Intuitive moderation styles and beliefs of teachers in CSCL-based argumentation

Julia Gil, Baruch B. Schwarz, and Christa S. C. Asterhan, the Hebrew University, Jerusalem, Israel
Email: ju17@walla.co.il, msschwar@mscc.huji.ac.il, kooij@mscc.huji.ac.il

Abstract: CSCL learning environments provide new contexts for discussions and are thought to provide new opportunities for learning. At the same time, such environments often do not provide guidance on how to act during the discussion. The purpose of this paper is to initiate research on moderation in synchronous discussions in a CSCL environment. The first study contrasts teachers' beliefs on good discussions and good moderation pertaining to face-to-face discussions with those pertaining to synchronous, CSCL-mediated discussions. The second study focuses on the strategies teachers intuitively enact in synchronous discussions.

The challenge of moderation in CSCL-based argumentation

Learning processes in classrooms are influenced by the quality of discussions in which the teacher engages with the students, and particularly the teacher's moderation practices (Mercer, 1995; Chi, Siler, Jeong, Yamauchi & Hausmann, 2001; Wegerif, 1996; Atzmon, Hershkowitz & Schwarz, 2006). Oral discussions are generally teacher-centered. The teacher raises questions, directs answers, stresses important issues, selects speakers, summarizes and presents new points into the conversation. CMC tools such as CSCL learning environments provide new contexts for discussions and are thought to provide new opportunities for learning: they enable learners to follow the developing interactions among others, to mutually examine the extent and nature of their own involvement in the process, and at the same time and to create awareness of the processes of self-thinking (Lave, 1991). At the same time, such environments rarely provide guidance or direction concerning how to act during the discussion (Soller, 2001).

Types of discussions in classrooms are varied. Among these types, collective argumentation is particularly important for learning purposes. The object of argumentation, the elaboration of arguments, has been recognized as central in knowledge acquisition (Driver, Newton, & Osborne, 2000; Schwarz, Neuman, Gil & Ilya, 2003; Zohar & Nemet, 2002), and epistemological understanding of knowledge construction (Duschl & Osborne, 2002; Erduran, Osborne, Simon, 2004; Sandoval & Reiser, 2004). However, several researchers have pointed at the difficulty teachers have at mediating collective argumentation. They need to continuously evaluate students' knowledge and to enact argumentative moves timely and adequately in order to promote understanding: asking for new perspectives, pointing at contradictions, inviting to participate, inviting to give explanations, etc. (Yackel, 2002; Schwarz, Dreyfus, Hershkowitz, & Hadas, 2004).

The complexity in sustaining argumentation has led scientists to elaborate CSCL tools for supporting collective argumentation in peer interaction. These tools (also called CSCA tools) have to be differentiated from knowledge representation tools (Bell, 1997; Van Bruggen, Kirschner, Jochems, 2002), since they support collective argumentation by affording argumentative moves to be taken by various speakers through discussion. The Digalo environment (Glassner & Schwarz, 2005) presents an approach that integrates these two models of fostering argumentation: the model emphasizing "knowledge representation", or "argument representation", and the supportive model in the argumentative process. Using this tool synchronously enables textual multiple-talk through which each of the subjects adds messages through mediation of graphical icons representing categories in collective argumentation and in argument construction (these categories are called the ontology of the environment). The underlying assumptions of the designers of this tool were that visual ongoing representation of the discussion can help students to reflect upon their argumentative steps and their components, and that discussants will enact practices of productive discussion (Glassner & Schwarz, 2005). And indeed, synchronized communication amongst subjects, mediated by ontologies characterizing collective argumentation (such as 'claim', 'argument', 'explanation', 'comment', 'question') as well as relational categories (such as 'support', 'opposition' or 'reference'), appeared to be productive (Glassner & Schwarz, 2005). In other words, adequate ontologies may have a mediating effect in the sense that when learners use the tools, they take more into consideration crucial features of collective argumentation, among them the reference to others as well as criticism and justification. The persistence of the argumentative map suggests the clear articulation of opinions, inspection of the map to decide whether the contribution is new,

reflection to evaluate understanding of previous moves, and to possibly request additional explanations, etc. However, these suggestions have been empirically corroborated without considering the role of human moderation, a role that was recognized as crucial in the long run (Shahar, 2003; Hakkarainen, Lipponen, & Järvelä, in press). It is then imperious to focus on the role of human moderators in helping students while discussing with CSCL tools.

To begin with in this endeavor, we use the general term 'moderation' to designate any kind of support given by a human to help at reaching the goal of the e-discussion. Researchers used different terms such as 'scaffolding', or 'mediating' to delineate teaching actions aimed at supporting construction of knowledge. Since we adopt a bottom-up approach, we will use 'moderation' as a general term but we will preserve terms used by researchers Three types of mediations have been identified in CSCL literature for either synchronous or a-synchronous interactions (Ashton, Roberts, & Teles, 1999): *pedagogical scaffolding*; *social scaffolding*; and *technological scaffolding*. *Pedagogical scaffolding* refers to moves aimed at achieving predetermined learning goals in order to help the learner complete his/her assigned task **(**Mercer, 1995; Muukkonen, Hakkarainen & Lakkala, 1999; Wegerif, 1996). It includes positive reactions, instructions, providing information and opinions, advising, pointing out preferences, raising questions, and a summary of students' remarks concerning external sources. Various researchers adopted different strategies. For example, Chi and colleagues (Chi et al., 2001) proposed an approach according to which interaction between teacher and student can be planned by asking generic questions, such as: “Can you explain...”, or “Articulate it with your own words”, “What are you thinking about the issue?”, “Could you add anything about the subject?” (See also Baker and Lund, 1997, for a similar approach that yielded positive outcomes). While Wegerif (1996) proposes a similar approach with scaffoldings in the form of questions such as: "What are you thinking?", and "Why are you thinking that way?", his perspective is less cognitive than ethical and dialogical since he is eager to instill ethical norms of argumentation rather than to instigate dialectical processes. *Social scaffolding* refers to support based on empathy, humor, and personal assistance. *Technical scaffolding* includes technical support with the software and interface for students working in a CSCL environment. These and other kinds of distinctions concerning kinds of moderation were done either theoretically or by observing teaching practices. In this paper, we adopt a bottom-up approach as we both consider both beliefs and practices of teachers in a specific case – synchronous e-discussions, so as to distinguish between kinds of moderation in that case.

The nature of human moderation in synchronous e-discussions and its influence on the quality of such discussions are open questions. These questions are relevant to ARGUNAUT (IST-2005027728 – partially funded by the EC under the 6th Framework Program, http://www.argunaut.org), a project aimed at providing tools for supporting the moderation of synchronous e-discussions. The present paper represents an initial step in this program. First of all, we need to learn about teacher beliefs and practices concerning moderation of synchronous discussions. The first study contrasts teachers' beliefs concerning good discussions and good moderation in face-to-face discussions and in synchronous, CSCL-mediated discussions. The second study focuses on the actual strategies teachers intuitively enact in synchronous discussions. In the two studies, the populations were different. This was due to difficulties in recruiting and training teachers to be moderators in synchronous discussions. The results of the two studies suggest the elaboration of suitable awareness tools to help teachers in mediating CSCL discussions.

The Research questions

1. How do teachers characterize and describe what constitutes a good discussion in oral classroom settings, as opposed to discussions in CSCL-based argumentation?
2. How do teachers characterize and describe what constitutes good moderation of oral classroom discussions, as opposed to moderation of discussions in CSCL-based argumentation?
3. How do teachers actually moderate synchronous, collective argumentation?

Study 1: Teachers beliefs about good discussions and moderation of discussions

Participants

The questions were investigated in the framework of an in-service teachers program aimed at promoting dialogic thinking in classrooms. Ten teachers from two different high-schools participated in the study: seven (six women and one man) from the first school and three (two women and one man) from the second.

Procedure

Two questionnaires were administered, one before and one after teachers designed a Digalo-based learning activity and implemented this in their classroom. Before the implementation teachers were asked to answer the following questions: "What is in your view a good classroom discussion?" and "What is in your view a good moderation of classroom discussions?" Following the classroom implementation, they answered two additional questions, namely: "What is a good Digalo discussion?" and "What is good moderation of Digalo discussions?" The ten teachers from the two schools answered the first questionnaire. Due to technical problems, only the seven teachers from the first school answered the second questionnaire.

Table 1. **Relative frequency (in %) of different teacher response categories to the question: "What is a good discussion in classroom/Digalo?"**

Category		Classroom Discussion (n=10)	Digalo Discussion (n=7)
Social dimension	Participation	40%	57%
	Collaboration	0%	28%
	Interaction	40%	57%
Ground rules for discussion	Attention / listening	60%	0%
	Mannered verbal content	50%	14%
	Mannered turn-taking	50%	0%
	Preventing domination of specific pupils	20%	0%
	Quiet atmosphere	0%	14%
	Preventing students' "flight" (e.g. surfing internet)	0%	14%
Cognitive dimension	Task-focus and relevancy	60%	0%
	Relevancy to the topic	30%	0%
	Construction of knowledge	60%	0%
	Valid of Argument	60%	28%
	No repetition	10%	0%
	Students' interest	0%	14%
	Deep discussion (not superficial)	0%	14%
	Clear map structure - organization of nodes	0%	57%
	Clear map structure - coherent ontology	0%	57%

Table 1 demonstrates the differences in teacher beliefs concerning qualitative oral versus Digalo-based collective argumentation on the cognitive dimension: Most of the teachers mentioned that a good classroom discussion is focused on task and relevant to the topic proposed, leads to the construction of knowledge and is characterized by valid arguments. They did not indicate, however, these categories for a good Digalo discussion,

except for the validity of the argument. On the other hand, teachers described good Digalo discussions as those in which students' interest is high, in which the maps that students created during the discussion seemed well organized and in which students made adequate use of the ontology proposed.

Table 2. **Relative frequency (in %) of teacher response categories to the question: "What is good scaffolding/moderation in classroom/Digalo discussions?"**

Category		Classroom Discussion (n=10)	Digalo Discussion (n=7)
Social dimension	Participation	20%	43%
	Discourse norms	100%	71%
	Interaction	30%	14%
Cognitive dimension	Eliciting more perspectives	20%	57%
	Focus	70%	28%
	Organization / construction of knowledge	60%	43%
	Posing challenges to students	30%	43%
	Increasing interest	20%	28%
	Asking for clarification	0%	43%
	Digital mediation of teacher	irrelevant	43%
	Correct use of ontology	irrelevant	14%
	Technological aspects	irrelevant	57%
	Learning design	0%	14%

Table 2 shows that for oral and Digalo discussions, good moderation means primarily mediation for participation, for adequate discourse norms and for interaction. Fulfilling norms of discourse was less important for digital discussions, though. In general, the criteria for quality of moderation in the two media were quite big. Concerning the cognitive dimensions, 'focus' which was so central in oral discussions was far less important in digital ones. Interestingly, a very different aspect, somehow orthogonal to 'focus', 'eliciting more perspectives' was considered as a good moderating action. Teachers also mentioned 'asking for clarifications' as central for digital discussions whereas this action was not mentioned as reflecting quality of mediation in oral discussion. Of course, 'technological aspects' did not appear for the oral discussion. These two categories did not appear in the teachers' answers when evaluating the moderation of oral discussions in classrooms.

In addition to written responses, teachers sometimes clarified what they meant. Many teachers stressed the importance of prerequisites for the success of any Digalo-based learning activity. They stressed the importance of investing a lot of effort and thought in (a) becoming well acquainted with the tool, (b) preparing and designing the sequence of activities, and (c) organizing social settings (e.g., assigning students to small groups based on their learning abilities).

Study 2: How teachers intuitively moderate Digalo discussions

Participants

Twenty MA students at the Hebrew university participated. The study was conducted in the framework of a course on the role of the teacher in technological classrooms. The course was delivered at the School of Education. About 90% of the students were in-service teachers.

Procedure

The course consisted of 14 meetings. Although the course describes the various roles of teachers in planning activities (including designing activities with the help of flexible technological tools) and the role of technologies in evaluating learning and teaching processes in general, it focused more on e-discussions and the role of the teacher before, during, and after the discussion. The course included the following themes: (a) the role of the teacher in planning, orchestrating, and evaluating lessons; (b) general overview of possible roles of technologies in supporting such teachers' endeavors; (c) types of classroom dialogues and strategies for sustaining them; (d) familiarization with the Digalo tool for e-discussions; (e) extracting arguments from a text that presents a controversial issue in a Digalo map; (f) discussing the same issue with the Digalo tool in small groups; (g) evaluation of [e-]discussions: ground rules, indicators; (h) scripts for discussions, participation in e-discussions according to agreed ground rules, evaluation of such e-discussions; (i) the role of the teacher in designing [e-] discussion activities; (j) the mediating role of the teacher in [e-]discussions, especially for constructing knowledge; (k) experiencing moderation in Digalo e-discussions and evaluation of the moderation. At the end of the course, the students were randomly assigned into 5 groups (4 students in each group). In each of the groups, one of the students was randomly assigned the moderator's role. The only explanation these moderators received was that they should moderate (run/manage) the discussion according to their own views and/or school experiences. The task the groups discussed revolved around an educational dilemma – whether to give a prize to a student whose achievements are very high, but who shows disdain for his peers and demonstrates anti-social behavior. The participants in each group (excluding the moderators) were asked to choose a role to play: being a school principal, a class teacher, or educational advisor. Each person had to represent the role he/she chose. We should note that although subjects underwent a 28 hours long course, the strategies the students enacted in moderating e-discussions could still be considered intuitive since they only experienced moderation once before.

Results

The discussions yielded 5 Digalo maps that represented the products of the 5 discussion groups. Figure 1 displays two of these maps. Every shape represents a contribution that a participant created throughout the discussion. The links between the shapes shows the rhetoric relationship between the contributions (support, opposition, [neutral] reference). The darkened shapes represent the contributions of the moderator.

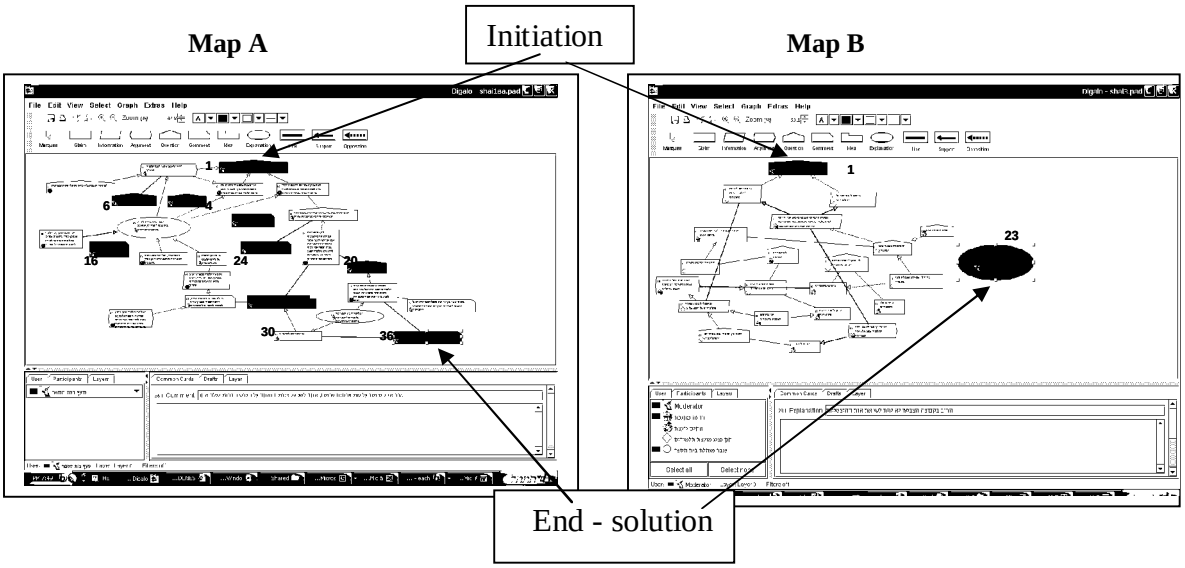

Figure 1: Two Digalo maps built by two different groups

The maps in Figure 1 show two very different types of discussions. In map B, the moderator intervened only at the end of the discussion when the group had to decide on the solution to the problem. In map A the moderator intervened nine times during the discussion. However, although the moderator linked his contribution to the participants, on six occasions no one reacted. So as to identify different moderation practices, we conducted both qualitative and quantitative analyses. In the first stage, we analyzed and characterized the content of the moderator contributions and identified five different moderation styles. We then turned to a quantitative analysis of a number

of discussion-map features and examined whether these confirm the different moderation styles identified earlier. We will present the results according to this order:

Content analysis of moderator contributions

Interestingly, the content analysis revealed that each of the five discussion groups was characterized by a distinctively different moderation style:

In group 1 (map A in Figure 1), the moderator encouraged discussants to start the discussion, drew their attention towards the proper choice of ontology, commented on the need to arrange graphical moves on the screen to prevent their overlapping each other, and directed the 'school principal' to a question referring to her. Typical moderator's interventions were *"Girls, what's up. You should express your opinion"* and *'"The principal, a question was asked, please answer it"*. Six out of the nine moderation moves in the first group were identified as aiming to encourage the group members to act. We termed such a moderation move as *organizing moderation*. As it was predominant in group 1, we identified the moderation style as an *organizing style*.

In group 2, six out of the nine mediation moves concerned what we could identify as 'guiding': The moderator presented directive questions and asked for clarifications. For example, the moderator wrote *"I'm sure that your idea is interesting, but can you explain and sharpen your argument more" or "In your opinion, is it enough that Shai excels in learning? What about social value and social relationships?"* We referred to this kind of moderation move *guiding moderation*. As it was predominant in group 2, we identified the moderation style as a *guiding style*.

The moderator in group 3 was not active during the discussion (as shown in map B in Fig. 1). His moderation consisted of presenting the issue to be discussed and the conclusion reached by the group. At the end of the discussion he only summarized the group decision concerning the educational dilemma: *"The group decision is to not allow the award of excellence to Shai*". We refer to this kind of (absence of) moderation an *observing style.*

Six out of the nine moves in group 4 interfered with the flow of collective argumentation. The moderator spelled out his opinion, involved himself as an equal-status participant, to be involved as another discussant. For example he wrote *"It's not true…. Have you forgotten all the problems he caused… or "I am not willing to let him (Shai) stay in school …"*. We named this moderation move as *involved* and since this move was predominant, we define the style of the moderation as *involved moderation*.

In group 5, all four mediation moves were of an assertive or authoritative type. However, the moderator did not interfere throughout the discussion. He allowed the members to present their views, yet toward the end of the discussion he used his authority in order to 'impose' his solution. He wrote at the end of the discussion *"I think that the teachers should propose a list of recommended children for getting the award , and we will vote for appropriate students from the list"*. We termed this kind of moderation move an *authoritative move*. Since all moderation moves in this map were of this kind, we identified here an *authoritative style of moderation*.

Of course, the five styles we discerned do not represent the full range of moderation styles. One could easily imagine combinations between the styles we identified. Additional studies are needed to identify more moderation styles. However, the information we collected so far not only indicates first directions for research on moderation styles but also on the extent to which such styles are desirable and on how moderators function when adopting them. We analyzed the discussion maps on the following moderation-relevant features: (a) the types of ontology shapes the moderators used; (b) the types of links used; (c) the number of moderator interventions in the Digalo discussion; (d) the distribution of these interventions throughout the discussion; and (e) discussants' responsiveness to moderator interventions. The combined results of these analyses are presented in Table 3, which displays the five aforementioned features of discussion maps for the five discussion groups.

Type of moderator shapes

Table 3 shows a crucial feature of moderation and of the maps in general, namely that the five moderators used different argumentative moves from the argumentative ontology proposed, and this use reflects their moderation style: For group 1, the organizing style of moderation was embodied in 'comment' and 'question' shapes, the style they adopted; in group 2, the guiding style was embodied in 'comment', 'question', and 'argument shapes; for group 3, the observing style was embodied in one 'question' and one 'explanation' shape; in group 4, the predominance of 'argument' and 'claim' shapes reflects well the involved style of moderation; only in group 5, the

use of 'idea' and 'question' shapes do not allude directly to an authoritative style of moderation. However, it is clear that the moderator chooses the shapes according to deliberate decisions. This choice expresses that the subjects participated in a course in which they learned to express themselves in e-discussions in terms of a given ontology. *The analyses we conduct concern only students for which the use of the ontology has become fluent to some extent,* since they participated in a preparatory phase in which they learned to use the tool and the ontology in e-discussions.

Table 3. **Features of the discussion maps by moderation style**

	Moderation style				
	Group 1 Organizing	Group 2 Guiding	Group 3 Observing	Group 4 Involved	Group 5 Authoritative
Number of contributions created by moderator	9	9	2	9	4
% of total map contributions created by moderator	33	26	9	30	16
Distribution of moderator interventions (%)					
Beginning	44	33	50	11	25
Middle	44	22	0	67	0
End	12	45	50	22	75
Moderator contributions in terms of shape-ontology (%)					
Claim	0	0	0	23	0
Information	0	8	0	10	0
Argument	0	23	0	43	25
Comment	45	23	0	0	0
Question	45	46	50	13	25
Idea	10	0	0	0	50
Explanation	0	0	50	10	0
% of total map links created by moderator	29	15	24	21	14
Links created by moderator (%)					
Neutral	88	55	50	50	100
Supportive	0	12	0	16	0
Oppositional	12	33	50	34	0
% of moderator contributions discussants responded to	33	44	50	55	100

Types of moderator links

The types of links used by the moderator were not uniform across groups (see Table 3), although most of them were neutral. This finding is not surprising for organizing and guiding styles of moderation. In these cases, the moderator does not express personal beliefs concerning the issue under discussion. For the involved and authoritative styles of moderation, the use of neutral links was more surprising. This seems to suggest that the choice of link type is demanding as it necessitates understanding discussants' contributions in context, and moderators prefer to use a neutral choice.

Relative contribution of the moderator

Another interesting finding in Table 3 concerns the relative contribution of the moderator. Contrarily to classroom discussions held face-to-face, in which teachers are usually very active (Mercer, 1995), it appears that most of the contributions are made by the discussants and not by the moderator/teacher. Here also the frequency in the moderator's contributions reflects the style adopted: For the observing style, it is of course very low, and for the organizing, guiding, and involved style of moderation, it is higher but does not reach more than a third of the overall contributions. This suggests that the students are actively engaged in collective argumentation. For reasons of space limitation, we cannot show here that they are debating ideas and problems amongst each other, challenge or

elaborate each other's ideas, and share 'social' experiences which are not directly related to the task. The interventions of the moderator are then naturally scarcer.

Distribution of moderator interventions along e-discussions

Table 3 shows another interesting feature of e-moderation: We adopted a timeline approach (de Laat, & Lally, 2003) to observe the distribution of moderation along the e-discussion. Table 3 nicely shows that this distribution is very different for each of the moderation styles: In the middle phase of the discussion, the 'observing' and 'authoritative' did not interact with the participants. On the other hand, the 'organizing' moderator was active in this part of the discussion. The guiding moderator was active as well. For both of them, moderation was an on-going process. Beyond the trivial findings that this perspective opens, it appears that easily computable data such as the distribution of moderation over time can give appropriate information which is compatible with information drawn from direct content analysis of interventions.

Responsiveness of discussants to moderation

The last perspective to which we refer here concerns the responsiveness of discussants to the moderators' interventions. Table 3 shows that for the organizing style of moderation, most of the moderator's contributions remained unanswered. At turn 4, the moderator wrote "*Girls, what is happening…start to sound out your attitudes*". In this move, the moderator encouraged the group toward action, but no place was left for further interaction with the group. At turn 13, the moderator wrote "*Girls, try to make your shapes smaller, so we can read your message easier".* This kind of moderating action is aimed at drawing the group's attention to handier visual organization of the map. In this case too, no room is left for further interaction between the moderator and the participants. At turn 16, the moderator wrote "*The principal, a question was asked, please answer it*". . . Here the moderator directs the school's principal (a role played by one of the participants) to the question she was asked, asking her to address it. Here as well, there is no place for continued interaction. In this discussion, in one instance only, did the moderator ask for an argument following an argumentation: At turn 3, a student wrote "*In my opinion, Shai does not deserve the title of "Excellent Student*". The moderator asked her subsequently "*Could you give the reason for that*?" After the student gave her explanation, no further interactions developed. In summary, in the case of this e-discussion, the lack of responsiveness of the discussants is natural since the organizing style of moderation is inherently directed at helping without interfering.

In group 2 which was characterized by a style of guiding moderation, nine guidance moves were enacted by the moderator during the discussion, out of which five were not responded to by the participants. In addition, most of the interactions referred to a specific intervention move: at turn 8 the moderator wrote "*Do you think that it is enough that Shai excelled in his studies – what about social values and interpersonal relationship*?" At turn 15 Dina linked her response to turn 8 with a neutral link: "*I am for it (to honor Shai with the award), and what do you think of the idea?*" Although Dina linked her response to the question of the moderator asked her, she did not address it directly. At turn 17, Maria also linked her contribution to the question of the moderator at turn 8 with a link of support: "(*We) come to school not only to study, but also to develop and construct personality. . .*" At turn 19, she reacts again to the same question: "*As a counselor, I think he deserves the prize, not because of the learning issue, but rather due to his influence in the social-personal domain* by using a neutral link. She goes on reacting in turn 24: "*Maybe it is worth noting the social meaning of the prize, and that the person who receives it, gets it not only for what he has done, but also for what he can still do,* again with a neutral link. Finally she reacts also at turn 27: *This prize expresses the school's ideology as to what constitutes a good student; it does not only mean academic achievement, but also a trustworthy human being*" with a neutral link. It appears that despite the moderator's mediation to provide further aspects of the issue under discussion, not all the responses are directly connected to the moderated subject itself. In addition, the large number of *one* student's responses to the same mediation is surprising. The small number of references to the moderation makes one wonder: why did this happen? In a post-discussion interview we conducted with the participants, it appeared that the discussants found it hard to distinguish between the contribution of the moderator as a moderator and the roles they had to play. It seems that concurrent flow of information from various speakers caused an overload, hence difficulties to relate to each other. It appears then that the lack of responsiveness of students in this case stems from the difficulty discussants have to take the moderator's guiding intervention into consideration because they are too much engaged in their discussions.

As for the other three groups, responsiveness was high, but this achievement was neither surprising nor interesting. It was not surprising that students responded to the unique question asked by the observing moderator – a question that simply stated the question to be discussed. Also, it was not surprising that in group 4, characterized

by involved moderation, the discussants responded to the moderator's interventions, since he acted as a discussant. In group 5, the style of authoritative moderation allowed responsiveness to "orders" at the beginning and the end of the discussion, but, as we already noticed, the moderator did not intervene during (in the middle of) the discussion (see Table 3).

In conclusion, in all discussions except for the 'guided one', the lack of responsiveness did not present a problem in itself since the style of the moderation invited a lack of responsiveness. As for the guided discussion, it was difficult for students to respond. Such a phenomenon is important since guidance is a central kind of moderation with the potential of leading to cognitive gains. It seems in this case that the environment should provide new tools for both the discussants and the moderator to be able to interact.

Discussion

In this study, we identified five styles of intuitive moderation in synchronous discussion: organizing, guiding, observing, involved and authoritative. Cognitive styles derive from abilities, beliefs and constraints of the environments in which persons act. In the case of moderation, the style derives also from practices the moderator/teacher enacts in his/her class. The variety of styles we could identify suggests that antagonist forces influence the behavior of the teachers. On the one hand, teachers in classrooms often see themselves at the center: they make their own decisions, initiate questions, evaluate answers, and reformulate or re-voice them, and generally summarize discussions in classes. They are generally authoritative, and assertive. On the other hand, the Digalo tool encourages autonomy of discussants through interaction with peers. Teachers are certainly sensible to such affordances. This is one of the main findings in Study 1 that showed that teachers believed that good Digalo discussions are different from face-to-face discussions in the classroom. Scrutiny over Table 2 suggests teacher's recognition that good moderation moves are essentially organizational and guiding.

In Study 2, moderators had to act and this was a very different story. In light of the dialogic stance our group adopts in teaching and learning activities (Schwarz & Glassner, 2003), two out of the five teachers showed undesirable moderation styles (authoritative and observing).. The involved style of moderation is not extremely welcomed, either, since the moderator should always be aware of his/her role (however, we think that 'involvement as an equal-status move' – and not a style, may be very good strategy). In Study 2, the subjects attended a course in which we tried to encourage students/teachers to guide and accompany learning processes rather than to use authority for transmitting knowledge. The ground rules we proposed implicitly suggested organizing and guiding styles of moderation. We think that the fact that only two moderators chose these styles may be understood by the difficulty shown by the moderator that adopted the guiding style of moderation in interacting with students. For him, it was difficult to interact and discussants often claimed that they did not notice his contributions throughout the discussion. It appears that the Digalo map created simultaneously by several participants presented an overload both for the students and the moderator. Such a situation requires high concentration from the participants in order to follow the flow of written contributions. It discourages some moderators from guiding and accompanying discussions.

The number of participants in these studies is of course extremely limited. However, in-service teachers programs we currently animate on the use of Digalo in classrooms seem to confirm what Study 2 suggests, the fact that teachers are intrigued by a tool that shows potentialities for learning, but experience difficulties to use effectively. One first step for promoting better Digalo discussions is to provide specific scripts to teachers beforehand in order to help them in facilitating collaboration in synchronous Digalo discussions. The EC-funded ARGUNAUT project (IST-2005027728) is aimed at providing teachers with awareness tools (graphs summarizing participation or links between discussants, pop-ups, messages, etc.) that help them and students in viewing characteristics of the discussion without disrupting the flow of the on-going collective argumentation.

References

Ashton, S., Roberts, T., & Teles, L. (1999). Investigating the role of the instructor in collaborative online environments. Poster presented at the CSCL conference, Palo Alto, Stanford University, CA, USA

Atzmon, S., Hershkowitz, R. & Schwarz, B. B. (2006). The role of the teacher in turning claims to arguments. Proceedings of 30th Conference of the International Group for the Psychology of Mathematics Education., Vol 5 (pp. 65-72). Prague.

Bell, P. (1997). Using argument representation to make thinking visible for individuals and groups. In R. Hall, N. Miyake, & N. Enyedy (Eds). Proceedings of the 2nd Conference on CSCL (pp. 10-19). Toronto.

Baker, M., & Lund, K. (1997). Promoting reflective interactions in a CSCL environment. *Journal of Computer Assisted Learning, 13*, 175-193.

Chi, M.T.H., Siler, S., Jeong, H., Yamauchi, T., & Hausmann, R. (2001). Learning from human tutoring. *Cognitive Science, 25*, 471-534.

De Laat, M. F., & Lally, V. (2003). Orchestrating collaborative learning: Software design to support online learning and tutoring strategies. Paper presented at the Ed-Media, Honolulu.

Driver, R., Newton, P., & Osborne, J. (2000). Establishing the Norms of Scientific Argumentation in Classrooms, *Science Education, 84*, 287.

Duschl, R. & Osborne, J. (2002). Supporting and promoting argumentation discourse. *Studies in Science Education, 38*, 39-72.

Erduran, S., Simon, S., & Osborne, J. (2004). TAPping into argumentation: developments in the application of Toulmin's argument pattern for studying science discourse. *Science Education, 88*(6), 915-933.

Glassner, A. & Schwarz, B. B. (2005). The Role of Floor Control and of Ontology in Argumentative Activities with Discussion-Based Tools. Paper presented at the CSCL conference, Taipei, Taiwan.

Hakkarainen, K., Lipponen, L., & Järvelä, (1998). Epistemology of inquiry and computer supported collaborative learning. A paper presented at the American Educational Research Association (AERA) Annual Meeting, San Diego.

Henry, F. (1992). Computer conferencing and content analysis. In A. R. Kaye (Eds*.), Collaborative learning through computer conferencing*: The Najaden papers (pp. 115 - 136). New York: Springer.

Lave, J. (1991). Situated learning in communities of practice. In L. B. Resnick, J. M. Levine & S. D. Teasley (Eds.), *Perspectives on socially shared cognition* (pp. 63-84). Washington, DC: American Psychological Association.

Mercer, N. (1995) *The Guided Construction of Knowledge: talk amongst teachers and learners*. Clevedon: Multilingual Matters

Mercer, N., Littleton, K., & Dawes, L. (2003). Computers and Learning Conversations. Paper Presented at the 'Learn IT' Seminar, Gothenburg, Sweden.

Muukkonen, H., Hakkarainen, K., & Lakkala, M. (1999). Collaborative Technology for Facilitating Progressive Inquiry: Future Learning Environment Tools. In C. Hoadley & J. Roschelle (Eds.), *Proceedings of the CSCL '99: The Third International Conference on Computer Support for Collaborative Learning* (pp. 406-415). Mahwah, NJ: Erlbaum

Sandoval, W. A., & Reiser, B. J. (2004). Explanation-driven inquiry: integrating conceptual and epistemic scaffolds for scientific inquiry. *Science Education, 88*, 345-372.

Schwarz, B. B., Neuman, Y., Gil, J., & Ilya, M. (2003). Construction of Collective and Individual Knowledge in Argumentative Activities: An Experimental Study. *The Journal of the Learning Sciences, 12*(2), 219-256.

Schwarz, B. B., & Glassner, A. (2003). The blind and the paralytic: fostering argumentation in social and scientific issues. In J. Andriessen, M. Baker, and D. Suthers (Eds.) *Arguing to Learn: Confronting Cognitions in Computer-Supported Collaborative Learning environments*, (pp. 227-260). Kluwer Academic Publishers.

Schwarz, B. B., Dreyfus, T., Hershkowitz, R. & Hadas, N. (2005). Teacher Guidance of Knowledge Construction. Proceedings of 28th Conference of the International Group for the Psychology of Mathematics Education, 4, 169-176.

Shahar, N. (2003). Patterns of behavior and types of mediation by teachers in argumentative e-discussions. M.A. Thesis. The Hebrew University, School of Education (in Hebrew).

Soller, A. (2001). Supporting Social Interaction in an Intelligent Collaborative Learning System. *IJAIE*, 11.

Suthers, D. (1998). Representations for Scaffolding Collaborative Inquiry on Ill-Structured Problems. Paper presented at the 1998 AERA Annual Meeting, San Diego, California.

Van Bruggen, J. M., Kirschner, P. A., & Jochems, W. (2002). External representations of argumentation in CSCL and the management of cognitive load, *Learning and Instruction, 12*, 121-138.

Wegerif, R. (1996) Using computers to help coach exploratory talk across the curriculum. *Computers and Education 26*(1-3), 51-60.

Yackel, E. (2002). What we can learn from analyzing the teacher's role in collective argumentation. *Journal of Mathematical Behavior, 21*, 423-440.

Zohar, A. & Nemet, F. (2002). Fostering students' knowledge and argumentation skills through dilemmas in human genetics. *Journal of Research in Science Teaching, 39*(1), 35-62.