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| | | communication formats (e.g., asynchronous, face-to-face) show that insights on effective instructional practices in these formats cannot be simply transferred to synchronous communication formats. We close this paper by briefly describing a tool that provides real-time support for e-moderators of synchronous group discussions, and whose development had been sparked by these findings in a further cycle of our design research program. Several questions and hypotheses are articulated to be investigated in future research, both with these new tools and in general. |
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# Online moderation of small-group discussions: The case of synchronous e-argumentation in a diagram-based discussion space

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**Abstract** In this paper, we present findings on moderation of synchronous, small-group argumentation in blended, co-located learning environments. Drawing on findings from the literature on human facilitation of dialogue in face-to-face settings, we first elaborate on the potential promise of this new practice. However, little is known about what constitutes effective human facilitation in synchronous e-discussions. A multi-method exploratory approach was then adopted to provide first insights into some of the difficulties and characteristics of moderation in these settings. To this end, we focused on (1) students' perspectives on what constitutes effective e-moderation of synchronous peer argumentation in classrooms and (2) the relations between characteristics of actual and perceived moderation effectiveness. The analyses presented in this paper reveal that the role of the e-moderator in synchronous peer discussions is a complex one and that expectations from e-moderators seem at times even contradictory. Also, comparisons with findings on moderation in other communication formats (e.g., asynchronous, face-to-face) show that insights on effective instructional practices in these formats cannot be simply transferred to synchronous communication formats. We close this paper by briefly describing a tool that provides real-time support for e-moderators of synchronous group discussions, and whose development had been sparked by these findings in a further cycle of our design research program. Several questions and hypotheses are articulated to be investigated in future research, both with these new tools and in general.

**Keywords** Online peer discussions · Argumentation · Human support · Teacher and tutor roles · Synchronous CMC

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Research on computer-supported collaborative learning (CSCL) is deeply rooted in constructivism. It intensively focuses on how productive peer collaboration can be stimulated and sustained in computer-mediated environments and how these collaborative activities facilitate learning. Within the field of e-argumentation, for example, it has been found that providing sentence openers (Cho and Jonassen 2002; Jeong and Joung 2007), software-embedded collaboration scripts (e.g., Stegmann et al. 2007), and representational guidance (Schwarz and Glassner 2007; Suthers 2003) may improve the quality of online argumentation. Others have argued that it is the medium itself that may facilitate important aspects of group argumentation (Asterhan and Eisenmann 2009; Baker and Lund 1997; Kim et al. 2007). These include, among others, the increased explicitness (because of the persistence of textual messages on screen), more preciseness in articulating arguments (because of the lack of nonverbal communication cues), and more willingness to express alternative views and critique ideas (because of the decreased influence of social status).

However, whereas important insights have been gained with regard to the effects of task and tool design on collaborative learning processes, the role of the human instructor in CSCL has not been considered with the same intensity as it could have been (McPherson and Nunes 2004; Lentell and O'Rourke 2004; Lund 2004). In this paper, we focus on one particular aspect of this role, namely, online human moderation of synchronous peer discussions in co-located classroom settings.

Computer-mediated discussions in co-located classrooms combine the aforementioned advantages of textual CMC with those of classroom settings, in which students and instructors not only share a physical space, but also a common set of behavioral norms and a common history. Recent research has shown that CMC in classrooms may offer several advantages, especially with regard to the social-interactive aspects of classroom discussions (Asterhan and Eisenmann 2009): When asked to compare their experiences with face-to-face (F2F) classroom discussions, students reported that student participation was more egalitarian, that they felt more comfortable to freely express their ideas, and that they engaged in more peer-to-peer interaction. In addition, they also reported experiencing much less classroom interruptions and disturbances in computer-mediated classroom discussions.

The question is, however, how can teachers make sure that what goes on in the digital environments meets the intended educational goal of the activity? They may share a physical space, but unless they go online themselves, teachers will have little knowledge about the content of the discussions. Also, when they do go online, how could they best support their students' efforts?

We will show that the literature has, in fact, little to offer about what constitutes effective online human support of synchronous discussions. The necessary larger context of our investigation then concerns the literature on human facilitation of peer dialogue in other settings, such as in face-to-face interactions and in distant, asynchronous e-learning environments. We will, therefore, first present overviews of these two literatures and summarize their main findings on how to effectively support productive peer dialogue. We will then discuss in what ways these two settings are distinctively different from synchronous communication formats, and argue that these differences justify a separate investigation into human facilitation in synchronous formats.

The overarching goal of the empirical studies presented in this paper is then to obtain first insights into online human guidance of synchronous small-group discussions and to compare these with the findings from the literature on face-to-face and asynchronous settings. Because of the embryonic state of this line of research, we will adopt an exploratory research approach and triangulate different research tools. Let us begin with what can be learned from human facilitation in face-to-face peer dialogues.

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**Effective human facilitation of student reasoning in face-to-face settings: The power of generic, low-content scaffolding**

An increasing number of studies have found that the extent to which students learn from collaborative activities depends on the depth and the quality of the dialogue peers engage in. Dialogue moves that have been identified as predictors of individual learning gains include explaining ideas to others (Coleman 1998), producing and receiving elaborated help (Webb 2009; Webb and Palincsar 1996), elaborating on each other's ideas and problem solving (King and Rosenshine 1993; van Boxtel et al. 2000), and engaging in reasoned argumentation (Asterhan and Schwarz 2007, 2009; Chin and Osborne 2010; de Vries et al. 2002; Schwarz et al. 2000).

However, groups do not necessarily engage in these types of dialogue without support (Webb 2009). Among others, prior to the task, students should be prepared for collaborative work and given appropriate and explicit instructions (Asterhan and Schwarz 2007; Chinn et al. 2001; Gillies 2003, 2004; Howe 2009; Nussbaum 2005; Mercer et al. 2004; Reznitskaya et al. 2007). Moreover, task designs should be specifically structured to increase the likelihood that students engage in productive talk (e.g., Andriessen and Schwarz 2009; King and Rosenshine 1993; Palinscar and Brown 1989). Many have recommended that, in addition to these, instructors should also monitor small-group dialogue *during* the collaborative tasks and intervene when necessary (Cohen 1994; Tolmie et al. 2005; Webb 2009).

The question is, however, what type of human support during group work improves group functioning? Several recent studies seem to indicate that low-content teacher interventions that aim at eliciting student thinking are more effective in sustaining productive student dialogue than providing explicit, content-specific help explanations and instructions: For example, Web et al. (2008) found that such teacher interventions nearly always produced more student explaining and often resulted in better group performance. Similarly, Chiu (2004) found that providing low-content help and issuing few directives benefited student group performance, both in the presence of the teacher as well as after (s) he had left. Gillies (2004) trained teachers to implement cooperative learning techniques in the classroom. Several of these teachers also received additional training in specific communication skills to support productive group dialogue. For example, they were trained to probe student reasoning, to acknowledge and validate their ideas, and to offer suggestions in a tentative way. Her observations of teachers engaging with groups showed that the teachers who received the additional training actively scaffolded group performance and reasoning, whereas the other teachers were much more controlling, disciplining, and directive during children's group work. The behavior of students in the former condition showed that they more often expanded on each others' ideas, asked more questions, and exhibited greater learning gains than did the students of teachers who did not receive the communication skills training. These findings were replicated and extended in a follow-up study (Gillies 2009). The importance of human support that focuses on eliciting student reasoning rather than providing direct expert feedback has also been emphasized in the literature on problem-based learning among adult medical students (e.g., Dolmans et al. 2002; Hmelo and Barrows 2006).

The findings on effective teacher support for peer-to-peer dialogue seem to corroborate with findings from the literature on two other forms of instructional discourse, namely, one-on-one tutoring and teacher-led classroom discourse: As for the first, Chi and colleagues have shown that tutoring styles that scaffold the tutee's own reasoning and explanation are more effective to the learning process than are more "didactic" tutoring styles that contain

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explanations and direct feedback (e.g., Chi et al. 2001; Chi et al. 2008). Effective tutor prompts included, among others, the following generic prompts: "Can you explain X," or "Articulate X with your own words," "What do you think about the issue?", "Could you add anything else about X?" (for similar approaches, see also Baker and Lund 1997; Mercer 1995; Wegerif 1996).

Similarly, the literature on teachers' discourse in classroom instruction has shown that recitation-style discourse patterns such as Inquire-Response-Evaluate (IRE) (Cazden 2001) limit students' participation in high-quality discourse. Resnick and colleagues (Resnick et al. 2010; Michaels et al. 2007) identified a number of specific teacher moves that produce qualitatively high forms of student participation in classroom discussions. These include, among others, asking students to restate someone else's reasoning ("Can you repeat what he just said in your own words?"), asking students to apply their own reasoning to someone else's ("Do you agree or disagree and why?"), prompting students for further elaboration ("Would you like to add on?"), challenge ideas ("Is this always true?"), and asking students to explicate their reasoning ("Why do you think that?").

Taken together, the literature on teacher and tutor moves that effectively support productive dialogue in educational settings reveal similar findings: Both in small-group, one-on-one tutoring as well as whole classroom discourse, effective teacher support can best be described as one that aims to elicit students' thinking and reasoning. It is striking that in all three fields the more common types of effective tutor moves are generic scaffolding prompts, such as "Why do you think X?", that can be applied to almost any content area In contrast to more directive or "didactic" moves (such as providing content-related feedback and providing the correct explanation), these scaffolds are directed at prompting the individual student to clearly articulate their knowledge in a public realm, to elaborate on the reasons behind their responses, and to relate to the ideas of others.

The question is, however, whether these support strategies will also be found to be effective for promoting productive dialogue in other communication formats, such as computer-mediated communication (CMC)?

## The consideration of human facilitation in CSCL environments

With the ever-increasing integration of CMC tools in learning settings, many tutors and teachers are asked to contribute to their institution's online courses or to blend their face-to-face teaching practices with computer-mediated activities. Several pedagogical approaches have been developed to describe what the role of the instructor should be in these (partly) virtual learning environments (e.g., Berge 1995; Collison et al. 2000; Goodyear et al. 2001; Laurillard 1993; Mason and Kaye 1989; Paloff and Pratt 2001; Salmon 2000). These pedagogical frameworks all consider the role and responsibilities of the human instructor (often referred to as the e-moderator) and are based on extensive experience in e-course development in post-secondary education settings, such as Open Universities. They are, therefore, particularly helpful for understanding and designing distant-learning environments, such as adult e-courses. What is characteristic of these settings is that learners are spatially and often temporally distributed, almost all instructor-learner and learner-learner communication is computer-mediated and asynchronous, and there are no-to-few F2F meetings. It is, therefore, not surprising that these frameworks emphasize motivation and socialization as necessary ingredients of e-moderation to ensure active student participation and prevent attrition from e-courses.

Whereas the development of pedagogical frameworks is important in its own right, the number of *empirical* research works that specifically focuses on human support during CSCL is still relatively small. However, the number of research-based works is rapidly growing, both on human facilitation in e-courses (e.g., De Laat et al. 2007; Goodyear et al. 2001; Hlapanis et al. 2006; Katz and O'Donnell 1999; Mazzolini and Maddison 2003; Packham et al. 2006) as well as more specifically on human support of a-synchronous discussions (e.g., Anderson et al. 2001; Lakkala et al. 2001; Lim and Cheah 2003). Much of this research has focused on the role of the human instructor in these online environments. For example, Mazzolini and Maddison (2003) showed that intervention frequency may vary from high (the "sage on the stage"), to moderate (the "guide on the side"), and even low (the "ghost in the wings"). The e-moderation literature generally suggests that it is important that instructors play an active, visible part in online discussions, especially in distant, asynchronous settings (Berge 1995; Salmon and Giles 1997; Salmon 2000). However, too much intervention may dampen students' motivation to actively participate. Mazzolini and Maddison (2003), for instance, showed that the number of postings contributed by an e-tutor was negatively related with length of discussions in an asynchronous discussion board environment. A considerable amount of attention has also been dedicated to the identification of the different roles that an e-instructor is required to fulfill in online environments (e.g., Anderson et al. 2001; Berge 1995; Goodyear et al. 2001; Packham et al. 2006), even though the exact number and their respective specifications vary among researchers (see, for example, Denise et al. 2004 for an overview of different approaches).

Lund (2004) reviewed and summarized many of these different distinctions and definitions, and proposed the following taxonomy of human supportive roles in CSCL: *Pedagogical* support aims at the students' learning, whether in terms of content or thinking skills, by providing factual information, scaffolding reasoning and knowledge construction, controlling the focus of attention, providing explanations, and so on. In line with the research on teacher support in face-to-face discussion settings, we propose to refine Lund's taxonomy by distinguishing between at least two different forms of *pedagogical* support: support that aims at eliciting student thinking and reasoning without providing direct, content-specific help, and direct instruction that aims at providing direct feedback and explanations. *Social* support focuses on the social relations between the discussants, on maintaining high levels of motivation, and on maintaining a pleasant atmosphere. *Interaction* support, on the other hand, aims at ensuring that students participate, are responsive to each other, and do not overlap each others' contributions. Finally, *managerial* support focuses on task design, completion, and monitoring and *technical* support aims at detecting operational and technical difficulties with the software and providing help accordingly.

For example, Packham et al. (2006) asked students and tutors to define what they consider effective e-course moderation within a distant-learning environment that included an asynchronous communication component. They found that effective support in this environment was defined in terms of the quality of feedback (Pedagogical support, without further specification), moderator encouragement and presence (Social support), and module management and organization (Managerial support). Other analyses corroborate with these findings (e.g., Anderson et al. 2001; Berge 1995; Goodyear et al. 2001; McPherson and Nunes 2004).

The present study aims to contribute to this growing body of knowledge, by focusing on the more specific case of synchronous small-group discussions in co-located classroom

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settings. As mentioned by Lund (2004), different characteristics of CSCL environments impose different constraints on the human support that it affords, which, in turn, may affect effectiveness and desirability of certain types of human support over others. Thus, even though there is a considerable literature on e-moderation, much of this may prove to be of limited relevance to synchronous group communication in classroom settings, as it assumes distributed and/or asynchronous contexts.

## Human guidance of synchronous discussions in co-located classrooms

The settings of synchronous, co-located CMC are, in many ways, more similar to face-to-face classroom discussions, than they are to distributed CMC: Participants share the same physical space, they know each other and the teacher for some time, and the online discussions are embedded in a sequence of F2F classroom activities (Asterhan and Eisenmann 2009). Certain forms of human support, such as managerial and social support, may, thus, be less relevant in this type of setting.

In addition, engaging in *synchronous* group communication is, in multiple ways, different from asynchronous CMC (e.g., Cress et al. 2009; Veerman et al. 2000). Among other differences, the time frame is significantly shorter, discussants are concurrently receiving and sending multiple messages at a high pace, individual contributions are usually shorter, the dynamics of communication are more similar to F2F formats, the communication is usually not threaded by default, and moderation has to be accomplished in real time. Not only is the role of the moderator likely to be more demanding in terms of time pressure and cognitive load (Packham et al. 2006), differences in software affordances and the very nature of synchronous group communication may also change the definition of what constitutes effective support in such environments, and what is expected from a discussion moderator.

In a previous study, we described and distinguished different moderation styles of synchronous group argumentation in classroom settings: authoritative, observing, scaffolding, orchestrating, and participative (Asterhan, submitted). Similarly, Walker (2004) has presented several examples of how adult tutors guide out-of-school, large-group peer discussions on everyday topics. The most common type of moves that tutors used in these settings were probing students to provide more information on a topic or probing them to explain their opinion. However, little is known about how students experience and evaluate moderation efforts and which moderator interventions are (in)effective in these settings.

## The present study

In the present study, we then address e-moderation of synchronous, co-located discussions. This topic is addressed in two separate, yet related sets of analyses: In the first set, we seek to explore students' perspectives on human support of synchronous peer discussions and what they consider attributes of effective support. These findings are then compared with similar studies that focused on such attributes in asynchronous and distant formats. In the second set, we aim to identify which moderator interventions are more effective than others in this setting. In particular, we seek to explore whether pedagogical support of the content-free scaffolding type is frequently used in online guidance, and if so, whether this type of support is as effective in promoting high-quality peer discourse, as it has been found to be in face-to-face settings.

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Whereas in the first set of analyses, data is collected with the help of self-report questionnaires, in the second set, we rely on protocol analyses and student evaluations of the tutor's behavior. All data is collected from in-vivo classroom settings, in which students and teachers/tutors had participated in synchronous discussions on controversial issues. These activities were embedded in the regular curriculum of three middle school classes and one graduate course. The discussion tool that was employed for this study was a diagram-based discussion environment called Digalo (Schwarz and De Groot 2007), which we will shortly describe in the next section.

## Diagram-based software for argumentation

Digalo (http://www.argunaut.org) enables synchronous, textual talk through mediation of diagrams, where each geometrical shape represents a different dialogical move. Over the years, we have reported on several studies with different versions of this software (e.g., Asterhan and Eisenmann 2009; Schwarz et al. 2009; Schwarz and de Groot 2007; Schwarz and Glassner 2007). Figure 1 presents a screenshot of a Digalo map, for illustration. However, given the multiple uses of diagram-based representational tools in CSCL research, and in particular for argumentation, we feel that a clarification of the software and its usage in our classroom studies is appropriate:

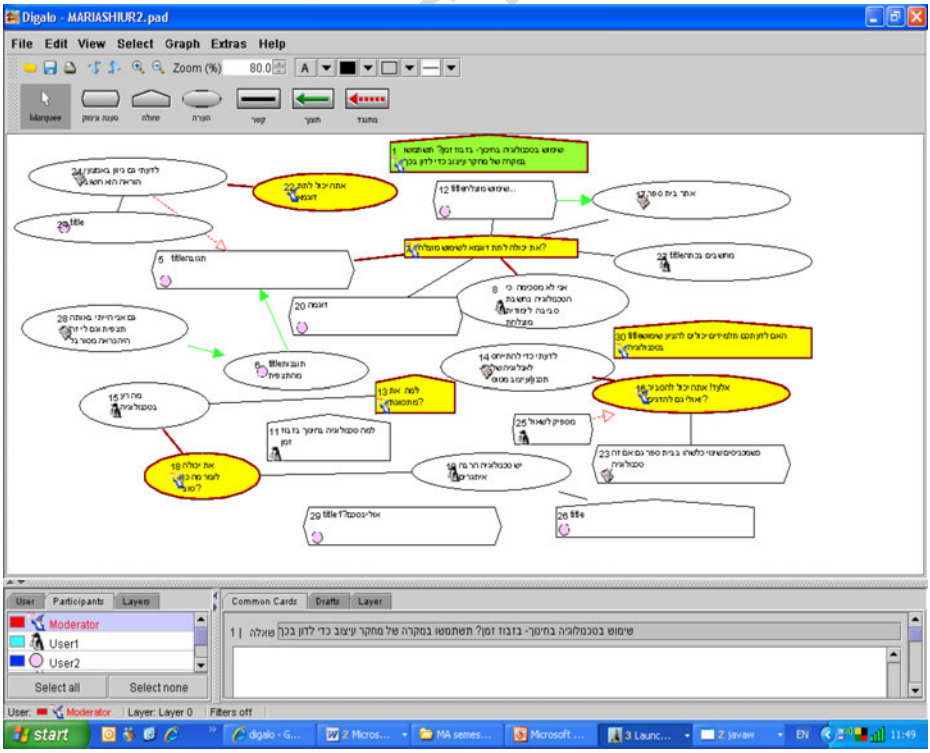


**Fig. 1** Illustrative screen shot of a moderated Digalo discussion map (moderator contributions in yellow, all original postings in Hebrew)

In Digalo discussions, users have to choose a particular contribution shape from a fixed set of options (e.g., argument, claim, question, explanation), write their contribution to the discussion in the shape, and link it to one or more contributions in the discussion map. These links express relations between contributions, that is, whether one is in agreement with, opposes, or is neutral toward the content of the other contribution. Thus, the discussion *itself* is mediated through geometrical shapes and arrows, and not used aside (after) a chat-based discussion as a representational tool to depict the evolving (completed) argumentative structure of the dialogue (for such tools, see, for example, Lund et al. 2007; Van Amelsvoort et al. 2007; Veerman et al. 2000). Thus in Digalo, the representational guidance of a diagram-based interface (Van Amelsvoort et al. 2007) is part of the discussion activity itself.

We are not aware of any studies that have compared the use of diagrams as the *medium* for discussion with using diagrams as *representational tools* before, alongside, or after a chat-mediated discussion, and this may be an interesting topic for future research. Nevertheless, there are two main reasons for why we prefer this type of discussion environment over the more commonly used tools, such as chat and threaded discussion forums: First of all, the use of arrows which express a stance of being in support of or against a certain textual contribution and the use of shapes that express different dialogue moves are likely to emphasize and scaffold the argumentative features of a discussion (Schwarz et al. 2003; van Amelsvoort et al. 2007). As Lund et al. (2007) concluded, "(...) marking one's opinion is easier 'on the fly' (...) than when painstakingly locating and transposing arguments from chat." Q1

The second reason for choosing Digalo over more commonly used discussion tools is much more mundane: Synchronous group discussions are characterized by a rapid pace of simultaneously posted discussion contributions. In commonly used discussion software, such as instant messaging and threaded discussion forums, turn adjacency is organized vertically and based on chronological precedence (Asterhan and Eisenmann 2009). When more than two students simultaneously participate, this quickly creates conversational incoherence (McAlister et al. 2004): Unrelated messages from other participants often intervene between an initiating message and its response (Condon and Cech 1996; Marvin 1995) and discussants tend to focus mainly on recently posted messages (Hewitt 2003). In discussion environments such as Digalo, jigaDREW (Lund et al. 2007), and Knowledge Forum (Scardamalia and Bereiter 2006), participants are free to post their contributions anywhere in a two-dimensional discussion map and link it to whatever contribution(s) they chose. With several different, but interconnected discussion threads going on at the same time and students moving between these threads, this flexibility is an advantage (Asterhan and Eisenmann 2009).

## Method

### Participants

The first sample consisted of 74 pupils from three 9th-grade classrooms of a junior high school in northern Israel. The second sample included 16 graduate students (12 discussants and four peer moderators) from the Education Department at the Hebrew University of Jerusalem who participated in a course on educational technology in the classroom.

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## Tools

As aforementioned, student discussions and e-moderation were conducted in the Digalo discussion environment. At the discussion map level, only the titles of a contribution are visible. However, when hovering over a shape with the mouse, participants can see its content with the help of tooltips. Each shape contains a number (expressing chronological order of postings) and an icon (personalizing the participant that posted it).

Students are always instructed beforehand about dialogical argumentation and are encouraged to choose proper ontological categories (shapes) for their dialogue contributions. However, the use of the shapes is only a suggestion and students often do not use them properly in the heat of synchronous e-discussions (Schwarz and Glassner 2007). The context in which we collected the data on online human guidance was one in which the moderator and the discussants shared the same end-user environment. In other words, moderator communications could be seen by all discussants and were an integrative part of the discussion map. To distinguish between moderator and discussant contributions, the latter were colored (see Fig. 1).

## Procedure

*A general description of the settings* Within the instructional tradition that has been developed over the years in the Kishurim group at the Hebrew University of Jerusalem (Schwarz and Glassner 2003; Schwarz and de Groot 2007), e-discussions are integrated into learning sequences that include different combinations of the following activities: individual or collective reading of texts, oral classroom discussions, frontal teaching episodes, individual preparation of materials, summary and classroom presentations of results. In each of its educational involvements, the teachers that participate in the Kishurim program are encouraged to gradually instill dialogic-dialectical norms of discussion, according to which students are expected to provide reasons for their viewpoints, to refer to each other, and to scrutinize their and others' views critically (Schwarz and de Groot 2007). Accordingly, the experiments reported here were preceded by classroom activities in which these norms had been favored, yet this process was still very much at its beginning stage at the time of this study. The students that participated in this study should, therefore, by no means be idealized as experienced debaters, nor should the classroom settings in which the study was situated be considered as revolutionarily different from normative classrooms. Prior to the moderated Digalo sessions we report on here, students in both samples had participated in one Digalo-mediated, small-group discussion on a different topic. They had quickly mastered the tool and seemed to use it with ease.

During the Digalo discussions, participants are instructed to communicate with each other through digital channels only, and to refrain from F2F communication. Group size for e-discussions in these contexts is typically 4±1 and synchronous Digalo discussions typically last between 30 to 50 min. Group formation is done in collaboration with teachers and is based on the creation of heterogeneous groups (both socially as well as with regard to competence), while ensuring that each group includes at least one "starter," that is, a person identified by the teacher to be capable of getting the discussion going.

*Specific procedures relating to moderation aspects* All the discussions in both samples were conducted in authentic, co-located classroom settings, in the facilities' computer labs

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(one student per computer). Students and moderators from both samples had first experienced participation in unmoderated Digalo discussions before participating in this study. Similarly, all moderators were first-time e-moderators. Each group was assigned one moderator. Discussants and moderators can only read and participate in the discussion map they are assigned to.

In the ninth-grade sample, the discussions were conducted in the school's computer lab, during regular school hours. In each session, three moderated groups of four students simultaneously conducted discussions on the same topic. Even though the teacher moderators (three different teacher moderators in each session) were all present and visible to everyone, discussants could not know which one of the adults was the moderator in their particular discussion.

Moderators in the university sample were assigned as first-time peer tutors, who had been selected and informed of their role a week beforehand so that they could prepare themselves on the topic of discussion. They were instructed to moderate as they believed appropriate.

In both samples, the topics of all e-discussions concerned ill-structured problems that related to social and/or moral dilemmas relevant to the curricular topic that was the focus of instruction at that time within the school year. Following the moderated discussions, students were administered a short questionnaire on e-moderation that was adapted to age group. The goal of the questionnaire was to obtain direct information from students on what they perceive to be important attributes of e-moderation in synchronous argumentation. Because of the exploratory nature of the research at this stage of data collection, we preferred an open question format to gain as much information as possible. In the undergraduate sample, questionnaires were administered immediately following the moderated discussions and included the following questions:

Name three attributes of good moderation

Name three attributes of poor moderation

Please describe how you experienced the moderation of the discussion you just participated in

Because this type of direct question concerning attributes of e-moderation was not considered adequate for junior high school students, the questions were adapted for this age group into a more personalized format (the computer-mediated discussions were referred to as "Digalo discussions" for easy referral):

Do you think the teacher moderation in a Digalo discussion is important? Yes / No, please elaborate.

What type of teacher interventions did you particularly like and dislike during the Digalo discussion?

What type of teacher moderation would you like to receive during a Digalo discussion?

They were administered approximately 7 days following the moderated sessions.

## Results and discussion

The results for each research question will be separately presented and discussed: Part 1 includes findings from self-report questionnaires that assessed students' perceptions

concerning effective human support of synchronous peer argumentation. Part 2, on the other hand, is dedicated to qualitative analyses of dialogue protocols to identify more and less effective tutor interventions.

## Part 1: What do students perceive as effective human support of synchronous argumentation?

*Ninth-grade sample* Table 1 presents the percentage of ninth graders that responded that they considered teacher moderation important or not. Overall, 68% of students indicated that moderation is important. However, when this was broken down by gender, we found clear differences between the male and female pupils: More than half of the boys, but only 6% of the girls, indicated that they did not want teacher moderation or gave reasons both in favor and against it.We then analyzed and categorized the reasons that these junior high school pupils gave for their responses in favor (see Table 2) or against teacher moderation (see Table 3) by adopting a data-driven, inductive approach: We first identified several different response categories for the reasons that students mentioned in favor and against e-moderation. One third of the total number of student responses was then analyzed by two independent raters. Inter-rater agreement was high (96%).

Table 2 shows that most of the reasons that students mentioned in favor of teacher moderation echoed traditional perspectives on the teacher's role: Almost half of them claimed that the teacher is important to keep the students on task, 20% stated that (s)he is needed to supervise the activity, and 20% mentioned that (s)he has to help those that cannot manage by themselves. On the other hand, one third of the students mentioned that teacher moderation is important for reasons of scaffolding critical thinking and knowledge construction. Only one student mentioned the role of the teacher moderator as someone who guides the collaboration.

From the reasons they mentioned, it appeared that most of the students who expressed that teacher moderation is not important, in fact *resisted* teacher moderation. The majority of reasons alluded to autonomy: Students reported that they should be able to freely express their own opinions, to work and collaborate independently and without teacher interference. A quarter of them mentioned that teacher moderation is not really helpful.

The two additional items on the questionnaire referred to the type of moderator actions the students particularly (dis)liked during their session and what type of moderation they would like to receive during Digalo discussions. Because the students' responses on these two questions were very similar, we did not calculate prevalence of response categories, but instead collapsed the data and will report on the most common responses. Students expressed that they particularly appreciate and would like teacher moderators to:

- Ask scaffolding questions that lead to insight and better understanding
- Keep the discussion focused

t1.1 **Table 1** Relative frequency of ninth graders' responses concerning the importance of teacher moderation ($N$=74 pupils)

| t1.2 Gender | Student responses | | | |
|---|---|---|---|---|
| t1.3 | Important | Not important | Both | No response |
| t1.4 Girls ($n$=32) | 85% | 3% | 3% | 9% |
| t1.5 Boys ($n$=42) | 45% | 38% | 16% | 3% |

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t2.1 **Table 2** Relative frequency of different reasons that were mentioned by ninth graders in favor of teacher moderation ($N$=52 pupils)

| t2.2 Category (x) | f(x) | Rel.f(x) | Examples |
|---|---|---|---|
| t2.3 Maintain focus | 25 | 48% | "when we get side-tracked from the topic of discussion, she directs us back to it" |
| t2.4 Scaffolding: Deepening and widening | 15 | 29% | "she introduces new perspectives" "directs me to improve my thinking" |
| t2.5 Supervision | 11 | 21% | "to supervise the discussion, and I am not just saying that" |
| t2.6 Help-seeking | 11 | 21% | "to direct and help out those who find it difficult", "help" |
| t2.7 Teacher standpoint and participation | 4 | 8% | "to hear her opinion", "to have her participate in the discussion", |
| t2.8 Promote collaboration | 1 | 2% | "encourage those that do not participate" |

- Help out those who need help
- Maintain a personal relation with the students
- Refrain from taking control of the discussion or try and change students' opinions

*Graduate students sample* We collapsed the questionnaire's first two items on students' perceived attributes of good and poor moderation and identified seven different main categories of moderation attributes (see Table 4).[1] A large number of the attributes mentioned by students referred to the moderator's *presence* within the discussion. They referred to moderator involvement (e.g., "involved and active," "is aware of and interested in what is going on in the discussion"), to the speed of his/her responses (e.g., "he has to be fast," " quick enough to respond and relate to everyone"), to his/her being active in the discussions (e.g., "does not watch passively from the sidelines") and keeping the discussion focused (e.g., "directs the discussion").

An additional group of prevalent responses are those that related to the moderator's objectivity and neutrality on the topic of discussion and adequate behavior that supports this neutrality (i.e., being tolerant, supportive, and pleasant). Examples of responses in this category are, among others, "A person that does not rule out other opinions, but treats them equally," "is not blunt and impatient," "does not impose his own opinion on the discussion," "creates a pleasant atmosphere," and "a bad moderator lets his own opinion take control of the discussion."

The category of *mediation for critical reasoning* includes those responses that, for example, referred to the moderator as the one that "raises perspectives that have not been touched upon in the discussion," "asks stimulating questions," "encourages elaboration of ideas," and "encourages expression of different opinions."

Aspects of good moderation that alluded to the encouragement of participation and students' mutual responsiveness were assigned to the category *Guides the interaction*. Students mentioned organizational (i.e., spatial organization of the map) and technical assistance only sporadically, four times and once respectively.

[1] Students' personal evaluations of the moderator in their session will be discussed in part II of this paper, and are, therefore, not presented here.

t3.1 **Table 3** Relative frequency of different reasons that were mentioned by ninth graders against teacher moderation (*N*=23 pupils)

| t3.2 | Category (x) | f(x) | Rel.f(x) | Examples |
|---|---|---|---|---|
| t3.3 | Autonomous thinking | 9 | 39% | "it keeps us from genuinely expressing our own opinions" |
| t3.4 | Independent problem solving | 7 | 30% | "cause the students should deal with the issue and solve it by themselves without the teacher's support" |
| t3.5 | No added value | 6 | 26% | "it does not help" |
| t3.6 | Peer interaction | 4 | 17% | "because that's the essence of a discussion, that students discuss among themselves, they are mature enough" |
| t3.7 | Interference | 3 | 13% | Mentions interference without further specification |
| t3.8 | Dunno... | 3 | 13% | Includes only responses that clearly stated so (blank responses not included) |

*Discussion* In this study, we asked students in higher and secondary education about effective moderation of synchronous argumentative discussions. First of all, it is striking that some moderation aspects were not mentioned often: Interaction support—such as encouraging the rate of participation, controlling turn taking, and encouraging interpersonal interaction and responsiveness (Lund 2004)—was hardly mentioned in either sample. It seems that unlike in F2F classroom discussions, in e-discussions there is no need for controlling turn taking, because messages can be simultaneously posted. Interactional support in asynchronous learning environments, on the other hand, focuses on increasing discussant participation and responsiveness to avoid topic decay and low rates of contributions (e.g., Gilbert and Moore 1998). However, the need for this type of interactional support is reduced in synchronous communication formats, because participants are online at the same moment and are dedicated to interaction for a certain predefined time interval. Students neither mentioned technical nor managerial/organizational support (Lund 2004) as critical aspects of effective moderation of synchronous argumentation. In contrast, organizational support has been found important for effective moderation of learning in e-courses (Packham et al. 2006). However, even though synchronous discussions are part of a learning sequence, which is organized and



t4.1 **Table 4** Categories of good tutor moderation and their prevalence, as perceived by graduate students (*N*=85 responses)

| t4.2 | Category (x) | f(x) | Rel.f(x) |
|---|---|---|---|
| t4.3 | Presence: Involved, active, and focused | 32 | 38% |
| t4.4 | Neutral and pleasant | 14 | 17% |
| t4.5 | Mediation for critical reasoning | 13 | 15% |
| t4.6 | Guides the interaction | 10 | 12% |
| t4.7 | Knowledgeable on the topic | 6 | 7% |
| t4.8 | Organization of map | 4 | 5% |
| t4.9 | Technical support | 1 | 1% |
| t4.10 | Other | 5 | 6% |
| t4.11 | Total | 85 | 100% |

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orchestrated by the teacher, our data support the interpretation that this is not the case *during* the discussion session itself.

In both the higher and secondary education setting, students expect a good moderator to scaffold their reasoning and their knowledge construction and to keep the discussion focused. Other aspects of pedagogical support, however, such as providing expert advice and feedback (Lund 2004; Packham et al. 2006) were not mentioned (higher education sample) or explicitly called undesirable (secondary education sample). Some of the undergraduate students did stress, however, that an effective moderator needs sufficient background knowledge on the topic of discussion in order to be able to scaffold effectively. Students also mentioned aspects of social support, such as the importance of a good moderator to maintain a supportive relationship with the discussants, be objective, and create a pleasant atmosphere. These findings, combined with the reasons that the (mainly male) ninth graders mentioned for their resistance to teacher moderation, seem to emphasize the importance of teacher/tutor impartiality and objectivity. According to them, moderators should scaffold reasoning, without revealing or imposing any personal opinions on the discussion. Finally, the undergraduate sample particularly emphasized the need for active involvement on the part of the moderator. Moreover, they mentioned that an important prerequisite for active involvement is speed, needed to intervene and react to discussants in a timely manner.

Thus, based on these students' reported perceptions on effective moderation, the role of a human facilitator of synchronous group argumentation is rather complex and may even seem contradictory at times: (S)he should be involved but not impose personal opinions, (s)he should scaffold but not interfere, and (s)he should be supportive but also elicit critical thinking and reasoning. To further explore these first findings, we then turned to qualitative analyses of several moderated discussion maps to observe how different types of human tutor interventions impact the discussion.

## Part 2: The perceived and actual impact of different moderator interventions

The activities in the graduate student sample produced four moderated discussion maps. As aforementioned, moderators in this sample were assigned peer tutors. They did not receive any specific pedagogical instructions on *how* to behave (intuitive moderation) but were given a week to prepare for the task. The question that was put up for discussion was as follows: "Technology in education: a complete waste of time?" No specific roles were assigned. Students were instructed to use and apply the knowledge that they had gathered during the course on educational technology. In particular, the students were encouraged to use their knowledge of scholarly texts that were part of the course syllabus and which presented positive or negative views concerning the role of technology in education. Protocol analyses focused on the identification of different types of moderator interventions. In addition, we also collected discussants' evaluations of the moderation practices they experienced in their own sessions (see Method section). This enabled us to search for relations between actual moderation characteristics and students' perception and evaluation of these.

First attempts to analyze the different moderator interventions were guided by common distinctions in the literature as summarized by Lund (2004): pedagogical (both scaffolding and direct instruction), interactional, social, managerial, and technical support. For two out of the four moderators, the majority of interventions could be distinctively characterized as being of the pedagogical scaffolding type. However, neither the discrete interventions, nor the overall behavior of the other two moderators could be easily categorized to any of the

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five different categories: Not only did they use a large variety of different moderation moves, the nature of some contributions was rather sophisticated and could not always be simply determined as being either of a pedagogical scaffolding, social, interactional, technical, or managerial type. Further inspection of the moderator interventions and of students' responses to them led us to focus on the difference between two different types of scaffolding prompts for reasoning: low-content, or *generic*, and content-specific, or *non-generic* scaffolding prompts. This distinction will be further elaborated in the following sections in which we describe the practices of three out of the four moderators. When citing the verbatim of moderator contributions, we provide in parentheses their chronological number within a discussion. This will give the reader an impression of their timing and temporal spread.

*Moderator 1: Generic scaffolding prompts* The first moderator posted six contributions to the discussion (25% of total number of contributions). All of them contained clearly identifiable pedagogical scaffolds meant to support the student's understanding and reasoning by providing him/her with adequate prompts to lead the student to construct, deepen, and widen his/her knowledge. For example, she asked an individual discussant, who claimed that technology-enhanced instruction is important, the following question: "Can you give an example of successful technology-enhanced education?" (contribution 7). Other contributions were: "What do you mean?" (contribution 13), "Can you give an example?" (contribution 22), "Can you tell me of a positive aspect?" (contribution 18), "Elad, can you explain and maybe also elaborate?" (contribution 13), "Do you think that the students themselves should come up with new technology uses?" (contribution 30).

The first five contributions are directed toward an individual discussant, whereas in the latter, she attempts to introduce a new direction to the discussion (without success). What typifies all these scaffolding prompts is that they are rather neutral and generic. That is, apart for the latter to some extent, they do not contain any specific reference to content or include new information. However, they are generic prompts meant to elicit further reasoning, deepening, elaboration, or examples.

As for students' responsiveness to these scaffolding prompts, two did not get any response (contributions 22 and 30) and two other prompts were linked to one other, albeit irrelevant contribution (13 and 18). The two remaining prompts managed to elicit relevant responses, four (contribution 7) and one (contribution 13) respectively. Note that the latter contribution included a personal reference (the discussant's name) to the person the posting was referring to. However, in spite of these responses, she did not follow up on any of them. She did not reveal her own personal standpoint at any point during the discussion.

In our short review of the literature on human support of student dialogue, it was shown that low-content, generic scaffolding prompts such as these, have been found to be particularly effective in promoting high-quality student dialogue, whether in one-on-one peer tutoring, small-group peer discussions or classroom discussions. However, in the synchronous discussion we described here, this type of generic scaffolding prompt was not appreciated and neither did it lead to a particularly productive discussion.

The questionnaires that we administered immediately following the session revealed that the discussants were neither satisfied with this particular moderation style, nor with the quality of the discussion. They reported that this tutor was too passive, did not challenge them, did not steer the discussion enough, and that they did not really feel her presence. Similar responses were received from one of the two discussants that participated in the discussion moderated by the second "scaffolding-style" moderator.

*Moderator 2: The devil's advocate* The second moderator was more active: He posted 10 contributions (37% of the total number of map contributions). Moreover, he adopted a very unique style. At the start of the discussion, he posted three different contributions, each reflecting a different position toward the topic of discussion: "On the contrary, technology is very useful" (contribution 3), "Of course! Technology in education is a terrible waste of time!" (contribution 2), and "So, so" (contribution 4). These were posted immediately following the discussion topic; contributions 2 and 3 on the left and right side of the map, respectively, and the neutral position in the middle. By themselves, each of these postings could be regarded as a move of what has been termed *participative moderation* (Asterhan, submitted): The moderator does not actively guide the discussion but participates in the discussion as a regular, equal-status discussant. However, from the sharp differences of viewpoints that the moderator used in his contributions at different stages of the discussion, it is obvious that he posted these contributions to provoke reactions from the discussants (meant to support responsiveness) and frame the discussion (a managerial action of designing the discussion environment). Also, by posting different, contradictory standpoints, he seemed to signal that he expects the group discussion to be critical and dialectical.

Only 2 of his 10 contributions were generic: In one instance, he made an organizational move by recommending that the discussant write shorter titles and place the content in the text area. The other concerned a generic scaffolding prompt: When he was asked to elaborate on contribution 2, he responded with "You are invited to propose reasons against technology." No response was received.

At first glance, each of the remaining eight moderator's interventions should be categorized as testifying of a *participative* style, according to which the moderator actively participates in the discussion and reveals his personal standpoints as an equal-status discussant. However, when this surface is scratched off, it becomes obvious that he is not actually revealing and defending his own personal standpoint, but has purposefully adopted a moderator strategy best described as *playing the devil's advocate*: He challenged claims or reasons proposed by discussants by doubting the relevance of the supporting reason, hinting at an example that could prove otherwise, or posing a challenging question. For example, when one of the discussants raised the point that technology implementations are too time consuming and take a lot of practice, he responded with "It also takes a lot of time and practice to [learn how to] drive a car..." (contribution 12). When another participant proposed that computers are important in science education to give "concrete" examples for subject matter that is difficult to teach, he questioned whether computer simulations can be considered "real" or concrete examples (contribution 20).

Students' responsiveness to this moderator's contributions was relatively high: Sixty-six percent of the total number of links that the discussants created were drawn between their own and the moderator's contributions. However, in spite of their appearance as "innocent" discussant contributions, Moderator 2 purposefully steered the discussion in a certain direction by adopting a devil's advocate moderation style that stimulated and scaffolded critical reasoning. More importantly, and in contrast to the generic, content-free scaffolding prompts of Moderator 1, these content-specific prompts succeeded in encouraging discussants to clarify their standpoints and articulate rebuttals to his challenges, thus improving the overall quality of reasoning in this discussion.

The discussants' evaluations of the moderator and the discussion were very positive: He was referred to as an "excellent" to a "good" moderator, who related to all the discussants, elicited explanations, and was involved in the discussion.

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*Moderator 3: Personalized scaffolding and the importance of involvement* The third moderator also posted 10 contributions during the session (33% of the total number of contributions). She used a variety of moves: At the start of the session, she posted a message that was meant to encourage participation ("Guys, where are you?"), a move of interaction support. In contributions 5 and 12, she attempted to deepen the discussants' reasoning with generic scaffolding prompts: "Do you agree with that?" (contribution 5) and "Question: Can you give an example of what you are referring to?" (contribution 12). She received no responses to these prompts.

In contrast, three other scaffolding prompts (contributions 7, 14, and 17) were of a content-specific type and elicited their intended reactions from discussants. One even triggered a quite long and interesting thread of 12 contributions in the discussion map: In contribution 3, one of the discussants claimed that stating that the implementation of technology in education is a waste of time is a superficial statement that has to be proven empirically. The moderator reacted to this argument with a question shape that included the following text: "So... are you saying [claim] that if we don't start using technology, then there is no progress in education?" (contribution 7). She did not ask the student to elaborate or clarify in a generic manner. Instead, she "revoiced" the student contributions (Resnick et al. 2010): She took the liberty to interpret the contribution as she may have understood it and asked the student whether this is what he meant, anchoring her request in a particular framework of meaning. This provoked an immediate reaction: The discussant explained his standpoint in a more articulate and elaborative manner and started a long sequence of reasoned argumentation between three individuals (two discussants and the moderator).

Another example of effective content-specific scaffolding is found in the following excerpt: In contribution 13, one discussant posted the argument that "[i]t is possible that the improvement in learning outcomes is caused by the enhanced experience, and not necessarily by the technology itself. Therefore, you can have similar learning effects through learning through experience, without the technology, such as theatre." The moderator reacts to this argument with a question shape (contribution 17): "But Yasmin, what do you mean with 'aspects of experience'? Cause this can be understood as the experience from the teacher's or the student's perspective." Yasmin answers the question, upon which the moderator emphasizes the effect of the teachers' motivation on student learning, and so on. Again, the moderator did not choose to post a generic request for clarification, but a content-specific prompt with a specific, personalized request for clarification that also introduced a new perspective on the topic of discussion. It elicited an immediate and appropriate reaction and led into an animate conversation thread.

Four other moderator contributions (contributions 9, 21, 26, and 29) were identified as being of the involved type, in which the moderator clearly acted as one of the discussants and actively participated in the discussion by articulating and defending her own position, albeit in a gentle and non-confrontational manner.

The discussants' evaluations of this moderator were also very positive (from good to excellent). They emphasized the fact that she aided in raising awareness to certain contributions in the map, stimulated the discussion, opened up new perspectives, was active and responsive, and expressed her personal opinion.

*Discussion* Whereas the distinctions between different types of human support proposed by Lund (2004) may be helpful in emphasizing certain aspects of moderation over others in different contexts, using it as a basis for analyzing discrete moderation moves within a discussion proved to be less satisfactory. Even though, in some instances, it proved possible

to successfully categorize a certain intervention as an act of, for example, pedagogical mediation, orchestrating the interaction, or a managerial move, the discussion map protocols revealed that too often a moderator's move seemed to serve several goals at once. We, therefore, believe that different categorization schemes should be developed.

We then turned our attention to the distinction between generic, low-content and content-specific types of moderator scaffolding prompts: Qualitative analyses showed that the use of generic scaffolding prompts in this synchronous environment were not appreciated by discussants and often did not elicit the expected responses from discussants. Content-specific prompts, on the other hand, were more effective in this respect. The two discussions in which moderators received high student ratings and in which student responsiveness to moderators' interventions was high were characterized by a mixture of involved and scaffolding styles, in which the moderators were active discussion contributors, qualitatively as well as quantitatively.

In light of these findings, we revisited the Gil et al. (2007) data on pedagogical scaffolding support and found similar results: Generic types of pedagogical scaffolding prompts did not receive any linked response, whereas content-specific prompts did. This finding may also explain the difficulty of obtaining results reported in other studies. For example, Veerman et al. (2000) compared the effect of two different peer coaching approaches on dyadic synchronous argumentation in a chat-based environment. The two approaches differed with regard to their goals (a focus on improving argumentation structure vs. argumentation strength), but were similar in form: Both included a set of low-content, generic scaffolding prompts. When compared to an un-coached, control condition, no significant differences in discussion quality were detected.

Interestingly, the literature on F2F tutoring and teacher-led classroom discussions has repeatedly shown the advantages of low-content, generic scaffolding prompts: For example, they have been found to be typical of productive tutoring (Chi et al. 2001) and productive teacher scaffolding of small-group and classroom reasoning (Gillies 2004; Resnick et al. 2010; Wegerif 1996; Yackel 2002). Even though, at this point, we can only speculate on the reasons for this difference, we would like to suggest several possibilities which could form the basis for future research:

From a cognitive point of view, explicitness and specificity may increase the salience of the moderator's messages. Among others, it has been argued that the lack of nonverbal cues in computer-mediated communication (CMC) increases the need for clear articulation (Walther 1996). If the mere lack of nonverbal information is the cause for the potential difference in tutor prompt effectiveness, then studies in synchronous and asynchronous CMC formats should yield similar findings when compared to F2F settings. In addition, the fast pace of synchronous e-discussions and the simultaneous postings by different discussants may significantly reduce the amount of cognitive resources that an individual discussant is able and willing to invest in trying to comprehend the moderator's behavior.

Finally, similar to discussion boards and discussion forums, communication in Digalo is visually organized and threaded by discussion topic. This is quite different from, for example, F2F and CHAT-mediated communication which is organized by chronological order only. Thus, the different participants in a diagram-based or discussion board discussion will often not share the same focus of attention at the same time, even if the communication format is synchronous. It is likely that at any given point in time, different discussants are engaging in different discussion threads in different parts of the map. As a result, a considerable amount of time may have passed between the original posting of a contribution and the actual reading of the moderator's reaction to that contribution.

In F2F settings, the participants are commonly sharing a focus of attention and are building on the content of the immediately preceding dialogue contributions. A teacher or tutor encouraging a student to further elaborate and explicate his/her thinking is easily understood within the context and flow of the interaction. In an online, threaded discussion, where students are "hopping" from thread to thread, a line of common reasoning is often discontinued and then later on picked up again by the same individual. It is not unlikely that the teacher/tutor intervention will have to be more content-specific to "draw" the student back into that flow of interaction and act upon his/her scaffolding attempts.

We would also like to suggest a more socially oriented account of the preference for a more involved and content-specific prompting. When moderating within the end-user environment, the moderator's contributions not only persist on-screen, but also remain an integrative part of the discussion, existing side by side with the other postings. It is, therefore, quite possible that they are regarded by others as part of the common product that is constructed by all participants, for which all share a common responsibility, and to which all should contribute. By remaining detached and posting generic scaffolds, moderators are likely to be perceived as showing, in an ostensive way, their lack of participation and contribution to the discussion. In this context, discussants not only failed to respond to generic prompts, but also reported feeling annoyed with them because they were interpreted as reflecting persisting detachment and lack of interest.

Thus, according to this account, different designs for moderator-discussant interaction may yield different results: For example, it is possible that if the moderator comments will be communicated through a separate channel, instead of being posted and persisting *within* the discussion map itself, generic scaffolding prompts and orchestrating types of moderator interventions may prove to be more effective and/or appreciated by discussants. We intend to further explore these potential differences in future research.

## General conclusions

The studies we presented in this paper constitute a first step in a design research program aimed at investigating and promoting a new practice in classrooms: human guidance of synchronous, collective e-argumentation. As an educational practice, human guidance of synchronous discussions in co-located settings such as classrooms is mainly envisioned rather than realized. An exploratory approach was, therefore, adopted. The findings we reported on here focused on moderation effectiveness, which was addressed in two manners: 1) assessment of students' perspectives on human guidance of synchronous dialogical argumentation, and 2) identification of more and less effective moderation moves through analyses of online discussion protocols.

So, what is or should be considered effective human guidance of collective e-argumentation in a synchronous communication format? First of all, the findings presented in this paper seem to indicate that many discussants expect active involvement from the side of the instructor-moderator and do not respond to, nor appreciate generic scaffolding prompts. This finding, together with the reports of junior high school and graduate students on what they consider effective moderation, reveal a rather complex picture on what constitutes and is perceived as effective guidance in this synchronous discussion format: Instructor interventions that are meant to orchestrate and regulate the interactional aspects of the activity were not frequently used, did not receive responses, and were not mentioned as crucial for effective moderation. Scaffolding reasoning and knowledge construction, on

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the other hand, were considered very important, but only when accomplished in a non-intrusive manner.

However, when moderators adopted a style of non-intrusive scaffolding that is known to be effective in F2F settings (e.g., Chi et al. 2001; Yackel 2002), that is, by using generic scaffolding prompts, this was neither welcomed, nor effective. Moreover, tutor moderators, who received many responses and who were particularly appreciated, actually "disguised" their moderation strategies, so that they *appeared* as regular participants who actively contributed to the dialogue.

It may be concluded then, that the role of e-moderators in synchronous peer discussions within educational settings appears to be a complex one. Moreover, students have different and, at times, even apparently contradictory expectations from them. Because teacher moderation of synchronous, co-located student discussions is a novel practice, a certain amount of confusion and contradiction might be expected, since students and moderators apply expectations from other instructional practices to the new situation. However, our findings, first and foremost, show that instructional practices that have been found to be effective in other communication formats (e.g., asynchronous, face-to-face) cannot be simply transferred to synchronous communication formats. Future research should focus on the impact of these different communication formats on interpersonal behavior, communication, and instructional practices.

These first indications concerning the effectiveness and appropriateness of different scaffolding styles (generic scaffolding and disguised, involved scaffolding) should be investigated in future studies to further explore their impact on peer argumentation. Moreover, research is needed to see whether these first findings can be generalized to teacher moderation practices in secondary school settings and to other online discussion environments. It remains to be seen, for example, how high school students will receive and perceive teacher moderation in a devil's advocate style. As mentioned by Walker (2004), this strategy could be effective as long as students perceive it as a "game tactic" rather than the teacher imposing his/her own view.

At the beginning of this paper, we mentioned that the studies reported here are part of a larger design research program in which we investigate the feasibility of a new practice, the moderation of synchronous e-discussions in learning settings. As a first step in this endeavor, we presented empirical findings that highlight several ways in which moderation in these formats may be quite different then in other formats of communication, such as F2F and asynchronous, distant communication. The next step in the design research program has been to develop a new environment that alleviates the difficulties that moderators encounter by providing them with a separate Moderator Interface, that enables them to: a) monitor several discussions simultaneously with the help of awareness tools, dialogue analysis tools, and an alerting mechanism; and b) to send easily distinguishable messages to individual or multiple discussants through separate communication channels (see Schwarz and Asterhan 2010, for further descriptions). This tool was developed in collaboration with different pedagogical and technical teams within the ARGUNAUT project (e.g., De Groot et al. 2007; Hoppe et al. 2009; McLaren et al. 2010; Wegerif et al. 2010). Based on the studies reported here, the participants in the Argunaut system hypothesized that moderating discussions through a separate Moderator Interface may significantly change the style and strategies that moderators will adopt, as well as what is perceived as effective moderation. It may lead moderators to reflect on discussions as objects to reach their educational goals. The awareness tools that highlight certain aspects of the interaction may help the teacher focus on learning processes in students, something that has been found extremely difficult in face-to-face class discussions (e.g., Yackel 2002).

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Secondly, the separate channel of communication through which the instructor can send messages to target students without traces in the discussion map itself may lead them to adopt a more non-intrusive, orchestrating style of moderation, without reducing moderation effectiveness. For example, in such an environment where the instructor's messages do not persist in the discussion map, generic scaffolding prompts may prove to be quite effective. In other words, future implementations of newly developed tools in authentic learning settings will show how the constraints and affordances of different environments shape the development of new moderation practices. In addition to such descriptions, more research is needed to explore the effectiveness of different types and style of human guidance on actual learning gains. For this to be accomplished, however, researchers need to overcome several methodological hurdles, because human guidance of group processes is inherently interactive: Whereas different types of guidance may indeed affect group processes, the moderator will adapt his/her behavior and techniques based on his/her perception of the needs of the group and its individual members.

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# AUTHOR QUERIES

**AUTHOR PLEASE ANSWER ALL QUERIES.**

Q1. "Coleman 1998; Web et al. (2008); Gillies 2009; Cazden 2001; Schwarz et al. 2003; Schwarz and Glassner 2003" were cited in the body but not found in the Reference list. Please provide complete bibliographic information. Alternatively, delete the citation in the text.

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