia and Montgomery (1993) found that friends working together on problem-solving tasks outperformed non-friendship pairs. However, the advantages were only evident in more challenging (e.g. unstructured, open or ill-formed) or more complex cognitive tasks.

Although the framework was originally used to define productive talk in problem-solving contexts, it has been modified (Kruger 1992) and applied to other tasks as well, such as collaborative music composition (Miell and MacDonald 2000). In the modified description, transacts are utterances children use to refine, extend or elaborate on *ideas* that they or their partners introduced in the activity previously. According to Miell and MacDonald (2000), such extension of Azmitia and Montgomery's definition of transactive discourse as *reasoned argument* is necessary for the context of creative design, where formulating and refining ideas may involve more than explicit argumentation.

Researching collaborative music composition, MacDonald and Miell (2000) have successfully applied this characterisation of transactive talk to analyse paired discourse and differentiate between the quality and effectiveness of different pairings. They linked the quality of the composition and the pattern of communication, claiming that it was the

discursive style of friends that put them at an advantage. These findings suggest that the processes and outcomes of peer collaboration can only be studied by considering both the nature of the relationship and the type of task, and that transactive analysis can help identify the features of collaborative discourse that lead to facilitative effects, both in problem solving and in creative activities.

However, we need to consider a crucial conceptual issue with regards to both frameworks; the predominant emphasis on logical reasoning. As it will be discussed in later sections, by focusing on the role of explicit reasoning in shared meaning making, we may overlook aspects of the collaborative talk which could, potentially, be equally significant (such as emotions, intuition and sensing). In later sections, we will discuss some collaborative learning studies which depart from the predominant focus on rationally-constituted thinking in joint meaning making and connection building between ideas.

Nevertheless, the two analytic accounts have been hugely influential in reconceptualising classroom talk and remodeling classroom practices. Most importantly, they have revealed the necessity to resource classroom interaction in order to facilitate the process of *learning to collaborate*. In the next section, we will discuss theorizing and research on ways in which productive classroom interaction can be supported and promoted, with a special focus on the classroom intervention programmes developed by Mercer and colleagues.

Supporting and promoting productive interaction

Many opportunities for collaborative learning are fortuitous. They simply emerge as a consequence of participation in a particular community of learners (Crook 2000). That said, we still need to understand how best to enable and resource learners' joint endeavours, such

that we can promote the most effective opportunities for collaborative learning and design strategies for optimizing collaboration. This concern with promoting collaboration is reflected in recent research in which two factors have assumed particular prominence: task design, and the quality of relationships.

Task design

When thinking about the issue of how to support and resource productive group work many researchers have emphasised the significance of task design, highlighting that group tasks should be designed such that learners *have* to work together on them. Tasks should not, therefore, be too simple. If each learner can readily solve a problem or complete a task independently, then there is no necessity or imperative for joint working. Equally, if a task is too complex and difficult for learners, then they will struggle to create shared understanding and meaning. A group task is thus one which requires intellectual resources that no single individual possesses, in which students work interdependently and reciprocally, and where the exchange of ideas and information (Cohen 1994) and the joint construction of understanding (Mercer 1995) is vital to success. Some research suggests that open-ended, challenging tasks are more effective in facilitating productive interaction than closed tasks focused on finding just one correct answer (Cohen 1994; Van Boxtel, Van der Linden and Kanselaar 2000). This is in part because closed tasks more easily result in one person, perhaps, a more knowledgeable participant, dominating the joint activity and discussion (Arvaja 2005). A clear task structure and provision of feedback is also important - and this might be one of the best ways in which computer-technology can resource joint activity (Howe and Tolmie 1999). That said, it is not simply a case of 'getting the task right'. Of course good task design helps: but because the meaning of educational tasks is

constituted within and created through interaction, task design is only part of the story (Mercer and Littleton 2007).

Quality of Relationships

Although contemporary neo-Vygotskian theory places growing emphasis on peer interaction among children, the exploration of the dynamics and cognitive outcomes of different peer relationships, such as friendship, is not of central concern (Azmitia 1996; Hartup 1996a). In empirical studies on peer collaboration children are often assigned to a systematically chosen partner, based on skills, experience or other non-relational factors (Hartup 1996a). Studies with such systematic pairings do not aim to consider the shared histories of the partners as a distinct variable contributing to the processes and outcomes of the collaboration. Nevertheless, the major limitation of such arrangements in educational research and practice is that they fail to recognise the role of affect in everyday social interactions, or the spontaneous organisation of joint activities over time in everyday life.

Van Oers and Hännikäinen (2001: 105) have suggested that:

‘The main reason why discourses in collaborative learning processes ever lead to improved understandings is that the participants in the process are willing to share their understandings and keep on doing so *despite* their disagreements and conflicts...the fact that they can ever be productive at all relies on the fact that the participants in this process, for the time being, feel obliged to each other, stay with each other and maintain togetherness’.

This claim draws attention to the significance of the relationship between partners as they interact and work together. Research investigating how friendships mediate joint activity

(e.g. Azmitia and Montgomery 1993; Hartup 1998; Youniss 1999; Vass 2002, 2003) has indicated that relational closeness is associated with the sharing of ideas, the mutual exchange of perspectives and points of view and a collective approach to complex, challenging tasks. There are also some indications that the development of close relationships, characterised by a sense of trust and mutuality, can enhance learning (Howes and Ritchie 2002; Underwood and Underwood 1999). Others, such as Azmitia (1996), Hartup (1996a, 1996b), Pellegrini, Galda and Flor (1997) posit a strong link between the quality of the relationship between partners, and the nature and outcome of the collaborative learning process, arguing that the way partners relate to each other may be a crucial determinant of their joint success.

Hartup (1996a; 1996b) lists four main reasons most typically cited to describe the advantages of friendship pairing for collaborative work. First, friends have expectations of reciprocity, commitment and equality in their relationship. Also, friends are more motivated than non-friends to maintain contact with one another and to repair communication breakdowns (Dunn 1993). Furthermore, due to their intimately connected existence - shared histories (Crook 1999a), shared social reality (Rogoff 1990) or shared frame of reference (Azmitia 2000) - friends simply know each other better. Finally, friends provide affective contexts that may enable them to cope with an intimidating or perplexing context, and to fight back anxieties that may block the successful completion of a task. This may be especially helpful to maintain children's motivation when facing an unusually challenging task or difficult problem (Azmitia 1996; Hartup 1996a).

Linked to the issue of intersubjectivity, Crook (1999a) argues that, in their domestic and playful lives, children frequently encounter situations which build heavily on their

discursive capabilities. Thus, naturally occurring joint activities in everyday settings provide children with a repertoire of discursive skills – for example hypothesising, predicting or challenging – which are otherwise seen as restricted to school-based activities. Such shared histories and pre-established discursive strategies are characteristic of close relationships, which develop while friends play or spend time together. These collaborative and discursive strategies could be put to use in the classroom context, thus capitalising on the resources that close relationships provide. As Crook explains, ‘Once we start from accepting that the learner already has available a repertoire of discursive resources, our attention can become focused on how to bridge that gap between the playful and the schooled deployment of those resources’ (1999a:105).

Implied in these arguments is the need to revalue close relationships (such as friendships) as important contexts for both informal and classroom learning. By doing so, as Crook (1999a) advocates, we may be able to mobilise discursive resources acquired outside school to school-based collaborative tasks and create continuities ‘between existing concerns and new ones that we are asking them [children] to reason about together in classrooms’ (1999a:105).

Conversely, these observations led some researchers to argue that children benefit from explicit instruction to help them develop positive peer relationships in the classroom. According to Blatchford and colleagues, what is needed is a *relational approach* to group working, which properly recognises that classroom learning is fundamentally a social endeavour (Blatchford, Kutnick, Baines and Galton 2003). The associated suggestion is that training should be given to promote the development of close relationships between classmates through amongst other things, developing interpersonal trust between learners -

something which is frequently emphasised in work investigating collaborative activity in the creative arts (see Miell and Littleton 2004). To this end, Blatchford and colleagues have developed an educational intervention programme which they characterise as using a *relational approach* to the development of group working. Drawing on influences from attachment theory and studies of parent-child interactions, the programme engages the participating (5-7 years old) children in activities designed to foster trust and mutual support and develop communication skills and joint problem-solving. Evaluations of the programme involving comparisons between experimental and control classes have indicated that this relational approach is not only successful in motivating children to participate in group activity and value it, but that it has a significant impact on their reading and mathematics attainment (Kutnick 2005; Kutnick and Colwell 2010).

In light of such evidence, one cannot deny the importance of fostering positive relationships in the classroom, especially if we also consider research concerning the influence of gender. This issue has been studied using both experimental and observational research methodologies (see Light and Littleton 1999; Leman 2010). Some of the key findings emerging from this work are neatly exemplified in the early work of Swann (1992). Swann presents compelling evidence, derived from in-depth classroom-based observations, to show how the different interactive styles of boys and girls are implicated in the ways in which knowledge is constructed, and so affect the experience for those involved. Her work has made salient the dynamics in mixed-gender groupings. Although there is considerable individual variation amongst males and females, male students of all ages tend to dominate discussions, make more direct and directive comments to their partners, and generally adopt more executive roles in joint problem solving. Findings such as these illustrate that peer-based interactions are often characterised by dominance and asymmetry and thus add

weight to Kutnick's claim that for group activity to be effective children need to be explicitly taught to relate in positive ways. Whilst agreeing with this basic premise some researchers, notably Mercer and Littleton (2007), have also suggested that learners have to do more than engage with each other in a positive and supportive way. Their argument is that learners also should become able to build constructively and critically on each others' ideas and that it is imperative to explicitly induct children into the use of such educationally productive ways with words.

Research evidence supports the view that whilst working and talking together *can* provide a powerful support for learning, often it does not. This is in part because much of the talk that occurs in the context of group-based activity in classrooms is unproductive - it being *disputational* or *cumulative*, rather than *exploratory* in nature. As discussed earlier, exploratory talk is a particular form of educated discourse in which reasoning-in-talk is apparent and there is evidence to suggest that it is educationally efficacious (Mercer and Littleton 2007). Given this, there have been attempts to induct children into the use of Exploratory Talk in the context of their ongoing, classroom activities and to evaluate the effects of this in respect of the quality of their talk, problem-solving, reasoning and learning (for a review see Mercer and Littleton 2007). The most well-established programme of intervention work has focused on enhancing the quality of 8-11 year olds' group-based educational dialogues – aiming to ensure that children enter collaborative activities with a shared conception of how to talk and think together effectively.

Evaluation studies, focusing on the efficacy of the programme, have revealed that children in target classes (trained in the use of Exploratory Talk) not only come to use significantly more Exploratory Talk than those in control classes, but also demonstrate more successful

group-based problem solving and enhanced individual educational attainment (for further detail see Wegerif, Mercer and Dawes 1999; Mercer, Dawes, Wegerif and Sams 2004; Wegerif and Dawes 2004; Mercer and Littleton 2007).

It is obvious from the discussion that collaboration is not an *educational panacea* (Light and Littleton 1998). Just as joint activities in everyday settings, instances of peer collaboration focusing around a classroom-based learning task have their *affordances* and *constraints*, and are heavily dependent on context. There is a growing body of collaborative learning literature with the aim to unpack the impact of contextual factors on the nature and quality of the collaborative processes and outcomes. Context is used in the broad sense, referring to both the external features of a situation, and as ‘constructed *within* the interactions themselves and *through* the effect of the participants’ interactional work’ (Grossen and Bachman 2000:492). There is empirical evidence that both external factors – e.g. task design, instructions, or the cultural tools used (Joiner, Faulkner, Littleton, Miell and Thompson 2000; Light and Littleton 1999) – and contextual features arising from within the collaborative partnership – e.g. previous experience (MacDonald and Miell 2000), or relationship (Azmitia 1996; Hartup 1996a; Vass 2004; Miell and McDonald 2004) – play significant roles in shaping the collaborative process.

An important aspect illuminating the context-sensitive nature of collaborative learning and knowledge building is the mediating role of the subject domain, discussed next.

Subject domain and collaboration

The struggle to establish intersubjectivity, the need to share ideas and reflect on others’ point of view is not restricted to specific tasks. Earlier sections - with research mostly

focusing on collaborative problem solving in the domains of maths and sciences - have already demonstrated the centrality of these processes in collaborative activities. Similarly, studying children's classroom-based collaborations in creative contexts, Ligorio and colleagues found that the students made conscious, continuous efforts to build intersubjectivity, 'opening windows' in each other's inner world (Ligorio, Talamo and Pontecorvo 2005:371).

Yet, discourse may be used differently to achieve such intersubjectivity in open-ended (e.g. creative) tasks and single-solution problem-solving activities in science or maths. For example, critical thinking (seen as required in problem solving) is traditionally described as building on logic (Glassner and Schwarz 2006), whereas creative thinking is often characterised as *subjective* (Glassner and Schwarz 2006) or *improvisational* (Sawyer 2006). Indeed, it has been suggested that creative design differs from scientific problem solving in the sense that it is an unstructured activity with no fixed goals or clearly specified and ordered stages (Sharples 1999; Rojas-Drummond, Albarrán and Littleton 2008; Vass 2003). Sharples (1999, 1996) describes creative design as a fusion of synthetic (or productive) and analytic phases, involving the creation of ideas (which can take the form of stream of consciousness, daydreaming or free association) and conscious, deliberate reflection on and critical appraisal of these. Also, it is seen as relying on engagement with one's emotions: the 'deliberate re-creation of emotional experience in the mind' (Sharples 1996:134). If so, creative design - including creative writing or music composition - may require or allow for discursive and collaborative strategies different from paired problem solving to support the iterative cycles of idea-creation and reflection. Therefore, linking back to the earlier section on the analysis of collaborative processes through the study of paired discourse, our

definition of productive talk may be task-dependent, reflecting task-specific variations in cognitive demands.

For example, Rojas-Drummond and colleagues (Rojas-Drummond, Mazon, Fernandez and Wegerif 2006; Rojas-Drummond *et al.* 2008) found task-related differences in children's discourse in paired reasoning and joint writing tasks. Although the analysis found similarities in the discourse of the two contexts - such as turn taking, the sharing of opinions, the discussion of alternatives, negotiation etc. - it also demonstrated that explicit, *accountable reasoning* was less frequent and less important in joint writing sessions than in paired reasoning. Rojas-Drummond and colleagues also note that the findings underline the necessity to 'include emotional aspects of creative and dialogic collaborations for a more comprehensive account of the phenomena' (2008:189).

Similarly, when looking at the discursive strategies associated with the different phases of shared creative writing (e.g. poem writing or story building) in primary school settings, we also found the lack of dominance of explicit reasoning (Vass 2003, 2007; Vass, Littleton, Miell and Jones 2008). Our analysis showed that patterns of paired talk associated with different phases in the iterative cycle were qualitatively different. Joint processes of creative content generation were supported by the uncritical accumulation and sharing of ideas. Discourse associated with this phase was characterised by intensity, overlapping talk (interruptions and overlaps as well as parallel talk) and the lack of explicit argumentation and reasoning. On the other hand, reflective phases were more often - though far from always - supported by detached perspective taking and explicit argumentation. In addition, the study showed that reflective phases were also often resourced by affectively-constituted thinking, which we defined as the participants' engagement with their feelings or their

introspections with regards to these (Vass, Littleton and Jones, under review). Thus, our analysis of collaborative creative writing discourse shows the richness and complexity of the creative design process and indicates the relative value of explicitness.

These findings call for a recognition of the diversity of the cognitive demands of different subject areas and learning tasks (e.g. creative arts vs. problem-solving in science and maths, or open-ended vs. single-solution tasks in any subject domain), and the need to consider how the nature of the particular task or general subject domain channels and shapes the shared knowledge building process, reflected in the collaborative dialogues. Linked to this, Sawyer and Goldman's recent study (2010) has also highlighted the fundamental need of the researcher to thoroughly understand the learning content or knowledge field of the observed educational dialogues, and to make this content knowledge central in their analysis and transparent in their dissemination.

In this sense, we may wish to develop domain-specific analytic models for the study of collaborative discourse. Conversely, as Rojas-Drummond and colleagues (Rojas-Drummond *et al* 2008) suggest, we may work with an overarching conceptualisation of productive peer collaboration with a recognition of domain-specific representations or alternatives. Whichever standpoint one takes, the variations in the use and usefulness of explicit reasoning underline a very important conceptual and methodological point: the mediating role of the task design and subject domain in shaping the processes of children's collaborative work.

A second, closely related issue is the potential over-emphasis on logic and reason in the conceptualisation and analysis of collaborative meaning making and shared construction of knowledge.

Emotion and reason in shared meaning making

Models of emotion and cognition

The affective aspects of the functioning of the human mind have largely been disregarded in mainstream Western developmental theories (Donaldson 1996), a biased view especially apparent in the social organisation of education (Holzman 2008). There is, however, now increased interest in emotions and learning (for example, how emotions empower or hinder knowledge construction), which often emphasise the interweaving or *inseparability* (Oatley and Nundy 1996) of cognition and emotion in the interpretive process of knowledge building (Sarason 2004; Donaldson 1996; Bruner 1986).

Recent psychological or developmental conceptualisations of cognition and emotion reject the traditional value-laden dichotomy, challenging the overemphasis on logical and *systematic thought over intuitive thought* (Duffy, 1998). For example, Donaldson offers a more complex perspective, instantiated in a model which incorporates emotion and reason as two interwoven, equally important functions. She argues that in the interpretive process of making sense of the world – knowing and understanding – emotion and reason are equally central. Furthermore, she posits a two-way relationship between emotion and thought, arguing that both can interfere with as well as empower the other. In her formulation, the purely intellectual and or purely emotion-based (or *value-sensing*) modes of cognition are two extreme ends of a continuum, where either emotions or thoughts are eliminated or their role is highly limited. Such differentiation into value-sensing or reason-

driven thinking is, she argues, a later stage in development, needing conscious cultivation. On the other hand, the core mode where thoughts and feelings are interwoven develops as a natural consequence of being brought up in a human society. Donaldson argues that we typically use a combination of intellect and affect in everyday activities, putting emotion on a par with rational thought. It is the nature of the human activity and that of the social-cultural context which determines the degree or predominance of each.

Similarly, Bruner (1986) distinguishes two 'modes of organising experience', one being *logico-scientific* or paradigmatic (drawing on paradigmatic imagination, mathematical argumentation and hypothesis testing) and the other being *narrative* (involving working with experiences as embedded in their time and place, and focusing on the emotional dimensions of the outcomes and endings). He defines these as two modes of thought, distinct but complementary. Yet, he does not simply associate these two types of thinking with different domains of intellectual activity. Instead, he sees them as central at different stages of the *evolution* of most intellectual endeavours. For example, scientific hypothesis creation may start with metaphors and stories, building on narrative thought, which then leads to hypothesis testing, drawing on logico-scientific thought.

Significantly, these models describe emotion and reason as two equally important *aspects* of cognition. Thus, affectively-constituted thought (value-sensing for Donaldson and narrative thought for Bruner) is seen as a distinct kind of thinking, not simply an influencing factor or a mediating force upon rationally constituted thought. Therefore, these conceptualisations go beyond contemporary conceptual work, which typically sees cognition and emotion as two interacting, deeply interrelated systems, but not as two areas or facets of the *same* system of cognition. In doing so, Bruner and Donaldson recapture

Vygotsky's description of the mind as 'a dynamic meaningful system that constitutes *a unity of affective and intellectual processes*' (Vygotsky 1987:50, original emphasis, in Holzman, 2008:46). Following this line of argument, there is a recognisable need to examine the relationship between intellect and emotion, and their role in collaborative meaning making and knowledge building. In what follows, we briefly outline recent work which aims to unpack this relationship, focusing on children's collaborations in creative settings.

Creativity, cognition and emotion

The problems with the low status of emotions are especially evident when we look at collaborative creativity where, as noted before, intersubjectivity may be achieved by means that go beyond the realm of logic and explicit reasoning. As Sharples' model of creative design reveals, affectively-constituted thinking has a central role in the iterative cycle of creative content generation and reflection, with emotions serving as both the generator and filter of creative thought. Such reevaluation of emotions is especially useful, given the lack of explanatory power of more traditional accounts of the creative process. Equally, it has implications for research on peer collaboration in creative contexts, helping us to refine our understanding of other-orientation and collectivity (and that of productive dialogue) in such settings.

Addressing this issue, in our recent work (Vass, Littleton and Jones, under review), we examined the role and significance of emotions (reflected in reliance on intuition, sensing or other facets of thinking linked to affect), as opposed to *rationally constituted thinking* (such as the use of abstract logic, deductive reasoning or other facets linked to intellect) in collective meaning making and shared connection building between ideas. In our research,

we drew on observational data from three collaborative contexts within as well as outside the classroom: creative writing, computer-supported narrative building and band rehearsals.

Our analyses of the conversational data have revealed that processes of inter-thinking - joint meaning making and shared connection building in respect of ideas - are not necessarily based on explicit argumentation, logic and transparent reasoning. In creative text composition and music writing, *affectively-constituted thinking* (which we defined as the participants' engagement with their feelings or their introspections with regards to these) was seen to mediate both phases of shared engagement (idea-creation), and shared reflections (evaluation of the generated ideas or material). They involved collective, free association through jokes, the shared re-living of emotional experiences through acting, and the joint refinement of ideas that was driven by intuition and sensing of what feels right. These strategies can be clearly linked to what Donaldson (1996) describes as the value-sensing end of our cognitive spectrum. They also resemble theatrical improvisation, following patterns of improvisational interaction (as described by Sawyer, 2004). The turns often involve a *metaphorical yes* to the previous turn; an acceptance that is reflected in the immediate incorporation of the new ideas, a response that accepts as well as further enriches the unfolding content. The discourse may *sound* like ripples of water: unbounded, free-flowing and unpredictable. In such instances, explicit reasoning seems to serve little function: it would probably hinder the process of sharing and connection building between ideas. It is obvious that children's associations in these episodes - though building on intuition, sensing and emotions rather than reason - are collective, meaningful and richly creative.

Similarly, in our observations of creative writing and music composition, we saw the (re)negotiation of shared understanding through reflections on the appeal of the generated material. The participants' judgements and understanding of what was right and wrong were often emotion-based. These affectively constituted reflections on the generated ideas or material were central in resourcing the cyclical process of shared creative engagement and reflection. Thus, we argue that in creative design affectively-constituted thinking is not restricted to phases of idea-generation. Rather, it seems to serve a central function throughout the observed creative collaborations. We do not wish to underestimate the role of reason and rationally-constituted thinking in joint connection building and meaning making. Indeed, explicit reasoning was used by participants to define the changes prompted by the affectively-constituted evaluative episodes. However, we need to emphasise that the same explicit reasoning may sometimes be redundant in the actual process of appraisal (rejection or acceptance of the generated content) in creative contexts.

The implications of these findings are manifold. First, they underline the necessity to consider the affective dimensions of creative work, other-orientation and collectivity. Seddon (2004), describing the collaborative work of musicians, uses the concept of *creative attunement* to describe such intensely shared moments. Storey and Joubert (2004) talk about 'the emotional dance of creative collaboration'. Affectively constituted thinking seems to be central in the development of imagination and creativity, as well as in our growing understanding of our own and other people's inner worlds. Opportunities for such emotion-based *connectivity* (Moran and John-Steiner 2004) or *interthinking* (Mercer 2000), however, are not embedded in logic or reason. In fact, they may not rely on language-based communication at all (Vass 2003; Seddon 2004; Cross 2009; Kokas 1999).

Therefore, the second key implication is the need to unpack the affectively constituted aspects of shared connection building between ideas in various domains. As Holzman (2008:115) notes, ‘New ways of seeing...emerge through new ways of being’. From a socio-cultural perspective, these transformations of perception and knowing are fundamentally social. Yet, academic work discussing the social aspects of learning (including research on collaboration) typically emphasises intellectual *attunement* and accessibility of reasoning as the main determinants of success in shared knowledge building, which they see facilitated by transparent logic and explicit argumentation. We need to challenge the potential overemphasis on intellect in these accounts, and also explore how the intersubjectivity and sharedness of the *figured world* of collaborators (Holland *et al.* 1998, in Moran and John-Steiner 2004) may be constituted via cognitive strategies that go beyond logic.

Thus, thirdly, our recent work underlines the necessity to consider the emotional aspects of cognition and learning in general. It therefore highlights the need to shift the emphasis from logic (rational and intellect-driven thinking) towards more complex models for the study of human learning and development. These reflections are in accord with accounts on the undervalued status of emotions in educational research, which stress the need to consider *both* logical *and* intuitive thought (Bruner, 1986).

The final contextual dimension we will focus on here is the mediating role of cultural tools in collaborative learning activities.

New technology and collaboration

As noted earlier, socio-cultural approaches to human cognition emphasise the mediational role of cultural tools and artefacts in human practices. Learning therefore is seen as ‘the acquisition of many specialised abilities for thinking’ (Vygotsky 1978:83), or growing expertise in the use of available and valued cultural tools (Säljö 1999). However, new cultural tools do not only represent new resources for the same activity. As research on computer-mediated cognition informs us, they fundamentally change the activities they are used for. They shape human life, modify our ways of thinking, and create new ways of knowledge construction (Säljö 1999). In this sense, technology of any sort has the capacity to both expand as well as constrain the repertoire of cognitive competencies (Rogoff 2003). Equally, technology is transformed via the process of appropriation by its users who *make it their own*: ‘the cultural tool both lends itself to being used in various kinds of ways and at the same time imposes various kinds of constraints’ (Light and Littleton 1999:11). The concepts of co-evolution or reciprocal causality are therefore especially useful when examining the relationship between learning, thinking and new technology (Bruckman 2004).

Computers and classroom-based collaboration

Within the wider public and academic interest in understanding the transformative role of new technology in educational practices, there is also a strong research focus on children’s computer-supported collaboration (e.g. Joiner, Faulkner, Littleton, Miell and Thompson 2000; Scanlon, Issroff and Murphy 1999). Just as with research on collaboration in general, early studies on computer-supported collaboration concentrated on whether joint efforts lead to better results than individual work. More recent empirical studies have shifted their focus to the processes underlying productive interaction (Littleton 1999). The ultimate goal of such research is to define ways in which computer technology can support education.

With regard to classroom activities, Crook (1999b, 1994) lists the following types of interactions involving computers:

- interactions at computers (working with the same computer);
- interactions around computers (working individually, in parallel);
- interactions through computers (through time and space);
- interactions in relation to some computer application.

Computers appear to have a specific role in collaborative learning. As many commentators note, the initial scarcity of computers in schools almost demanded that children were organised to work at them in small groups. It also appears that groups focused around a computer task do far better than most other sorts of groups both in terms of group performance and in terms of subsequent individual performance on similar tasks (Light 1997). What is even more striking is that the presence of other children in the room was also found facilitative even if the children were working on separate computers without any interaction (Light 1997).

One possible explanation for such a positive effect is that, through facilitating role distribution, computers open up new metacognitive space for reflection. Role differentiation in collaborative problem solving has already been discussed with reference to the study of Forman and Cazden (1985). Role differentiation in computer-supported collaborative problem solving contexts was explored by Light and Littleton (1999), among others. Light and Littleton found that, when sharing the computer equipment and additional props (e.g. paper maps), children typically divided the responsibilities among themselves, thus adopting the role of the *navigator* (working with the map) and the *pilot* (working with the mouse or

keyboard). This, they argued, has not led to imbalanced contributions, since upon encouragement from the experimenters, the children alternated these roles frequently. Thus, through navigating or monitoring the task, the children both acquired skills to jointly *engage* in the completion of the task and to *reflect* on the joint processes. Would computer-support similarly enhance processes of engagement and reflection in other subject areas, such as shared creative writing?

Lankshear and Knobel (2003) report the paucity of research in new technologies and literacy, especially in early childhood research. The small set of studies which look at the computer as a tool for collaborative writing purposes (Daiute 1992; Lankshear and Knobel 2003) suggest that computers may significantly boost interaction and collaboration in the classroom, for example indicated by the frequency and content of spontaneously initiated talk among students in computer-based writing activities as opposed to *normal* classroom writing (Kamil, Intrator and Kim 2000). The literature available so far indicates the positive effects of computer use in this context. For example, Jones and Pellegrini (1996) suggest that the use of a word processor improves the writing skills and writing quality of young children. One possible explanation is that it reduces the mechanical demands of writing – such as spelling, correcting mistakes and inserting and deleting texts – and thus helps less skilled writers to concentrate on organising their thoughts and constructing sentences (Jones and Pellegrini 1996). This may lead to more intense metacognitive processing, content generation and longer texts of higher quality. Another assumption is that computer use enhances processes of planning and revising, especially if the software encourages children to edit their texts repeatedly. Reflection and reviewing are essential in creating cohesive and well-written texts.

The study reported by Vass and Littleton (2009) aimed to expand on this argument, building on research on computer-supported problem solving (e.g. by Light and Littleton, discussed earlier). It explored ways in which computer resources already available at school (i.e. word processors) can mediate collaborative creative writing activities. Similarly to Light and Littleton, Vass and Littleton found that computers facilitate role distribution through the encouragement of turn taking, suggesting that the *scribe/editor* role distribution typical in the observed computer-supported writing sessions created metacognitive space for reflection on formatting and transcribing. Through monitoring and editing each other's input, the children had the opportunity to both offer their contributions to the completion of the joint task and to reflect on the joint processes. Yet, the analysis also revealed that exchanging roles often broke the flow of creative text composition and that rigid alternation often led to individualistic input. Thus, the joint generation of creative content did not necessarily benefit from sharing through alternation of computer use. An important challenge for software developers may be to create new, enhanced contexts for children's collaborative learning, for example, through the reorganisation of the physical setting of shared computer use. For instance, the use of two keyboards or two mice – as in the inventive KidStory Project developed for collaborative storytelling (Stanton *et al.* 2001) – could help to overcome some of the potential problems with the turn-taking and role-differentiation characteristic of computer-supported collaborations.

Next, we will introduce key issues in the newly emergent work on virtual collaboration and learning.

Virtual forms of collective experience: cyber-collaboration and classroom based learning

New media are often blamed for the physical and social isolation of the younger generations (Jenkins 2006b). Research on the social aspects of digital media - especially the convergent forms of new media - challenges us to problematise this popular belief, and recognise the - often virtual - opportunities for social cognition and connectivity new technology affords.

Let us start with the social practices linked to gaming. Interest in computer or video games means that the individual will be drawn to (and motivated by) the kind of cognitive challenges and reward structure these games present, and will develop the cognitive skills that are needed to meet such challenges. However, the development of expert gaming knowledge is an essentially social process, motivated by the values, goals and practices of a community of gamers (these values include: risk taking, entrepreneurship and expertise). Motivation for learning is inherent in the desire to become an expert gamer. Gamers are not autonomous problem solvers, but engaged in *social collectivity* (Logan 2008) in virtual space.

Jenkins (2006a) refers to these new contexts for social participation (not restricted to gaming communities but also encompassing different types of online social networks) as *participatory cultures*, 'with relatively low barriers to artistic expression and civic engagement, strong support for creating and sharing one's creations, and some type of informal mentorship whereby what is known by the most experienced is passed along to novices' (Jenkins 2006c:3). Gee (2004) uses the term *affinity spaces* to describe informal learning contexts structured around the use of new media. He contends that these offer *powerful learning opportunities* by generating shared practices that i) bridge the gap between participants of different age, class, gender, education etc., ii) bring along more

democratic or symmetrical forms of teaching and learning between experts and novices, and
iii) blur the distinction between the role of the teacher and the student.

Cover (2004:174) defines participation as a ‘strongly held and culturally based desire’ which was basically undermined and negated in the previous technological era. Thus, one could argue that new technology may recreate the structure for learning through participation in the form of cyber participation or virtual collaboration.

For instance, the convergence of internet and gaming has led to novel forms of online gaming, such as alternative reality games (ARGs), with a very strong participatory orientation. Although some ARGs are commissioned for marketing purposes (commercial ARGs), most of them are actually developed by independent individuals and groups for education, training or leisure (Dena, 2008). Researchers are just beginning to explore the social and educational benefits and implications of alternative reality games (de Freitas and Griffiths 2007; Dena 2008). For instance, Shaffer and colleagues (Shaffer, Squire, Halverson and Gee 2005) discuss the affordances of *epistemic games*, which build on virtual collaboration and simulated experience to create educationally valuable contexts for social activity (e.g. *Madison 2200*, an epistemic game based on the practices of urban planning, where virtual community activities may have real-life consequences).

Thus, some of the spontaneously evolving new-media participatory cultures have actually created a cross-over between leisure and institutional learning. But new media contexts foster new *habits of mind*, requiring a fresh understanding of collective action and collective creation, the ability to belong to different social groups that may not meet face-to-face, the skills to artfully reconnect thought and practice in a virtual landscape and the confidence to

establish new relations to authority. (For a detailed discussion of such new *habits of mind* see Vass 2009. Also, for an account of the role of dialogue in teaching thinking with technology see Wegerif 2010.) Therefore, mediated thought and action will become increasingly collective and interactive. This may have a revolutionary impact on education, with participation in various online and face-to-face arenas of learning activity becoming an integral part of ongoing classroom practices. Learning may take place in a complex world of intersecting paths in virtual and real space, blending formal educational contexts, professional practices and more informal arenas of shared activity. If so, learning (including collaborative learning) may also become essentially mobile, not tied to the physical space of the classroom (Sharples 2008; Sharples, Taylor and Vavoula 2007). Note that, as a result of these transformations, the boundaries between what is virtual and real, or what is formal and informal, may also shift or possibly break down. These transformational potentials for both formal and informal learning are clearly significant, challenging researchers to conceptualise and explore such new, virtual forms of collective, distributed knowledge building.

Concluding remarks

This chapter aimed to provide an account of contemporary research on classroom-based collaborative learning in the socio-cultural tradition, discussing both the theoretical underpinnings of this research field, and topical issues emerging from decades of research in the area. We discussed the significant shift of focus in collaborative learning research from the study of collaborative outcomes to the study of collaborative processes, driven by the recognition of the plurality and complexity of socially mediated learning and knowledge building. This shift in attention brought along a rich array of research examining the nature of classroom-based collaboration through the analysis of collaborative discourse, leading to

worthwhile intervention programmes to promote and resource productive forms of collaborative educational dialogue. Linked to this, we outlined current literature which aims to unpack the complexity of socially mediated learning through the study of contextual dimensions, looking at the significance of task design, relationship quality, subject domains and cultural tools for the processes and outcomes of classroom-based paired activities. Three important, topical issues emerged from our discussion.

The first crucial issue is the obvious necessity to examine and problematise current educational practices, specifically the quality and nature of classroom discourse. Closely related to this is the recognition of the need to enhance classroom-based collaborative work by promoting and resourcing productive educational dialogues. The implications for research are significant, revealing the urgency to develop a secure conceptual framework of collaborative learning and educational dialogue that is rooted in and informed by classroom realities. Such framework is essential to inspire further classroom-based research on peer collaboration, and research-led transformations of classroom practices with regards to the role and employment of collaborative activities. Following Mercer and colleagues' influential work, we understand that 'participation in external dialogue promotes internal dialogue' (Mercer, 2009). Future classroom-based research needs to unpack these crucial links between dialogue and thinking further.

Research on collaborative learning must also recognise the need to consider the emotional, affectively constituted aspects of collective, shared knowledge building. The reviewed research, especially in the domain of collaborative creativity, calls for a shift in emphasis from logical reasoning (rational and intellect-driven thinking) towards more complex models for the study of joint knowledge building. This argument is in accord with accounts

highlighting the undervalued status of emotions in educational research in general, and stressing the need to consider *both* logical *and* intuitive thought (Bruner, 1986). Also implied in this argument, and posing an exciting new challenge, is the necessity to transform our classroom practices to accommodate for the unboundedness and emotional intensity observed and valued in creative collaborations.

Finally, we noted the potentially transformative impact of new technology on classroom-based learning, including collaborative activities. There is no doubt that software development has huge potential to create new, effective contexts for children's classroom-based collaborative learning. Similarly, the reviewed research has highlighted the transformational potentials of new, convergent media for school-based teaching and learning. We should be encouraged by the collaborative efforts of policy makers, researchers and educators to predict possible educational futures with new technology. In the United Kingdom, the Beyond Current Horizons programme (www.beyondcurrenthorizons.org.uk) conducted with the DCSF (Department for Children, Schools and Families), the extensive CIBER project on the Google generation (2008), the wide range of research commissioned and managed by BECTA (e.g. Oblinger 2008), or the work carried out by the Schome Research group (www.schome.ac.uk), are all illustrative of the intense social and intellectual focus on envisaging an education system for 'the Information Age'. Theorising and research on the transformative potentials of new technology for collaborative learning needs to respond to this newly emerging field of inquiry, and conceptualise as well as promote productive forms of collaborative knowledge building afforded and mediated by new technology.

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