Human support in CSCL: what, for whom, and by whom?

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HUMAN SUPPORT IN CSCL

What, for Whom, and by Whom?

Human support has been widely studied in the context of traditional classroom or practitioner teaching-learning situations in which tutors support pedagogically those being tutored, sometimes referred to as tutees. The literature is too extensive to be cited here, but see Chi, Siler, Jeong, Yamauchi & Hausmann (2001) for an in-depth comparison on potential explanations for the effectiveness of tutoring, and as examples of recent specific studies see Lajoie, Faremo, Wiseman (2001) and Derry, Seymour, Lee and Siegel (in press). On the other hand, somewhat less research has been conducted on human support in computer-supported collaborative learning (CSCL) situations (but see Ashton, Roberts & Teles, 1999; Graesser, Person, Harter, & The Tutoring Research Group, 2001; Graesser, Person, & Magliano, 1995; Hudson, 1999, 1997; Kaptelinin & Cole, 1997; Katz, O'Donnell, & Kay, 2000; Light, Colbourn, & Light, 1997; Pilkington, Treasure-Jones, & Kneser, 1999; Rasku-Puttonen, Eteläpelto, & Arvaja, 1999; Schlager & Schank, 1997).

This chapter will take the form of a synthesis of and commentary on the aforementioned literature, with the goal of exploring the notion of human support in research on tutoring in general and in CSCL in particular. It is aimed both at researchers and practitioners, the latter being either teachers using CSCL or CSCL designers and programmers. It will be shown that in spite of the theoretical underpinnings of CSCL stressing the importance of co-construction in learning (Baker & Lund, 1997) and the unit of analysis as being the sociocultural setting in which activities are embedded (Kirshner & Whitson, 1997) human support is most widely represented in the literature in a quite limited sense. Firstly, it is portrayed most often solely from the tutor's point of view (Chi et al., 2001) and not as an inherent part of a co-constructed interaction (but see Derry et al. (in press), for a counter example). Secondly human support is generally seen as being given by tutors to tutees, and is not portrayed as often in other CSCL participant combinations (e.g., support given by students to students), although certain forms of peer collaboration can be seen as support and is often referred to as co-construction in the CSCL and more generally cooperative learning literature (Plety, 1996).

1. SUPPORT BY WHOM?

In order to explore the notion of support further, it will be useful to enumerate the different participants in a CSCL situation who may give or get support and

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attempt a description of human support. Who are the potential participants in a CSCL situation? Quite generally, there may be students, tutors, teachers and possibly technical experts. All participants may give support in one form or another whereas we may naturally postulate that tutors, teachers or technical experts do not generally receive support, whereas students do. Such a hypothesis stems from the stereotypical idea that in a pedagogical situation, those that need to be 'supported' are those that are learning, e.g. the students. This brings us to the notion of support, in particular human support. What does it signify? And is our stereotypical hypothesis justified?

1.1 Tutors supporting students

Ashton et al. (1999) define four categories of instructor actions (i.e., types of support given by an instructor) taken during distance-learning collaborative on-line environments: pedagogical, social, managerial and technical. *Pedagogical actions* encompass all attempts to reach a particular learning objective relevant to the course and include feedback, giving instructions, giving information, giving opinions, preferences or advice, questioning, summarising student comments and referring to outside sources. *Social actions* encompass attempts to make students comfortable and promote inclusion and include using empathy, meta-communication, humour and performing interpersonal outreach. *Managerial actions* encompass attempts to coordinate assignments, discussion and course activities in order to maintain a sense of structure in the course, most pertinent for on-line distance courseware and less so for the traditional classroom or for CSCL face-to-face situations, as in those cases, CSCL systems generally form only a small part of a course. Finally *technical actions* include assistance to students in using the course delivery software or CSCL environment and are based on user and system issues.

In the Ashton et al. study, the support comes from the instructor, be it pedagogical, social, managerial or technical and is aimed at the student. Although this is the generally accepted direction of support, the type of support is enlarged to include social, managerial and technical in addition to the traditional pedagogical, mainly because of the 'at-a-distance on-line' nature of the collaborative interaction.

But even if educational or pedagogical support is commonly taken to be the type of support that teachers or tutors give students, what it means to support a student in a pedagogical fashion is by no means straightforward. Waeytens, Lens & Vandenberghe (2002) note that teachers' visions about 'learning to learn' influence the supportive actions they take with students. In this study, teachers with a vision of teaching as 'transmission' and of learning as 'absorbing' and that view students as essentially passive, gave supportive actions in the form of tips and advice in order to prepare for tests or study particular subject content and specifically pointed out the important information to be remembered. On the other hand, teachers with a vision of the learning process as student exploration and discovery and who view students as capable, autonomous and responsible preferred to have students learn from each other, develop new methods on their own and discover what is important instead of being told by the teacher. So it seems that the vision teachers have on the teaching-learning process has a direct influence on what they consider to be pedagogical support. In fact, they may have a vision of learning that leads to providing an environment in which students may support each other.

1.2 Students supporting each other

Peer tutoring both outside of and in CSCL settings, has been given a fair amount of attention in the literature, although oftentimes it is discussed as peer collaboration, peer interaction or co-construction (Arvaja, Häkkinen, Eteläpelto & Rasku-Puttonen, 2000; Plety, 1996; Soller, Linton, Goodman & Lesgold, 1999; Wu, Farrell & Singley, 2002). Salomon & Perkins (1998) note that while a tutor's objective is to facilitate student learning, peers working together aim for task accomplishment, so the goal of human support may vary with the person doing the supporting. Human support goals are also influenced by individual interaction styles. Plety, (1996) identified four types of individual profiles in his long-term study on cooperative learning in four person groups: the animator, the verifier, the questionner and the independent group member. Plety showed how each type of individual gave different types of support during group learning. Finally, although it is not the focus of this chapter, students may also support themselves each individually, for example, in the form of self-regulated learning (Puustinen & Pulkkinen, 2001).

1.3 Tutors supporting each other

Finally, if we were to imagine human support for teachers and tutors, what form could it take? Support could be given either by the computer (Leroux, 1995) or by other CSCL participants while being mediated by the computer. Schlager & Schank's (1997) TAPPED-IN® community gives an example where teachers may find support in the form of meeting colleagues, getting information on curriculum reform, and finding resources such as pertinent web sites, but this is support in the form of exchange outside of actual teaching or tutoring. The present literature review reveals only one study (Katz & O'Donnell, 1999) that included tutors giving support to tutors (in this case expert tutors coached peer tutors) in a CSCL setting concurrent to tutoring. No studies were found of support given to technical experts.

In short, with some exceptions, human support in pedagogical situations is generally seen as being directed towards students, and as being given by teachers, tutors or possibly technical experts. Support given can be social, managerial (for example, in the case of on-line courseware), or technical (in the case of computer use), but is generally seen as pedagogical in nature.

1.4 Who supports whom and how?

The following table sums up who may give support to whom and lists the types of support theoretically possible. The table makes a number of assumptions, firstly that technical experts are not domain experts, although of course they may be. This assumption means their support would focus on how to use the CSCL system and not on how to help students from a pedagogical standpoint. Secondly tutors and teachers, in addition to giving support on pedagogical, social and managerial issues may become technically competent with increased system use and give technical support to students. Thirdly tutors and teachers may give what we have termed *meta-support* to their peers, in other words support on how to give support, be it from a pedagogical, social, managerial or technical point of view. They can also give technical support to other tutors and teachers.

We have already seen that the nature of support changes with the person giving it. In the same way, the intended receiver of a particular support also changes its nature. Whereas the meta-technical support directed at other teachers deals with how to support students technically, the meta-technical support directed at technical experts could deal with suggestions on how to change the system so as to better support both students and teachers in their activities. Fourthly, students are portrayed as giving all types of support to their peers, but as not attempting to give support to teachers or technical experts. The latter half of this statement is of course a highly cultural supposition.

Table 1. Possible types of support given by and to different CSCL participants

		Support given by		
		student	tutor/teacher	technical expert
Support given to	student	pedagogical, social, managerial technical	pedagogical, social, managerial, technical	technical
	tutor/teacher		meta-pedagogical, meta-social, meta-managerial, technical, meta-technical	technical
	technical expert		meta-technical	technical

Now that we have set the stage for human support in CSCL by discussing the potential participants and the types of support possible, let us turn our attention to the general focus of this chapter. The central questions we will address are the following. As mentioned earlier, what can general studies of tutoring teach us about human support in CSCL? Next, what are the links between educational theory, educational approaches, human support in general and human support in CSCL environments? And finally, how can we design CSCL to provide for the support we choose?

The remainder of the chapter is organised into three main sections. The first provides a theoretical review of the notion of human support in relation to learning (Section 2) and in relation to two different educational theories: situated cognition and activity theory (Section 3). The second main section presents the state of the art of human support in CSCL from three different points of view. Firstly, we report how different educational approaches to collaboration may provide for different types of human support (Section 4). Secondly, we give examples of human support found in the CSCL and tutoring literature in relation to the types of support defined earlier in Table 1 (Section 5). Thirdly, we discuss how the characteristics of CSCL software provide for different types of human support Section 6). The third and final main section suggests implications for human support within CSCL in higher education and summarises the chapter's findings (Section 7).

2. THE NOTION OF HUMAN SUPPORT IN LEARNING

The importance of human or indeed other support given during learning can be understood with the help of three central concepts, all of which stem from Russian psychology.

2.1 *The Zone of Proximal Development*

The first concept is Vygotsky's renowned 'Zone of Proximal Development' (Vygotsky, 1930/1978). According to Vygotsky, the Zone of Proximal Development is "the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers." (p. 86). In this vision of human support, actions taken or language used by the adult or more capable tutor are progressively relinquished so that the child or student is able to progressively master a task, at first with the tutor and then without, as an independent problem solver.

In a computer conferencing setting, Hudson (1999) sees the tutor's role as providing structure to an electronic space, which he further interprets as providing the scaffolding for learning within the students' various zones of proximal development. Once an initial purpose for activity is defined, students may be then be tutored each according to his or her own capacity. According to Kaptelinin and Cole (1997), however, different interpretations of the original definition of the 'Zone of Proximal Development' imply different strategies for creating CSCL environments (see Valsiner & Van der Veer, 1991 for different interpretations as well as Engeström, 1987). Kaptelinin and Cole (1997) choose to see the Zone of Proximal Development as a way in which individual and social phenomena mutually determine each other. One of the results of their study indicates that educational benefits of collaboration depend on the degree to which learners are involved in their collective activity. For example according to these authors, if learners can meet the same goals by acting alone, if they are forced to collaborate, not given time enough to form a group identity, have initial failures or if their system does not allow for sharing emotions, then involvement in the collective activity will decrease and the educational benefits of collaboration will suffer. These factors can be influenced by system design, but also by how the software is used in the classroom, both of which influence the possible human support (see Chapter 6 by Jermann, Soller, & Lesgold and Chapter 9 by Kreijns & Kirschner, this volume).

2.2 *Internalisation*

The second concept - internalisation - was also developed by Vygotsky and taken further by Leont'ev (1975/1981a), is the transformation of exterior processes taking place on exterior material objects into processes that take place on the mental level, as part of consciousness. The importance of human support to internalisation is made clear by the following citation originally in French translation:

> "In other words, the specifically human higher psychological processes cannot appear other than within human-human, i.e. interpsychological interaction. It is only thereafter that these processes begin to function autonomously on an individual level; some of them lose their original exterior form and become intrapsychological processes" (p. 107, author's translation).

For Leont'ev, internalisation is not simply the displacement of exterior activity toward a level of consciousness that pre-exists. Instead, internalisation is the process by which consciousness forms (see also Chapter 2 by Lipponen, Hakkarainen, & Paavola, this volume). Similarly, Bruner, (1986) sees tutoring as the implanting of vicarious consciousness in the child or student by the adult or more capable tutor. As internalisation takes place within human interaction, one can conclude that human support is facing a tall order - that of consciousness creation in the person being supported!

As Kaptelinin and Cole (1997) state, once a person internalises a new ability, after having experienced it as being distributed between people, he or she becomes more competent in contributing to collective activities. The implication is that collective activities build upon themselves in that as individuals experience activities collectively, they become more competent and in turn help others progress. Whether tutors become competent in helping tutees or students in helping their peers, the idea is that their competence stemmed from either watching others or their own peripheral participation (Lave, 1991). CSCL environments could thus specifically provide for such opportunities (see for example the Vicarious Learning Project: McKendree, Stenning, Mayes, Lee, & Cox 1998).

2.3 *Mediation*

Vygotsky claimed that higher mental functioning is mediated by technical tools but also by psychological tools, such as language, diverse forms of counting and calculating, mnemonic techniques, algebraic symbol systems, works of art, writing, schemes, diagrams, maps, and all sorts of signs (Vygotsky, 1985). According to Wertsch (1991), the introduction of a psychological tool into a mental function causes a fundamental transformation of that function and does not just facilitate it.

The concept of mediation is important for human support in that both technical and psychological tools are used by the tutor. For example, a CSCL interface is a technical tool around which a tutor may give support. This technical tool can fundamentally change an activity. CabriGéometre® (Laborde, 1995) illustrates this by the fact that geometrical systems can now be considered in rotating space as opposed to only on paper. This fundamentally changes the ways in which tutors can support geometry learning.

Concerning the use of a psychological tool, Rosé, Moore, Van Lehn and Albritton (2000) and Chi et al. (2001) have shown that students learn either more effectively or at least as well when tutors prompt students to express themselves, rather than when tutors furnish answers. This also has implications for tutoring in CSCL from a mediation point of view. If developers or teachers lean towards supporting 'Socratic tutoring', tutors could be supplied with a set of generic prompting sentences coded into the interface (technical tool), if the interaction is type-written, such as 'Could you explain or put this in your own words?', 'What do you think?', 'Anything else to say about it?', or 'Do you have any ideas/thoughts on why that might be the case?' (Chi et al., 2001). A similar approach has been suggested for students collaborating in CSCL environments in order to ease the burden of interaction management and orient their interaction toward problem-solving and reflective activities (Baker & Lund, 1997). This same approach could also be extended to include student sentence-openers in CSCL collaborative environments where peers tutor each other, or are being tutored, for example 'This reminds me of ...', 'I think that ...', 'That could be explained by ...', 'An argument for that would be ...', or 'An argument against that would be ...' (see Soller et al., 1999; Jermann et al., this volume). This would require checking coherency and redundancy between the tutoring sentences and the student sentence-openers as well as the possibility for 'button-playing' so that participants do not bat back and forth phrases without elaboration. A psychological tool such as language is one of the media *in which* the tutor gives support, others may include drawing diagrams, calculating or writing together, etc. Harnad (1990, 1995) cited in Light et al. (1997) argues that using e-mail makes text capturing, quoting and commenting easier which has the potential to support highly focused conversational interaction. If the e-mail exchange takes place on a list, the interaction becomes accessible to an audience and may benefit other individuals (see preceding subsection on internalisation).

Thus technical and psychological tools change the ways in which human support can be given in CSCL situations. In accordance with sociocultural theory, human support may also modify the technical and psychological tools. Tutors may suggest changes in a CSCL interface so that they are better able to support their students, for example they may request a shared workspace for collaborative diagram drawing. In the same way, human support may change the language being used in a given situation, for example teaching a framework for interpreting students' physics problem solving leads to the adaptation of framework terms in subsequent discussion (Lund, 2002). This last section has focused on how the theoretical notions of the zone of proximal development, internalisation and mediation can contribute to understanding the nature of human support and its place in CSCL. The next section deals with human support in relation to educational theories.

3. EDUCATIONAL THEORIES AND HUMAN SUPPORT

Various educational theories have been presented and discussed in Section 1 (Chapter 1 by Kirschner, Martens, & Strijbos and Chapter 2 by Lipponen et al.) of this volume; the reader is kindly referred to these chapters. As these theories have already been given space, our purpose here is only to briefly evoke two of them: situated cognition (which in our view encompasses Vygotskian sociocultural theory) and activity theory. We would then rather concentrate on comparing the ways in which they provide for human support roles. It should be noted that these theories share a common theme - they view knowledge in a non-dualistic manner so as to avoid the mind-body split (Descartes) and thereby also avoid a cognitivist outlook of human cognition as information processing oftentimes compared to a computer program executed in the brain (Simon, 1984). If we choose what may be considered to be an overly specific theoretical focus, it is precisely because the perspective based on Vygotskian social psychology, activity theory and social practice is where the human relationships between teachers and students are seen as fundamental (Hudson, 1999), relationships being the basis of human support.

3.1 *Situated cognition and human support*

According to Clancey (1997), "situated cognition is the study of how human knowledge develops as a means of coordinating activity *within activity itself*." (p. 4, Clancey's italics). Clancey explains that this means that feedback, occurring both internally and within the environment over time, is of the greatest importance. Feedback has long been one of the principal concerns of ITS developers (Corbett, Anderson, & Patterson, 1990) and is at the heart of tutoring activity. An initial question concerning feedback dealt with when to give it: immediately, after the student had thoroughly searched for him or herself or somewhere in between? Du Boulay & Luckin (2001) state that for the modelling effort of tutoring in the community of artificial intelligence in education, tutoring is either seen as encompassing a tutor's response to student errors or as how teachers motivate students.

In this chapter, we postulate that giving feedback should be considered from the point of view of *all* participants in a tutoring dialogue, and not just from the point of view of the tutor. For example, when could students be encouraged to give feedback to a tutor's comments? If it is required that situated cognition theory, as authors Kirshner and Whitson (1997) state, shift the focus from the individual as the unit of analysis toward the sociocultural setting in which activities are embedded, what does such a shift imply for studying human support in CSCL? Such a shift is partially supported in the study carried out by Chi et al. (2001), who compare three hypotheses for tutoring effectiveness: tutor-centered, student-centered and interactive. In what they term the interactive coordination hypothesis, the contribution of tutor-tutee interactions in tutoring effectiveness, as measured in learning gains, is investigated directly. The tutor-centered pedagogical hypothesis examines tutors' moves in relation to specific student moves, such as errors, while the student-centered constructive hypothesis considers the effects of tutor-elicited students' constructive responses on learning.

Dialogue analysis is thus one method of studying interaction and it has been carried out by a large number of those who have studied tutor-tutee interactions. However, in order for situated cognition theory to *underpin* dialogue analysis, the analysis must treat the participants as co-constructors of their own interaction. Even though tutor-tutee dialogues are traditionally seen as tutor dominated and research has concentrated on the tutor's role (Chi et al., 2001) a sociocultural approach would perform analysis from both the tutor's and the tutee's perspective, searching for that something extra that *emerges* (Baker, 1994) from dialogue. From a researcher's point of view then, CSCL environments that include possibilities for human tutoring interventions should thus provide for studying students' (not limited to errors) and tutors' interventions with the same degree of detail.

Such multiple perspective dialogue analysis is however not sufficient in order to satisfy the demands of situated cognition theory in relation to CSCL and human support. The field of action within which the interaction takes place, though difficult to delimit, should also be taken into consideration, the point of departure for its analysis being the perspective of the participant(s) whose behaviour is being analysed (Goodwin & Duranti, 1992). How a person interprets a situation has a direct effect on how he or she performs in it. For example, what is the relationship the participants have with the CSCL environment? Is it an integrated part of their everyday experience, or a novelty item in the classroom? In the former case, a set of usages may have been developed around the CSCL tools available, and a community with specific modes of communication may have been created, aspects of the situation that influence both tutor and tutee. It may be valuable to study tutor and tutee activities that are anchored in habitual use of a CSCL environment, especially in relation to how best provide human support. We will consider the latter case, when the CSCL environment is introduced as a novelty item, in the next section on activity theory and human support.

3.2 *Activity theory and human support*

According to Leont'ev (1972/1981b), who has further elaborated Vygotsky's notion of activity, the essential distinction between two activities is the difference between their objects. An activity oriented toward an object is the first part of Leont'ev's macrostructure for activity. An activity's object is its motivation, whether that motivation be material or not, perceived or imagined. A motive implies a need, the driving force of any human activity. What are the tutor's needs in a CSCL tutoring interaction? What are the student's? The present literature review has revealed no studies that have attempted to answer such questions. However one could propose possible answers to be explored based on knowledge of the nature of a need as described by activity theory and on knowledge of the tutor-tutee situation. On a simple level, if a tutor is being paid, his or her salary may meet any material needs. On a more abstract level a tutor may feel a need to contribute to students' scholarly success. The student, on the other hand, needs to receive a passing grade in the course or may (hopefully) feel a need to understand the material being tutored.

In the same way that a motive is the corollary of an activity, a conscious goal is the corollary of an action, actions being 'component' parts of an activity. The actions needed in order to carry out an activity are performed under the influence of the activity's motivation, but are each oriented towards a goal. An action oriented toward a goal is the second part of Leont'ev's macrostructure for activity. What are the actions and associated goals needed in order for the tutor and/or tutee to meet his or her needs? As Leont'ev points out, pedagogical research usually *furnishes* ready-made goals for participants, in our case for tutors and tutees; but how do tutors and tutees develop their own goals? There are very few studies to this day on how goal formation is carried out and the present review has revealed none concerning tutoring and CSCL environments. Once a set of goals has been identified, one could begin to ask how to support reaching them, either in terms of CSCL system development or task design. The third part of Leont'ev's macrostructure for activity concerns the operational aspect of performing an action, in other words, the means by which the action is accomplished. Leont'ev calls these means 'operations'. In the same way that actions are determined by their goals, operations are determined by their conditions. The conditions for carrying out an operation are particularly pertinent when actions are carried out by instruments - e.g. tutors and tutees interacting in a CSCL environment. Such environments propose new conditions for carrying out operations. It is precisely these new conditions that make particularly interesting the case where the CSCL environment is introduced as a novelty item in the classroom.

Tutors and tutees must appropriate the new communication medium and in doing so, they may collaborate on new unintended tool use, for example students beeped the button intended for getting each other's attention as a way of signalling going back and forth between the chat interface to the graphic interface (Baker & Lund, 1997). This can be viewed as students inventing a method for supporting their own communication. See also Docq and Daele (2001) for a study on how students appropriate CSCL tools. It therefore becomes interesting to study in what ways new tools actually can *transform* an established activity (Engeström, 1987), in this case peer communication support. This section has illustrated how situated cognition based on social constructivism and activity theory provided interesting theoretical frameworks for reflection on human support in CSCL

4. STATE OF THE ART IN CSCL HUMAN SUPPORT

In this section, we review the types of human support roles present in the literature from three points of view. Firstly, human support is discussed in light of a selection of educational approaches to collaboration, whether they are in a CSCL context, or in a collaborative context without any computer. Secondly, a taxonomy of human supportive roles in CSCL is proposed and analyses of these roles found in the literature are discussed. Finally, a selection of characteristics of CSCL software are evoked in order to ascertain how each characteristic either constrains or enhances the human support it is possible to offer.

4.1 Educational approaches to collaboration and human support

How do particular educational approaches to collaboration and/or cooperation influence human support? In their meta-analysis of cooperative learning methods, Johnson, Johnson, and Stanne (2000) speak of cooperative learning as occurring when students work together to accomplish shared learning goals (p. 2) (see also Chapter 1 by Kirschner et al., this volume). They attribute the widespread use of cooperative learning to the variety of cooperative learning methods available for teacher use, ranging from concrete and prescribed methods such as well-defined step-by-step procedures to flexible methods such as conceptual frameworks teachers can use as a template to help structure the activities of their own specific circumstances. Similarly, according to McConnell (1994), the role of the teacher or tutor in cooperative learning is to provide a supportive context for the cooperative group to work. This may vary from providing a structured context where work, roles and group processes are assigned to students and followed through by the tutor to providing a more open context for the groups to work in where tutor interventions are minimised. The results of the Johnson et al. analysis tentatively indicate (see their article for caveats) that the latter conceptual and flexible method has a greater impact on student achievement. Examples of well-defined step-by-step procedures include 'Jigsaw' (Aronson & Patnoe 1997) and 'Cooperative Integrated Reading & Composition' (Stevens, Madden, Slavin, & Farnish, 1987) while examples of the flexible method are 'Learning Together' (Johnson & Johnson, 1999) and 'Group Investigation' (Sharan & Sharan, 1992); for more detail see Chapter 5 by Järvelä, Häkkinen, Arvaja, & Leinonen, this volume).

It was previously shown that a teacher's outlook on learning influenced the type of supportive activities he or she provided. Here, Johnson et al. (2000) indicate that more flexible teaching methods used for structuring activities can have a greater impact on student achievement regardless of the content taught. There seems to be a need to study the human support given in the well-defined step-by-step procedures as opposed to the human support given during the flexible methods. Intuitively, the types of support would seem to vary and if they do, could this be one of the factors contributing to higher student achievement in the flexible method case?

4.2 Research on tutoring

A literature search on tutoring mostly in higher education or more globally, on human support for problem solving (with or without computers) shows it has been studied in the following contexts (Table 2, in alphabetical order by reference). The *time* column refers to whether the interaction was synchronous or asynchronous. The *space* and *medium* column refers to the type of communicative messages exchanged, spoken face-to-face, type written ('chat' like interface or threaded discussion e-mail list) or spoken through a video-conference set-up. The *artifacts* column lists the tools, CSCL interfaces or other materials available to the students and tutor during the interaction. The remaining columns describe the type of *students*, type of *tutor* (given simply as 'tutor' when non-specified), the *combination* in which they worked (one-to-one, dyad-tutor, group-tutor, etc.), and the *article* that describes the study. In the case where more than one study is represented in the article, one of them is chosen. Finally, where relevant, the last column indicates whether or not the type of support that the authors analysed had an *effect* on the type of behavior studied (for example behaviors studied included learning, but also the nature of dialogue exchanges or managing conflict, etc.). If the effect was positive (e.g., tutoring facilitated learning), then this is shown by a '+'. If the effect was negative (e.g., peer support did not facilitate successful problem-solving), then this is shown by '-'. Alternatively, results in terms of support effect can be inconclusive ('?'). In the few cases where *support effect* was not directly studied, other results are given. These different studies can be organised in four groups of researchers and their research goals: 1) design or develop automated help technologies, 2) facilitate learning to tutor through knowledge of tutoring activities, 3) study how tutoring relates to student learning or 4) investigate the different participant roles: student, peer, tutor, teacher. First, We will proceed by giving examples of the work done in each group and then concentrate on what the notion of supportive roles in the general tutoring literature has to add to such studies in CSCL.

The first community of researchers study tutoring dialogues in order to design or develop some automated help technology. For example Fox's (1993) objective is to design 'Intelligent Tutoring Systems' (ITS) after having a) documented dialogue processes in naturally occurring human-human tutoring and b) determined the strengths and weaknesses of intelligent systems. Fox experienced tutoring as a way of teaching methods and practices and not as information transfer. She stressed two findings: the indeterminacy of tutoring language and communication, open to an indefinite number of (re)interpretations and the joint achievement and mutual orientation of tutoring activities. Katz and O'Donnell's (1999) objective is to develop automated coaches that can support students during collaborative problem-solving exercises. Their approach is to highlight peer coaching impasses, identify cues that coaches use to detect and diagnose peer interaction impasses and specify how coaches remedy these impasses. Peer coaching impasses included individual or shared knowledge deficits between one or both members of a peer-coach/student dyad, communication failures and pedagogical problems. Cues used by expert coaches to detect peer coaching impasses included noticing long silences, lack of productive student actions, peer coach failures to respond to the student and faulty student claims that were not refuted by the peer coach. Expert coaches remedied peer coaching impasses either by advising students directly or by addressing the obstacle that prevented the student coach from resolving the impasse. Graesser et al. (2001) have developed a computer tutor (AutoTutor) that incorporates features of what the authors call 'naturalistic' tutorial human dialogue, defined as not incorporating the 'ideal' tutoring strategies found in the ITS literature (cf. for example the Socratic method (Collins, 1985)). Such a dialogue is characterised by a five-step frame: 1) tutor asks question, 2) learner answers question (or begins to solve problem), 3) tutor gives short immediate feedback on the quality of answer or solution, 4) tutor and learner collaboratively improve the quality of the answer and 5) tutor assesses the learner's understanding of the answer. Rosé et al. (2000) are building a dialogue enhanced version of a web-based course on basic electricity and electronics following a comparative study of 'Socratic' and 'Didactic' tutoring. Leroux's (1995) work differs slightly within this perspective of designing automated help technology as his computerised pedagogical assistant is also geared towards helping the *human* tutor as he or she tutors, for example he envisages retrieving computer traces of students' activity in real time or taking control of a student's computer from a distance. The SCALE project (for example, cf. Corbel, Girardot & Jaillon, 2002) has developed a re-play functionality of student-constructed argument graphs potentially allowing teachers to use the slow-motion replay of student work as a means of supporting them in post-reflective discussion.

Another group of researchers are more interested in the analysis of tutorial dialogue *per se*, in its educational context. Derry et al. (in press) analysed talk between a group of educational psychology university students in conflict and a problem-based learning (Barrows, 1988) tutor in order to propose improvements to the tutorial process. Their ultimate goals are to improve understanding of how future teachers learn through problem solving, to facilitate and support such learning and to train future teaching assistants to work within this framework. Their work highlighted how tensions relating to conflicting intellectual commitments in regards to subject matter taught within a group can be managed by a tutor and how social interaction and learning can thus be hindered or facilitated.

A third group of researchers study how tutoring relates to student learning. Soury-Lavergne (1998) did student-tutor dialogue analysis, but she combined it with the study of the creation of computer-generated geometrical figures in TéléCabri® during problem-solving and asked to what extent a teacher's interventions change the student-milieu relation. She found that tutors' explanations followed a path beginning with manipulation of the geometrical interface through functional and geometrical levels of the interface and ended with the problem to solve whereas students' comprehension functioned in the opposite direction, beginning with the problem to solve, moving through the other two levels and ending with the manipulation of the interface. The work already mentioned by Chi et al. (2001) on different hypotheses for tutoring effectiveness also falls into this category of relating tutoring to student learning.

Finally, a fourth group of researchers has studied tutoring specifically in the CSCL or CMC (Computer Mediated Communication) environment. Wu et al. (2002) have examined the role of a teacher or peer (more experienced or same-level) with one or two other students in an algebraic problem-solving situation in a networked CSCL environment. It appeared that teachers used different tutoring techniques for individuals than for pairs, using less *probing* and *diagnosing* and more *leading* and *hinting* for the former. Peer tutors preferred *prompting* followed by *leading*. The fact that same level peers acted as individual problem solvers led the authors to suggest that supporting collaboration requires 1) diagnosing impasses, 2) facilitating problem-solving interaction and 3) suggesting ways to divide the problem into sub-tasks in order to share out responsibility.

Time	Space	Medium	Artifacts	Students	Tutor/Teacher	Combination	Reference	Effect of Support
Asynch.	At-a-distance	Typewritten messages	On-line course delivery software	University students in Fine Arts, Statistics and Psychiatric Nursing	Course supervisor, tutor marker, technical consultant	Course supervisor, tutor marker, technical consult – 33 students	Ashton, et al. (1999)	Categorisation of tutoring: pedagogical, managerial, technical and social
Synch.	At-a-distance	Typewritten messages, Spoken	NetMeeting©, Lotus Notes© RealNetworks©	British and German students or employed persons	Multi-national content expert tutors	Tutor-15 students /employed	Böhmann, et al. (2000)	+ effects of tutoring on task facilitation as viewed by users
Synch.	At-a-distance	Spoken by video-conference	Lyceum	University MBA students	Lyceum specialist tutors	70 tutors 850 European students	Buckingham-Shum, et al. (2001)	? effects of tutor's role ; results described tutors' training
Synch.	Face-to-face	Spoken	Written biology text	8th graders studying the human circulatory system	University students	Tutor-student	Chi, et al. (2001)	+ effects of 'interactive' tutoring on student learning as shown by testing
Synch.	Face-to-face	Spoken	STEP web site video	Undergraduate students in educational psychology	Teaching assistant	Teacher-5 students	Derry et al. (in press)	+ and – effects of dialogue management techniques on qualiy of dialogue as shown by dialogue analysis
Synch.	Face-to-face and distance	Typewritten messages	Computer terminal	Undergraduate science and math students	Female graduates in science/math	Tutor-student	Fox (1993)	+ effects of tutoring as shown by qualitative dialogue analysis

Time	Space	Medium	Artifacts	Students	Tutor/Teacher	Combination	Reference	Effect of Support
Synch.	Face-to-face	Spoken	Television set, a marker board, colour markers and a course textbook	Undergraduate psychology students	Graduate students in psychology	Tutor-student	Graesser et al. (1995)	Differentiation between 'skilled' & 'unskilled' tutoring ; + effects of latter as revealed by 5-step dialogue frame
Synch.	Face-to-face	Spoken	Multimedia package World of Number® (Shell Centre et al. 1993)	Comprehensive school math students	Comprehensive school math teacher	Tutor-small group	Hudson (1997)	+ and – effects of tutor's role in relation to software use by students as revealed by dialogue analysis
Synch.	At-a-distance and face-to-face	Typewritten messages and spoken	Sherlock 2®, an ITS for avionics (Katz, 1995)	Pairs of students working in the ITS Sherlock	Avionics technicians	Tutor-student - student	Katz & O'Donnell (1999)	+ and – effects of tutor's varions roles on comprehension as revealed by dialogue analysis
Synch.	Face-to-face	Spoken	Problem-Based Learning (PBL) meeting, no special technology	2nd year medical students	Experienced tutor in collaboration	Tutor-4 students	Koschmann et al. (1997)	+ effects of tutor's interventions on identifying a 'learning issue' as revealed by dialogue analysis
Synch.	Face-to-face	Spoken	Roboteach® (Leroux, 1995)	Professionals (e.g., production treatment)	Tutor -Assoc. for Personnel Training	Tutor-3 students, Tutor-2 students	Leroux (1995)	+ effects of a 'pedagog. Assistant' on tutor and students

Time	Space	Medium	Artifacts	Students	Tutor/Teacher	Combination	Reference	Effect of Support
Asynch.	At-a-distance	Type written messages	Web-based archive of threaded discussions	1st, 2nd, 3rd year university psychology students	Tutors	Tutor-100 students Tutor-6 students	Light et al. (1997)	+ and – effects of tutors' interventions on communication, but affected by tutor 'stance'
Synch.	Distance: distributed over 6 'learning centers'	Threaded BB, e-mail , video-conference,	DisCo® (Svensson & Ekenstam, 1998)	Groups of university systems analysis students	University teachers in systems analysis	Tutor-"learning center" group Tutor-6 "learning center" groups	Magnusson & Svensson (2000)	+ and – effects of 'group types' through analysis of interviews, diaries and participant observations
Synch.	At-a-distance and Face-to-face	Typewritten messages	WebCT©	Master of Ed. University students	Tutor	Tutor-6 students Tutor-2 demonstrators Student-student	Pilkington et al. (1999)	Tutoring role showed characteristic patterns of exchange in dialogue
Asynch.	At-a-distance	Typewritten messages	BSCW® (2003, OrbiTeam/GMD) GW:groupware	Economics and Finance University students	Tutor	4 groups of a tutor-5 students	Renzi & Klobas (2000)	Students changed view of GW collaboration as measured by test
Synch.	At-a-distance	Spoken by video-conference	Cabri-géomètre® (Laborde, 1995)	Hospitalised 8th and 9th grade geometry students	Junior high and high school geometry teachers	Tutor-student	Soury-Lavergne (1998)	+ and – effects of tutoring on the student-milieu relation
Synch.	At-a-distance	Threaded typewritten discussion list	Algebra Jam® interface (Singley et al. 1999)	Pairs of and single 8th-12th grade algebra summer school students	High school math teacher, peer tutor	Teach./Tutor-stud., Stud.-stud., Teach.-stud.-stud.	Wu et al. (2002)	+ and – effects of tutor's/peer's role in terms of info. flow & instructional strategies

Pilkington et al. (1999) have investigated participant roles in CMC Seminars and used Exchange Structure Analysis (ESA) to analyse verbal exchanges in this context and found that differences in exchange patterns appeared to reflect participant roles (for example tutors' talk was more likely to be initiating, asymmetrical and to use response complements (similar to feedback) while tutees' talk was characterised by reinitiating and clarifying statements). In addition, individuals were found to alter their exchange structures depending on the role they held in a given interaction. As already mentioned, Ashton et al. (1999) have investigated the role of the instructor in collaborative asynchronous online environments and have developed a coding scheme capable of capturing the range and variety of instructor postings: pedagogical, managerial, technical and social. The author and her colleagues are currently analysing how the tutor's role in CSCL environments is modified by a tutor's analysis of student interaction (but see Baker & Lund, 1997; De Vries, Lund & Baker, 2002) for articles dealing with peer collaboration in similar CSCL systems).

In each of the cases cited here, although the ultimate research goal differs, the work on which it is based has some common ground. Most studies investigate human tutoring dialogues in some way, generally concentrating on the nature of tutors' utterances. This corroborates the statement by Chi et al. (2001), that most of the research on tutoring, at least that which is cited here, takes a tutor-centered approach. As we have seen from the theoretical discussion in the beginning of the chapter, it is quite clear that such an approach does not necessarily find its basis in the view that tutor-tutee interactions are co-constructed and negotiated, that tutors but also tutees have goals that influence their activity, and that CSCL tools may thus be appropriated in different ways depending on their user and that different users thus require different support.

5. EXAMPLES OF HUMAN SUPPORT IN CSCL

Instead then of discussing the majority of tutor-centered approaches, let us try to go forward in the spirit of the theoretical notions and frameworks we have already presented and focus on the notion of human support given by each of the CSCL participants as a facilitating activity taking place within an interaction, attempting to give equal time to tutors (be they teachers or peers) and tutees. What do we mean by facilitate? One can find a large variety of cognates for 'facilitator' in the tutoring literature, namely: mediator, coach, scaffolder, commentator, demonstrator, motivator, explainer, guide, organiser, mentor, evaluator, trainer, resource allocator, role-play leader or advice giver. The majority of these terms seem to fit into the tutor-tutee direction of support, although some may be applied to peer tutoring.

Going back to the introduction and taking Table 1 '*Possible types of support given by and to different CSCL participants*' and considering a combination of the work of others and of those in Table 2 '*A breakdown of a selection of research on human tutoring support*', we can build a series of new tables that will allow us to see which combinations of support in CSCL are found in the literature and will enable us to further reflect upon them. What are concrete examples of each type of support?

Are the categories so neatly divided? Are there cases of multi-functionality, for example where social support can be seen as pedagogical support in disguise?

In the original schema proposed by Ashton et. al. (1999) containing pedagogical, social, managerial and technical support, coordinating discussion was seen as part of managerial support including pointing students toward messages, foreshadowing upcoming topics, starting, ending or extending topics, making comments about the topics, e.g. pertinence, level, length or format, defining the audience for messages, and defining the appropriate place for messages. Such support in the form of discussion coordination is representative of e-mail list management, the case in Ashton et al. (1999). However, disentangling overlapping talk or providing time for group members to speak is more indicative of real-time interaction, either face-to-face or on-line synchronous chat. Although we assume it to be widely known that the characteristics of communicative environments influence the kind of interaction support that can be provided, there is still a lack of research on how students can profit from the CSCL systems that provide tutors with ways to help students structure activity, for example in the case where they provide or take away resources at opportune moments. In the following tables, the types of support will be abbreviated: 'P' for pedagogical, 'S' for social, 'M' for managerial, 'T' for technical and 'I' for interaction support (a new type of support described in the previous paragraph). Meta support will be signified by 'M-P' for meta-pedagogical, 'M-S' for meta-social and so on.

5.1 Students giving support

Table 3 illustrates some examples from the literature where students support students - each type of support is represented.

Table 3. Examples of human support between students

By	To	Type	Example	References
Student	Student	P	Complete individual work and share results with group	Light et al. (1997)
			Share project data, links, files and documents through a central repository	Renzi & Klobas (2000)
			Ask for explanations and justifications	Soller et al. (1999)
			Ask questions	Wu et al. (2002)
		S	Encourage each other	Wu et al. (2002)
		M	Take turns doing required work	Light et al. (1997)
		T	Solve technical problems for other participants	Böhmann et al. (2000)

Table 4 shows that in spite of our earlier stereotypical hypothesis, there is at least one study that showed that students can give support to tutors and technical experts albeit in a deferred manner, in the form of answers to a questionnaire, after system use. However such support is meta-support; it is about *how* to give support.

Table 4. Examples of human support from students to tutors and technical experts

By	To	Type	Example	References
Student	Tutor	M-P	Give suggestions on how instructional design could be improved and how different elements of the course could be integrated in a better way	Böhmann et al. (2000)
	Technical Expert	M-T	Give suggestions for improving the usage of the technical system	Böhmann et al. (2000)

5.2 *Tutors giving support*

Tables 5, 6 and 7 reflect the most examples in the present literature review, respectively: *human pedagogical support between tutors and students, human social support between tutors and students and human interaction support between tutors and students*, again emphasising the common held notion of tutor to student support.

Table 5. Examples of human pedagogical support between and tutors and students

By	To	Type	Example	References
Tutor	Student	P	Seek factual information, challenge and clarify, remedy misconceptions	Admiraal et al. (1999)
			Control the focus of attention	Bruner (1986)
			Elaborate and summarise content	Graesser et al. (2001)
			Scaffold student reasoning, facilitate students' reflection on own knowledge	Koschmann et al. (1997)
			Prioritise information, draw generalisations, provide explanations, support meta-cognition, build conceptual models, direct students' attention to own thinking, bridge for transfer	Lajoie et al. (2001)
			Use 'inquiry scaffolds' appropriately	Lakkala et al. (2001)
			Reframe argumentation, foster shared problem-solving	Rasku-Puttonen et al. (1999)
			Provide a demo of a procedure	Wang et al. (2000)

The few examples of pedagogical support in Table 5 and others that exist in the literature would merit much more space than we have in this general synthesis chapter. However, it is already apparent that even pedagogical support varies widely in its nature, ranging here from helping students to focus their attention on specific points, what to do with those specific points once attention is focused, and as a tutor, taking different kinds of action in relation to the specific points in order to provoke other actions on the part of the students. The example by Lakkala, Rahikainen and Hakkarainen (2001) of tutors supporting correct use of inquiry scaffolds at least in the beginning of collaboration, is pedagogical, but also interactive (how one frames the discussion with a partner, either choose *problem*, *own explanation*, *scientific explanation*, etc. as a label for discourse) and technical (how to use the interface).

The underlying intended structure of the teaching-learning activity or *instructional model* (see Chapter 5 by Järvelä et al., this volume) is seen by some authors as providing a framework for possible tutoring moves. For example in Hudson (1997), the multimedia mathematics activity follows a cycle of observation, reflection, recording, discussion, and feedback. In Lajoie et. al. (2001) the authors present a nine-step model of clinical problem solving that the tutor made explicit in working with students: 1) bedside history-taking, 2) bedside physical exam, 3) summary of important information from history and exam, 4) problem list construction, 5) differential diagnoses, 6) further data collection, 7) revision of initial problem list, 8) written and oral communication or the results of steps one to seven and 9) learning how-to-learn in a clinical setting.

It can certainly be argued that support of social interaction has pedagogical consequences. In Table 6, '*human social support between tutors and students*', managing peer collaboration, for example, making sure one student does not completely dominate all activity, could help to ensure equal participation and benefit both partners. However, more research is needed on what quality control of collaborative activities may mean (Baker, 2002).

Table 6. Examples of human social support between tutors and students

By	To	Type	Example	References
Tutor	Student	S	Take advantage of motivated excitement and manage it so that it produces productive work, reduce inappropriate authoritative talk, maintain camaraderie, avoid emphasising group differences, recognise personal grudges between tutor and tutee and avoid them	Derry et al. (in press)
			Encourage collaborative learning communities, learn how to perform in different medical-care roles	Lajoie et al. (2001)
			Provide quality control over collaborative activities, manage peer collaboration	Magnusson & Svensson (2000)

In Table 7, '*human interaction support between tutors and students*', we give interaction support a place of its own attesting in our view, to its importance in CSCL.

Table 7. Examples of human interaction support between tutors and students

By	To	Type	Example	References
Tutor	Student	I	Give students a greater or lesser degree of freedom in collaborative work by making available or hiding activities via an agenda tool, establish a topic-oriented structure for the contributions of the participants, structure a session into individual activities and progress through them within an actual session	Böhmann et al. (2000)
			Disentangle overlapping talk and providing time for group members to speak	Derry et al. (in press)
			Give different types of immediate feedback, prompt, hint, splice	Graesser et al. (2001)
		I	Address problems with peer interaction	Katz & O'Donnell (1999)
		M-I	Lead, prompt, hint, probe	Wu et al. (2002)

There were not many examples in the literature for Table 8, '*human managerial and technical support between tutors and students*'. The examples from Renzi and Klobas (2000) deal with the monitoring of electronic discussion and are more exclusively managerial or technical whereas the computer-supported coordination of the *process* of scientific investigation (Loh, Radinsky, Reiser, Gomez, Edelson, & Russel, 1997), could allow teachers to support step-by-step reflection. It is a case where a type of managerial support, (what are the steps to take in a process?) made possible by the computer, provides a specific type of pedagogical tutoring support.

Table 8. Examples of human managerial and technical support between tutors and students

By	To	Type	Example	References
Tutor	Student	M	Monitor electronic discussions to ensure projects are on schedule, coordinate the process of scientific investigation	Renzi & Klobas, (2000), Loh et al. (1997)
		T	Monitor electronic discussions to identify signs of difficulty with the technology, post a response about software use to all students	Renzi & Klobas (2000)

As described earlier, the concept of *meta-support* illustrated in Table 9 and defined as 'support on or about support' is one of the contributions this chapter makes to reflection of human support in CSCL, although examples are quite rare in the literature. It would seem to be potentially quite effective, in the manner of Schlager and Schank (1997) to build on-line communities of teachers where teachers and tutors could exchange their different ways of supporting students in CSCL.

Table 9. Examples of human meta-support between tutors, and tutors and technical experts

By	To	Type	Example	References
Tutor	Tutor	M-P	Inform each other on a variety of approaches on educational reform	Schlager & Schank (1997)
		M-I	Scaffold in implementing a more direct form of coaching	Katz & O'Donnell (1999)
		M-S	Argue that student groups must have a coordinator with a complete view of the project, while others argue that groups worked better when leadership varied according to task throughout the project	Renzi & Klobas (2000)
		M-M	Exchange e-mail about the practical aspects of the course, identify new pertinent websites	Renzi & Klobas (2000), Schlager & Schank (1997)
		T	—	—
		M-T	—	—
Tutor	Technical expert	M-T	—	—

Although we didn't find any documented examples in the literature of teachers giving meta-technical support (support on *how* to technically support others) to technical experts, Lakkala et al. (2001) noted that the learning communities that benefited simultaneously from good pedagogical and technical support for CSCL systems did so because the researchers that designed them were often present in the classroom. In such situations, it seems likely that teachers gave their opinions on system re-design, possibly in relation to the supportive activities they would have liked to carry out. Participatory design (Blomberg & Kensing, 1998) is particularly relevant here.

It is interesting to note that the example from Renzi and Klobas (2000) that we term '*meta social*' support as the argument between teachers - whether or not groups should be encouraged to have varied leadership - is most probably based on the view that the teachers may have on which group configuration gives better *pedagogical* support.

5.3 Technical experts giving support

Table 10. Examples of human technial support between technical experts and students, tutors and other technical experts

By	To	Type	Example	References
Technical expert	Student	T	Provide support before and within a session	Böhmann et al. (2000)
Technical expert	Tutor	T	Give a detailed script with technical instructions underlying pedagogical actions supplied to tutors and sample instructions for students, train tutors to use software for on-line tutorials	Buckingham-Shum et al. (2001)
Technical expert	Technical expert	T	—	—

There were not many examples of technical experts giving support to others (unless we consider the researchers in the classroom) although it is generally recognised that users of CSCL systems necessarily need it. This section gave concrete examples of (meta) pedagogical, (meta) social, (meta) managerial, (meta) interaction and technical support between the possible combinations of tutors, students and technical experts, where such support was possible - it is not likely possible that students give social support to technical experts for example. Table 11 summarises the types of support between CSCL participants found in the literature.

Table 11. A summary of types and CSCL participant pairs involved in support

Type of Support	Combination of CSCL Participants Giving-Receiving Support								
	S-S	S-T	S-TE	T-S	T-T	T-TE	TE-S	TE-T	TE-TE
Pedagogical	X			X					
Social	X			X					
Interaction				X					
Technical	X			X			X	X	X
Managerial	X			X					
Meta-pedagogical		X			X				
Meta- social					X				
Meta-interaction					X				
Meta-technical			X						
Meta-managerial					X				

The interest of such an exercise is twofold. Firstly, answers based on the literature to the question 'what, for whom and by whom?' of human support in CSCL are provided. Secondly, areas where human support has not been addressed in the literature are uncovered. For example, Table 11 shows no X in the column where (meta) support is given from tutors to technical experts. As mentioned previously, such a situation is opportune for CSCL developers who should incorporate the tutor's point of view of software use into their design.

6. CHARACTERISTICS OF CSCL SOFTWARE AND HUMAN SUPPORT

Now that we have discussed who gives and gets what type of human support in CSCL, we turn to how the characteristics of CSCL software influence the possibilities for human support. The characteristics include synchronous versus asynchronous, contiguous versus distributed, semiotic multi-representational versus single channel and social presence versus isolation or anonymity (for more on social presence see Chapter 9 by Kreijns & Krischner, this volume).

6.1 Synchronous versus asynchronous

Light et al. (1997) show that students prefer an asynchronous interaction during what the authors describe as conventional university courses: students who do not often express themselves orally during tutorials get a chance to participate, the asynchronous mode allows longer reflection, which both allows students to include ideas that come to them at a later time and to make sure their message is clear by taking time to write it. Depending on the course level (beginning or advanced), on-line discussion either contained questions for the tutor relating to issues raised during lectures (and answers from the tutor), or commentaries on papers students had read with the tutor and all students participating. On the other hand, Renzi and Klobas (2000) report that their students expressed a preference for face-to-face meetings in order to deal with complex and sensitive issues, particularly those concerning task allocation and coordination. They used the CSCW (computer-supported collaborative work) software mainly for data sharing.

The results of these two studies could lead us to surmise that task plays a role in determining preference for asynchronous or synchronous environments. In the Renzi and Klobas study, the students were divided into groups of five and asked to use BSCW® (2003) to pilot test a WWW site evaluation form by using it to evaluate 20 hotel web-sites and from that, to prepare a group presentation. In contrast, students in the Light et al. (1997) study mainly exchanged messages on course content. Task allocation and coordination in complex tasks is easier to carry out face-to-face while complex discussion can benefit from extra preparation time.

The first implication for human support is that the tutor should be aware of which type of software, synchronous or asynchronous is best suited for the task he or she envisages, otherwise s/he may find that the possibilities for tutoring are compromised. Secondly, the tutor's viewpoint on the purpose of the software has a direct effect on interaction. As was experienced by Light et al. (1997) a particular tutor did not encourage students to write to the tutor with questions and did reply directly to students' contributions, the tutor's view being that the purpose of group e-mail exchange was more for a general discussion of ideas.

6.2 Contiguous versus distributed

Magnusson and Svensson (2000) experienced competitive attitudes between the groups included in their distributed site study, expressed through entries on the discussion board, in diaries or as ironic comments during video-conference sessions. Such attitudes may need to be managed by tutors.

Another possible disadvantage of distributed environments involved the chat. Users in the Böhmann et al. (2000) study often felt distracted by the multiple conversations that were going on in the chat, for example solving technical problems for other participants - technical support between peers - or social conversation. On the other hand, they appreciated the opportunity to spontaneously ask questions, react to what happened and to perceive how other members reacted. This problem could be partially remedied by the creation of different virtual spaces for different types of conversations, assuming participants then played by the rules, keeping to topic in a particular room. A tutor could play the role of gatekeeper, deciding on the pertinence of contributions in regards to a particular room.

Lack of particular visual clues present in face-to-face interactions are also typical of distributed systems where participants have more difficulty in forming social relationships (Böhmann, et al. 2000; Kaptelinin & Cole, 1997). Light et al. (1997) report on students that felt that the reason they were able to use a web-based archive of threaded discussions so effectively was due to their small group size and to the fact that they all knew each other personally. Here, the tutor could play more of a social animator role.

6.3 Semiotic multi-representational versus single channel

Although the Böhmann et al. (2000) study shows that the separation of communication and task related cooperation tools seems to be promising, the authors guard against channel overload, the overload caused by the necessity to rapidly change between the different media in order to process incoming messages. For example, they characterise a situation where some users had difficulties: there were multiple conversations in the chat interface, the tutor was communicating over the audio channel while the participants were working with a cooperation tool. Whether tutors should be given the technological power to temporarily deactivate chat talk in order to gain attention for their audio communication is an open question.

Buckingham-Shum et al. (2001) stress the power of the virtual equivalents of the overhead projector, the flipchart and the whiteboard as opposed to plain text, which has tended to dominate mainstream CSCL. Available choices do not imply efficient usage however, and tutors must learn how to use such tools in the virtual environment.

7. IMPLICATIONS FOR HUMAN SUPPORT IN CSCL

This chapter has touched on numerous implications for human support in CSCL systems in general as well as specifically in higher education. They are summarised in subsection 7.1 (general) and 7.2 (higher education). In subsection 7.3, three 'take-to-school' messages that describe the most important implications for practitioners are also presented.

7.1 General implications

?? All participants could benefit from various kinds of support, not only students, but also teachers, tutors and technical experts;

?? The concept of support can be even further broadened to include support in social infrastructure, in other words, not only the curriculum, course organisation and assessment, but also the teacher community, the parents and even the local community (Lakkala et al., 2001);

?? The type of support varies with the person receiving it, for example meta-technical support for teachers would explain how to support students technically whereas meta-technical support for technical experts would explain how to ameliorate the CSCL system so as to better support students and tutors in their activities;

?? The type and goal of support varies with the person giving it, for example, the goal for peers working together is task accomplishment while a tutor's objective is to facilitate students learning - the tutoring activities should thus be developed according to the pedagogical objectif: is it learning to collaborate or coming up with a solution to the problem? Or both ?

?? Different interpretations of the 'Zone of Proximal Development' (ZPD) imply different strategies for creating CSCL environments. If the mechanisms underlying the ZPD are seen as being based on conflicts between individual and collective goals and actions (Kaptelinin & Cole, 1997), then learners build new meanings and acquire new skills by coordinating the individual and collective perspectives. Such coordination is influenced by the CSCL environment;

?? CSCL systems being used for a period of weeks by the same users should develop and provide new opportunities for users in step with the progression of users' competencies;

?? CSCL systems should provide for peripheral participation to give users a chance to watch others in action and prepare themselves;

?? Technical or psychological tools, in the Vygotskian sense, change the type of human support that is possible to give in CSCL systems (see the examples given in subsection 2.3);

?? The human support given may in turn modify the nature of the CSCL technical and psychological tools. Intended usages can be bypassed by creative users whereas extended usage often invokes suggestions for change in technology or appropriation of terminology and concepts;

?? It is potentially the case that Socratic tutoring is more effective than Didactic tutoring - communicative and task interfaces could be designed accordingly;

?? In order to remain true to the situated cognition perspective, CSCL multi-participant interactions should be able to be studied equally from each participant's point of view (see also Chapter 3 by Stahl, this volume);

?? Whether users habitually use a CSCL system or whether it is new to them will influence the types of support needed, used and created during use;

?? Tutors' and other participants' needs and goals in terms of giving and receiving support during a CSCL interaction should be more closely researched in order to better design CSCL systems and accompanying pedagogical tasks and situations for human support;

?? Human support cannot be so neatly divided into categories, for example social or interaction support can also be a form of pedagogical support and most always has pedagogical implications;

7.2 Implications for higher education

The specificities of higher education for CSCL in terms of support are not necessarily obvious. Students may be more self-regulative with age, but this is not necessarily the case. Although there is a greater content specificity in higher education, teachers do not necessarily use a larger diversity of educational approaches than their colleagues in primary and secondary school, with the notable exception of on-line distance courses, the topic of most of the implications below.

?? Tutors may have to manage the competition between groups that has been shown to emerge in a distributed environment;

?? On-line distance courses are of course popular among students who live long distances from the University, but students need high levels of intrinsic motivation and good time management in addition to increased levels of human support. The same is true for tutors who may put in long hours monitoring student contributions and answering student queries on line;

?? Databases of student-tutor questions and answer dialogues may prove to lighten a tutor's workload. Instead of replying individually, the tutor could recommend a link in the database to the student (Light et al., 1997; Mayes & Neilson, 1995, McKendree et al., 1998; Pilkington, et al., 1999);

?? Tutors must learn to use the multiple resources in CSCL environments and indeed tutors and other participants could be taught how to support each other. However, human support varies with system characteristics and more research must be done on the possibilities for human support;

?? Students' visions on the teaching-learning process influences whether or not they even *solicit* support (Magnusson & Svensson, 2000);

?? In order to remain coherent with CSCL's theoretical framework, feedback should be considered not only from the tutor's point of view as a response to student error for example, but also from other participants' point of view;

- ?? The concept of meta human support - support on or about human support - gives the CSCL research community a way to further progress by suggesting that users reflect on human support.

7.3 Three take-to-school messages

First of all, tutors should be aware of which types of software (synchronous or asynchronous, for example) are best suited for envisaged tasks. Otherwise possibilities for tutoring may be compromised. Institutionally, tutors should be granted the possibility to be able to change software accordingly, something which logistically may pose major problems (see Chapter 8 by De Graaff, De Laat, & Scheltinga, this volume). Secondly, teachers' visions on the teaching-learning process influences the support they give - teaching seen as transmission or seen as providing for student exploration radically changes the type of support given. Also, depending on the underlying educational approach with which a CSCL environment was implemented and the vision a particular teacher may hold on the teaching-learning process, he or she may feel helped or hindered in performing the types of support compatible with his or her vision. Finally, teachers' different educational approaches, especially different cooperative learning methods influence the kind of human support that is possible to give, for example some tutors do not encourage students to send e-mails during on-line tutorials that contain specific questions to the tutor because in their opinion, e-mail lists are for general discussion.

8. SUMMARY AND CONCLUSION

This chapter reflected on the notion of human support in CSCL, discussing its relation with the theoretical notions of the zone of proximal development, internalisation and mediation from Russian psychology and its relation with the educational theories situated cognition and activity theory. The literature reviewed showed that human support is mostly regarded from the tutor's point of view, corroborating other review results. A new way of looking at human support was suggested, taking into consideration the support CSCL participants other than tutors (e.g., students or technical experts) can give and the support that participants other than students (e.g., tutors or technical experts) can receive. Examples of types of support for each type of tutor-tutee pair were given from the literature, building upon the Ashton et al. (1999) schema of instructor support: pedagogical, social, managerial and technical. The concept of *meta* support for each category was introduced as well as the notion of support for *interaction*. Human support was discussed in relation to the CSCL characteristics of synchronous versus asynchronous, contiguous versus distributed and semiotic multi-representational versus single channel. Finally all of the implications for CSCL were summarised in general and more specifically for higher education.

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