Adaptive human guidance of computer-mediated group work

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Symposium overview

Many studies have shown that small-group work can have positive effects on student achievement, especially compared to other forms of instruction that involve less peer interaction (e.g., O'Donnell, 2006). However, learners may not benefit as much as they could, because they often fail to spontaneously engage in productive forms of interaction and dialogue (Fischer, Kollar, Haake & Mandl, 2007). An expert teacher or tutor monitoring group progress and providing support in real time has been found to significantly improve group productivity (see Webb, 2009, for a recent review on guidance of collaborative group work). In this symposium, we focus on human guidance directly provided by a teacher during (1) small group discussion, and (2) scripted through assigning the role of tutor and tutee in dyadic collaboration (also called *peer tutoring*). For example, in teacher-guided, small-group discussion, Chiu (2004) has shown that the explicitness of teacher's content-specific help was negatively related to students being on task immediately after the teacher's intervention, and to group's performance on that problem. Providing low levels of help content, and issuing few directives seemed to benefit student performance. Chiu showed that beyond the kinds of interventions teachers undertook, a key element in determining the effectiveness of teacher interventions is whether the teacher's help is tied to students' ideas (see also Meloth and Deering, 1999 for similar insights). As claimed by Yackel (2002), however, such an adaptive behavior task is extremely complex for teachers, especially since they have to closely monitor group and individual progress.

Peer tutoring has also been found as productive. For example, in *reciprocal teaching* (Brown & Palincsar, 1989; Palincsar & Herrenkohl, 1999), students were trained to carry out certain strategies designed to their improve comprehension of their texts. Fuchs and colleagues (Fuchs et al, 1997) studied tutors-students trained to give highly elaborated conceptual rather than algorithmic explanations helped in promoting high-level discourse. Reflecting on the important activity of the help receiver, King (1999) trained tutors to ask questions designed to encourage the tutee to provide explanations, to ask further questions to push the tutee to elaborate upon or justify their explanations as well as to correct incomplete or incorrect explanations. All these experiments led to overall beneficial effects but the contingency of the help given by the tutor to the tutee, its adaptive character, is crucial but not easily reached.

On-line learning environments open new perspectives for guiding both small-group discussion and peer tutoring. The tools embedded in computer software may enable the teacher/tutor to monitor and evaluate group and individual processes more accurately, and as a result provide support that is contingent upon the learners' needs. However, it is questionable whether the positive results obtained in face-to-face settings are transferable in the guidance of small groups or individuals in on-line environments. On-line guidance of individuals or small groups is then a new enterprise.

The four presentations in this symposium focus on the effectiveness of guided small group discussion and peer tutoring and on their adaptive character. We will describe moderation and tutoring strategies, the unfolding interaction between moderator and group (members), the effectiveness of certain prompts and strategies over others, and, for on-line group work, ways to support the teacher or tutor. The first presentation focuses on face-to-face peer tutoring. It proposes a new quantitative methodology to study the *reciprocal* relation between the actions of the tutor/teacher/moderator, on the one hand, and of the tutee/small-group, on the other. They show how this new methodology may be used to gain new insights into the way both sides of the interaction mutually influence each other's actions. The three other presentations concern on-line group work and show indeed that peer tutors can be effectively supported by computer software to become more adaptive to their peer tutees' needs (Walker, Koedinger & Rummel), that moderators can adaptively moderate multiple synchronous discussions (Schwarz & Asterhan), and that teachers can cope with students' heteroglossia in e-discussions on socio-scientific issues (Baker).

Statistical Discourse Analysis of Young Children's Peer Tutoring at Computers

Christine Wang, Ming Ming Chiu & Cynthia Carter Ching

Past studies have shown that active participation is essential for peer tutoring and collaboration that successfully yields subsequent individual learning gains (e.g., Mackie, 1983; Gauvain & Rogoff, 1989). Yet these studies are lacking in two ways: (1) excessive focus on tutor actions can limit our understanding of the tutees' contributions (Chi, Siler, & Jeong, 2004); and (2) understudied sequential mechanisms between early actions and later actions of tutors and tutees within and across peer tutoring sessions may limit our understanding of moment-by-moment tutoring dynamics (Ellis & Gauvain, 1992). These challenges become compounded when we look at young children as a peer tutoring population, because, compared to studies of older populations, the limited indicators of participation (often verbal expression of new ideas or disagreement, Roscoe & Chi, in press) are not sensitive enough to capture younger children's emerging (and sometimes effective) tutoring processes (Cooper, Ayers-Lopez, & Marquis, 1982).

The purposes of this study are to address these limitations in the existing literature, to understand young tutors and tutees' mutual and sequential influence on each other's participation while engaged in computer tasks, and to investigate what other kinds of non-verbal indicators of engagement would be effective for this population. We focused on two one-on-one tutoring sessions, one for each of two groups consisting of a first-grader one kindergartner. The task was for the first grader to teach the kindergarteners to use the *SimpleText* computer program. Using statistical discourse analysis (SDA, Chiu & Khoo, 2005), we analyzed the videotaped behavior sequences of a first-grader (Nancy) teaching two kindergartners (Calvin, Ellen) to use the *SimpleText* program during 469 transcript conversation turns. Each conversation turn was coded for the variables used in the model (see Figures 1 and 2), which showed high inter-coder reliability (Krippendorff's α [2004]).

Unlike ordinary least squares regressions, SDA addresses the difficulties of nested data, discrete outcomes, and serial correlation during analysis of group processes at the conversation turn level. SDA identifies watersheds (breakpoints) and models discrete outcomes, time period differences, serial correlation, and direct and indirect effects.

$\mathbf{P}_{yij} = p(\mathbf{Y}_{yij}=1|Calvin, b_{01}) = F(b_{y00} + f_{y0j} + b_{y01}Calvin)$ (1)

The probability ($\mathbf{P}_{yij}$) that the vector of y tutee outcome variables $\mathbf{Y}_{yij}$ occurs at turn i of time period j is the expected value of $\mathbf{Y}_{yij}$ via the Logit link function (F) of the overall mean b_{y00}, the time period deviations (f_{y0j}), and each variable (e.g., $Calvin$).

$\mathbf{P}_{yij} = F(b_{y00} + f_{y0j} + b_{y01}Calvin + b_{yuj}\mathbf{U}_{yij} + b_{yvj}\mathbf{V}_{y(i-1)j} + \gamma_{yvj}\mathbf{V}_{y(i-2)j})$ (2)

Current (**U**) and previous speaker variables ($\mathbf{V}_{y(i-1)j}$, $\mathbf{V}_{y(i-2)j}$) were entered via a vector autoregression (see Figures; Kennedy, 2004). These analyses were then applied to the parallel tutor outcome variables.

Results

The tutor and the tutees generally gazed on-task (89%; 80%, respectively) and were active (81%, 61%). Being "active" was defined as talking, using the computer, or pointing. The tutor contributed more ideas (53% vs. 17%) and displayed positive emotion more often (10% vs. 5%). Locations of artifacts (mouse, keyboard), tutor behaviors, and tutee behaviors all influenced one another's participation (see Figures). The tutees were more active when the mouse or keyboard was closer to them. While tutor commands increased tutee activity, tutor disagreement stifled it. However, the explanatory models differed substantially for each tutee. Results also suggest that tutor actions might have stronger effects and be more important when tutees are less engaged or more passive. More important, tutee differences altered interaction dynamics, even with the same tutor on the same task. The keyboard location and tutee behaviors had similar effects on the tutor's behaviors such as disagreement, on-task gaze, actions and emotional displays.

Sequential effects were also noted. For example, tutee disagreements sharply increased tutor disagreements. After the tutee gazed on-task (–1), the tutor was more likely to express a new idea, suggesting that the tutor checked for joint attention before expressing a new idea. This result suggests that young tutors attend to one another's engagement more subtly than shown in previous research. Tutee new ideas did not immediately beget further new ideas, suggesting that the tutor might have spent time processing the tutee's new ideas.

There are several contributions that we see from this early exploratory work. First, the multidimensional indicators of active participation (verbal, non-verbal, computer-related actions, emotions) provided many ways to study interaction during peer tutoring. Second, we expanded the tutoring explanatory mechanism by showing how tutees influence tutors and how they mutually

interact. The tutor's different tutoring dynamics with different tutees highlight how tutoring mechanisms can differ across working pairs. Future research can illuminate how tutor differences influence tutoring dynamics. Third, the statistical discourse analysis systematically shows how recent actions affect subsequent actions at the micro-level and suggests future applications at the macro-level to address temporal issues. This study suggests that online moderators and online students would likewise mutually influence one another, and that online artifacts can also play a substantial role in directing attention and influencing participation. Specifically, online moderators can benefit from access to online students' computer actions and video displays of their non-verbal behaviors to adapt to their needs accordingly.
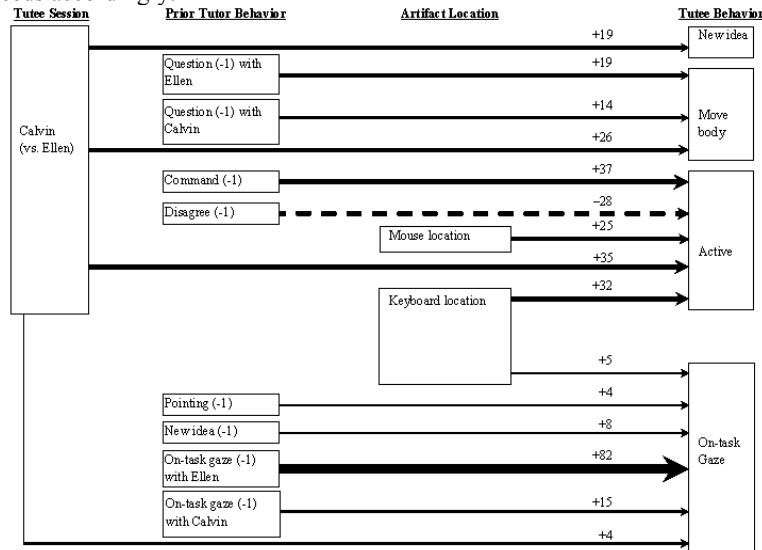
Figure 1. Model predicting 4 types of tutee participation behaviors. All arrows indicate significant effects Solid arrows indicate positive effects and dashed lines indicate negative effects. Thick arrows indicate larger effects.
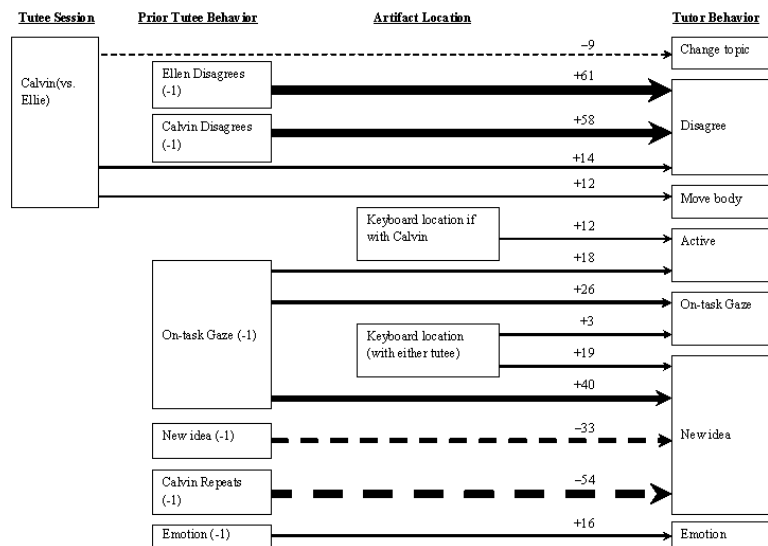
Figure 2. Model predicting 7 types of tutor behaviors. All arrows indicate significant effects Solid arrows indicate positive effects, dashed lines, negative effects. Thick arrows indicate larger effects.

Automated Adaptive Support for Peer Tutoring in High-School Mathematics

Erin Walker, Nikol Rummel and Kenneth R. Koedinger

Reciprocal peer tutoring is a type of small-group work where two students of similar abilities take turns tutoring each other. It has been shown to improve domain learning of students involved (Fantuzzo,

Riggio, Connelly & Dimeff, 1989), most likely because students who tutor other students benefit from the reflective and elaborative processes involved in observing problem-solving steps and providing explanations (Roscoe & Chi, 2007). However, for students to benefit from the tutee role they must receive help that is conceptual (Fuchs et al., 1997) and that gives the tutee correct information about the domain (Webb, 1989). Many previous efforts at assisting peer tutoring have focused on structuring the tutoring process. For example, King, Staffieri, and Adelgais (1998) attempt to increase the conceptual content of the interaction by having students ask each other a series of questions at different levels of depth, and Fantuzzo et al. (1989) support the correctness of the interaction by having students compare tutee problem-solving steps to problem solutions. While these approaches have been successful, adaptive support for the peer tutor may be an improvement over fixed support in two ways. First, it would be able to provide individually tailored *interaction* support, for example by detecting when peer tutor help was not conceptual enough, and giving relevant feedback. Second, it would be able to provide context-sensitive *domain* support, adaptively alerting peer tutors to tutee errors rather than simply providing a resource for peer tutors to consult.

We have developed adaptive support for peer tutoring by augmenting the Cognitive Tutor Algebra (Koedinger, Anderson, Hadley, & Mark, 1997), a successful intelligent tutoring system for individual learning, with peer tutoring activities. In our extended system, students work on literal equation solving problems, where they are given a prompt like, "Solve for *x*" and an equation like "*ax* + *by* = *c*". Each student gets the opportunity to tutor a partner by observing the tutee solve problems, marking problem steps, and giving help in a chat window. We provided peer tutors with two types of adaptive support: one which assisted the peer tutor in giving correct help (*domain* component), and one which assisted the peer tutor in giving conceptual help (*interaction* component). For the domain component, we adapted the hints and feedback already present in the Cognitive Tutor Algebra for a collaborative context. As tutees took steps in the problem, peer tutors were asked to mark the tutees' steps as correct or incorrect. If peer tutors made an error (e.g., marked a "correct" step "incorrect"), the system indicated the error by highlighting it in the interface, and then gave peer tutors the domain feedback students would typically receive if they were solving the problem individually, along with a prompt to communicate it to the tutee (see Figure 1a). As tutees solved the problem, the peer tutor could request a domain hint from the computer tutor at any time. While this domain help provided peer tutors with information on which problem-solving steps were correct and why, it did not provide explicit guidance or feedback on how students should help their partner, and thus we added an additional *interaction* component to the assistance. Prior to composing a chat message, students were asked to select a sentence classifier labeling their message as a prompt ("Ask Why"), error feedback ("Explain Why Wrong"), hint ("Give Hint"), or explanation ("Explain What Next"). Upon submitting the help, an intelligent tutor for collaboration used a combination of the self-classification, an automated assessment of the help quality, and the domain context (whether tutees had just made an error or not) to make an estimate of the level of student help-giving skills. Based on this assessment, the computer gave context-sensitive reflective prompts in the chat window that were seen by both the peer tutor and the tutee (see Figure 1b). We expected that the adaptive support would lead peer tutors to give more correct help by alerting them to the domain errors that they made, and lead peer tutors to give more conceptual help by alerting them when more conceptual help would be necessary.

We conducted a classroom study with 77 participants comparing two conditions: adaptive assistance (40 participants) and fixed assistance (37 participants). In the fixed condition, students had access to problem solutions and tips for good collaboration. The support contained the same content as the assistance in the adaptive condition but did not vary based on student actions. We found that adaptive support did indeed have a positive effect on student help. When peer tutors made marking errors, they corrected their error significantly more often in the adaptive than in the fixed condition (adaptive $M = 65.8\%$, $SD = 26.6\%$; fixed $M = 7.5\%$, $SD = 14.6\%$; $F(1,69 = 127.6)$, $p < 0.001$). Further, students gave significantly more conceptual help in the adaptive than in the fixed condition (adaptive $M = 2.58$, $SD = 2.75$; fixed $M = 1.38$, $SD = 2.14$; Mann-Whitney $U = 525.5$; $p = 0.05$). Overall, it appeared that adaptive support was more effective than fixed support at improving student interaction.

We further examined why the adaptive support may have had a positive effect on student interaction using qualitative observations. Interestingly, when students received reflective prompts they would rarely acknowledge them, and often would not appear to incorporate the advice into their next utterance. This behavior was in stark contrast to their use of domain hints given by the computer, which were often immediately repeated to tutees in a form stripped of conceptual content (e.g., tutors might receive the hint "subtract *x* to get it to the other side", and simply say "subtract *x*"). This pattern of behaviors suggested either that students perceived domain help as more integral to the task than interaction help, or that they perceived it as easier to implement than interaction help. Further, it seemed that students felt free to ignore advice from a computer in a way that they would not from a human being, potentially because our computer agent was not as responsive to specific student

utterances as a human would be. Given these observations, it is interesting that student behavior improved in the adaptive condition compared to the fixed condition. One factor that qualitatively appeared to mediate this process was student feelings of accountability for their partner's learning. It is possible that even the limited responsiveness of the computer to the peer tutor behavior, in combination with the reflective prompts being posted publicly (i.e., in view of the peer tutee), triggered feelings of social responsibility which led peer tutors to give help more thoughtfully. Accountability also played a role in how peer tutors attributed the help they give tutees. Peer tutors would occasionally frame their help as coming from the computer (e.g., "it wants you to subtract x"), placing peer tutors and tutees in the position of interpreting the help together. Allowing peer tutors to take on a novice role compared to the computer may be a secondary advantage of the assistance provided. In future work, we hope to explore why adaptive support has a beneficial effect on student interaction, and what features of adaptive support augment this effect.
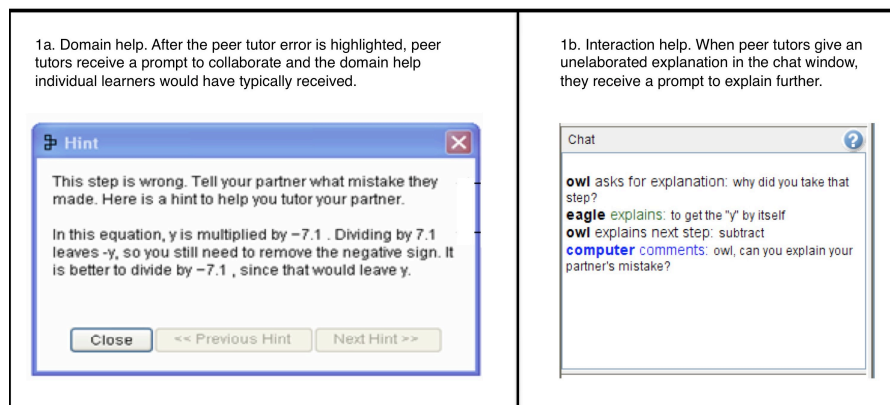

Figure 1. The adaptive domain support and adaptive interaction support given to collaborating students.

Human guidance of synchronous discussions: A nascent school practice
Baruch Schwarz and Christa Asterhan

Although small group methods have been shown to have positive effects on student achievement (e.g., O'Donnell, 2006; Slavin, 1995), simply placing students in small groups does not guarantee learning gains which depend on the quality and depth of discussions, such as the extent to which students give/receive help, share knowledge, build on each others' ideas and justify their own, and the extent to which students recognize and resolve contradictions between their own and others' perspectives (Asterhan & Schwarz, 2009; Webb & Palincsar, 1996). Teachers should then help to avoid detrimental practices and to facilitate beneficial ones. However, little is known about how the teacher can foster small group learning. Influencing student interaction through teacher's discourse is particularly underrepresented in research (Webb, 2009). Several studies (e.g., Chiu, 2004; Webb, 2009) have found that beyond the question of what *type* of teacher prompts are more effective (direct or indirect, explicit or implicit) , a key element in determining the effectiveness of teacher interventions is whether the teacher's help is tied to students' ideas.

Due to the complexity of this task (Yackel, 2002), some researchers have preferred to adopt a phenomenological approach to observe how extraordinary teachers facilitate group learning in specific contexts (e.g., Hmelo and Barrows, 2006, 2008 in a PBL context; and Zhan, Scardamalia, Reeve and Messina, 2009, for long-term classroom learning in small groups with Knowledge Forum). These studies show that small-group facilitation is complex but possible and open new research directions: (a) How can 'normal' teachers face the challenge of ascertaining student thinking during small group work to base their interventions? (b) How can 'regular' teachers successfully monitor and support several discussion groups at the same time? Our goal is to show that it is possible to provide a suitable environment that tackles these challenges in the context of a program for fostering critical thinking through collective argumentation.
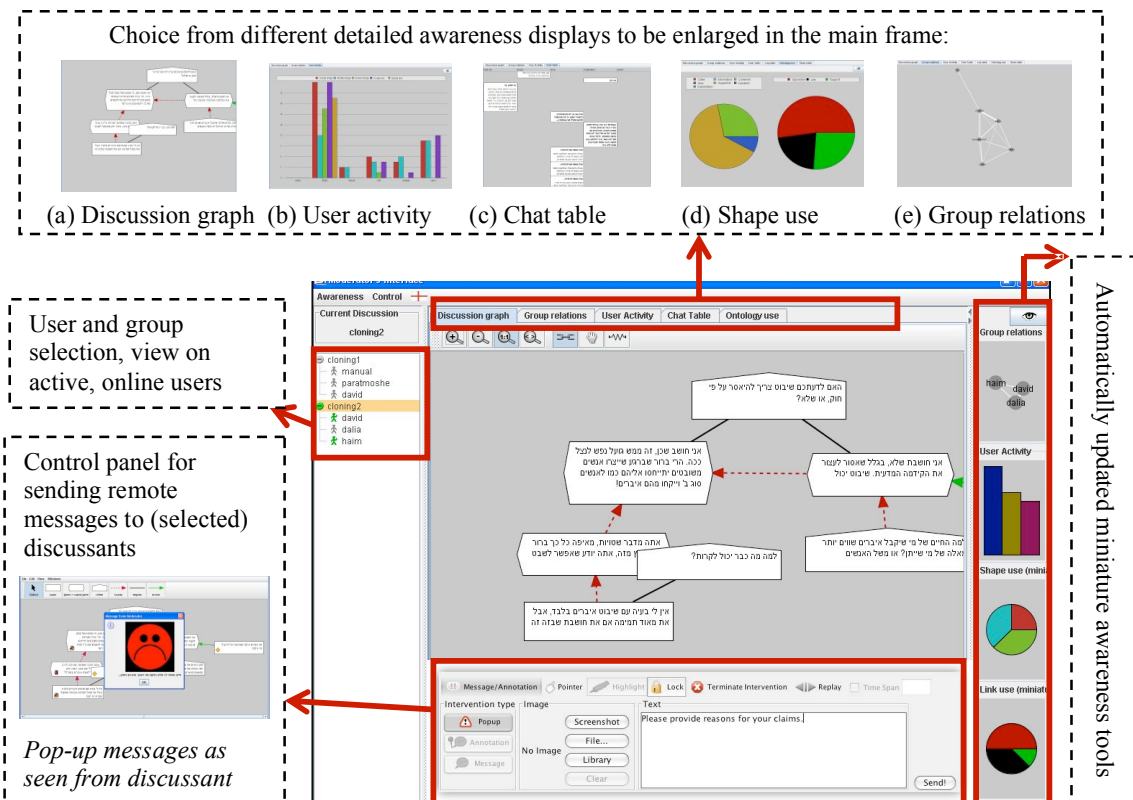
Overall, software tools have limited ability to provide adaptive scaffolding (Puntambekar & Hübscher, 2005). Collaborative scripts are not adaptive either. In the context of a-synchronous discussions in on-line group work in post-secondary e-courses, guidance has been studied and referred to as *e-moderation* (e.g., Salmon (2004). Human guidance of synchronous group discussions seems to be more appropriate, but has not been sufficiently studied yet. Studying guidance of synchronous discussions is then a new adventure but two ideas of e-moderation of e-courses should be retained:

Moderators should not be *intrusive* but be *caring* about their students. The balance between *non-intrusiveness* and *care* is difficult to find, since moderation should be based on ascertaining current group thinking.

Design research for enabling e-moderation of multiple synchronous discussions

As our goal concerns facilitating critical reasoning through synchronous group interaction, the moderator is committed (a) to participation, (b) to argumentation, and (c) to the other. Moderating commitment to argumentation is particularly demanding since it means both monitoring argumentative moves and following the ideas developed along with these argumentative moves, especially in classes, that is, in multiple synchronous discussions. We undertook a design research program that led to the construction of the *Moderator's Interface*, placed within a multifunctional environment called *Argunaut*. Figure 1 shows some of the most important functionalities of the Argunaut Moderator's Interface (AMI).

Figure 1. Argunaut's Moderator's Interface and its main features.

Choice from different detailed awareness displays to be enlarged in the main frame:

(a) Discussion graph (b) User activity (c) Chat table (d) Shape use (e) Group relations

User and group selection, view on active, online users

Control panel for sending remote messages to (selected) discussants

Pop-up messages as seen from discussant

Automatically updated miniature awareness tools

In this presentation, we will report on a case study in which one teacher, Rhonna, moderated four groups of three university students discussing societal dilemmas. We will answer three questions. The two first are: *(1) What are the strategies of e-moderation in parallel synchronous discussions?* and (2) *what are the AMI's functionalities that mediate the enactment of these functionalities?* The AMI, is central in all the strategies deployed by Rhonna in her multiple discussions. It enables passing from one group to another one instantaneously. This possibility combined with the persistence of previous contributions confers to AMI the potentiality to navigate across multiple synchronous discussions. Rhonna begins by (a) observing contributions without intervening though hovering over postings to quickly read their content in the Discussion Graph tab, or scrolling up and down the Chat Table tab, help grasping the development of ideas. This observation leads her to identify the development of ideas and the contribution of students in this development. Also, the role of each participant could be made salient through selecting a discussant in the participant list made his/her contribution visible in the Discussion Graph or in the Table Chat. The Ontology Use and the Group relations tab were mostly used to get an impression about overall group functioning.

An interesting strategy developed by Rhonna is (b) to include students in their group discussion through private care, that is, without the other discussants being aware of that private care:

she first notices that one student did not participate, and then in her successive visits to the group of this student, to monitor her participation. Rhonna uses private channels of communication with annotations attached to specific contributions. She finally convinces her to participate because two channels, public and private are open at the same time. A third general strategy is to encourage groups to open new perspectives through generic interventions. This is made possible because Rhonna is able to monitor the development of one discussion at a glance with the help of awareness tools through the Ontology use tab that shows the distribution of connecting links, and suggests for example that there is too much agreement in a particular discussion. The Remote Control Panel enables Rhonna to send pop-up messages to the group as whole to prompt them to consider additional perspectives. She also (d) progressively helps in deepening the discussion space either by using generic interventions or through specific hints. These monitoring actions are once more achieved through the Discussion Graph and the Chat Table. The Chat Table is particularly handy to check ideas with dexterity. Rhonna also uses the distribution of links to see that links are almost uniformly black, indicating a lack of distinctive and different standpoints. She uses the remote control panel through alternation and combination of highlighting, using pop-ups and annotations to encourage the deepening of the discussion space. She draw the discussants' attention to specific contributions or groups of contributions (through highlighting); she refers to a specific contribution through a question or a challenge (with annotations); and she points at a general lack of the discussion (with the pop-ups). She also (e) socializes students that include themselves in discussions, of course in the public sphere, without patronizing but rather in indirect ways: After having identified that one student is willing to participate in the discussion but that the others have not referred to her so far, Rhonna initializes private communication with her to encourage her and public communication to encourage the discussants to refer to each other. This combination enables the socialization of an out-group discussant into the discussion, in a delicate way and by avoiding any patronizing. Rhonna also (f) puts public focus on specific issues (substantial or problematic). The power of this strategy depends on the possibility to advertise it. The Remote Control Panel enables an array of moderator's interventions to catch the eye of the group persistently, until discussants catch the bait.

In the presentation we will also answer a third and central question: *Do e-moderation actions have some impact on the flow of synchronous discussions?* We will show that to some extent, the moderator could capitalize on the tools provided by the system and use them to evaluate the effectiveness of her past actions. We will conclude that the adaptive facilitation of multiple synchronous discussions is possible in classrooms. We will show then that this nascent practice with help in the organization of learning settings in classrooms that preserve group collaboration but give to the teacher a central role in moderating multiple discussions towards productive interactions.

Buds, flowers and fruit: potentialities for guidance in collaborative argumentation-based learning
Michael Baker

The title of this presentation is inspired from the following passage of Vygotsky's works, justly famous for the power of its imagery: "The zone of proximal development defines those functions that have not yet matured but are in the process of maturation, functions that will mature tomorrow but are currently in an embryonic state. These functions could be termed the "buds" or "flowers" of development rather than the "fruits" of development." (Vygotsky, 1935/1978, p. 86). Bruner's seminal work (Wood, Bruner & Ross, 1976) defined types of tutorial interventions that could guide (or "scaffold") and facilitate the processes whereby such buds could come to fruition. The relevant use of scaffolding strategies required the adult to be able to identify features of the individual learners' problem-solving behavior, such as focusing on the problem, progression towards the solution, motivation and emotion. The growing emphasis in the Learning Sciences research community on the study of collaborative learning in small groups raises problems for adaptive guidance of such groups of a quite different order of complexity from those encountered in individual learning. Whilst teachers guiding individual learning need to pay attention to problem-solving in specific domains, and individuals' emotional states, in group interactions, if there genuinely is collaboration, then problem solutions emerge from the interaction via processes that in some sense go beyond the sum of individual contributions. In many countries, teachers are simply not trained to be aware of and to identify the "buds" of potentially productive and constructive forms of interaction (Miyake, 1986; Baker, 1999).

In this paper, I begin by discussing potentially constructive forms of interaction, for a specific genre: argumentative interactions, arising during collaborative problem-solving in science, and pedagogically-oriented debates concerning societal questions. This focus is motivated by an extensive and growing literature on the role of argumentative interactions in the co-construction of knowledge

(e.g. Coirier & Andriessen, 1999; Kuhn & Udell, 2003; Leitão, 2000; Andriessen, Baker & Suthers, 2003; Schwarz & Glassner, 2003; Muller-Mirza & Perret-Clermont, 2009). Within this research, three main families of such processes have been described. The first set of potentially constructive processes concerns changes in students' degrees of epistemic commitment ("change in view", Harman, 1986) towards the problem solutions that are proposed (for example, changes in belief and/or acceptance). The way that students' views change turns out to be radically different according to whether they 'care' or not about what is being discussed; in other words, whether the topic involves their value and idea systems (such as in the case of discussing human cloning) or does not (such as in working on the concept of energy in physics). In one case, students are often led to strengthen and deepen their views, as a result of argumentation; in the other, they proceed by elimination of flawed proposals (Baker, 2003). The second set of processes involves knowledge negotiation, building or co-construction of new solutions, during argumentation itself, or as a means of building new compromises. The third set involves cognitive-linguistic operations performed on fundamental concepts at stake in the debate, distinguishing concepts from each other (by "argument by dissociation"), and deepening the meaning of the questions being debated (Baker, 2002).

Such complex and subtle potentially constructive interactive processes are difficult for teachers — as for researchers — to identify. Indeed, teachers may need to set their understanding of students' interactive learning processes within a broader understanding of collaborative learning, whereby their guidance interventions as moderators of students' debates operate on at least three dimensions: effective *collaboration* (such as degree of shared participation, listening and uptake), *moderation of the debate* itself (adhesion to debate ground rules, coherence, progression towards a clear outcome) and providing or verifying *taught knowledge*. The problem of teachers' identification of dialogical learning potentials is further compounded by the prevalent *heteroglossia* (Bakhtine, 1929/1977) of students' discourses, which combine elements of school-based and everyday genres (Wertsch, 1991). This means that (to take an authentic example), although students' discussion of wearing makeup and doing body-piercing may not at first glance appear to provide an opportunity for adaptive guidance, it may do so if it is seen in the context of a discussion of what Nature is, in a debate about human cloning or genetically-modified organisms (Baker, 2009).

In the second part of the presentation, I shall present analyses of guidance interventions of teachers who are moderating students' synchronous on-line pedagogical debates (in the domains of physics problem-solving, and water preservation policies), together with the precise interactive contexts in which the interventions are produced. These will then be compared with the buds that could have been identified, had the teachers been aware of them. The presentation will conclude with reflections on how to train teachers to identify opportunities for adaptive guidance of students' pedagogical debates.

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