Inter- and intra-subjective planes of e-argumentation: Motivation, self-perception, expectations, and actual interlocutory behavior

Baruch B. Schwarz, Christa S. C. Asterhan
School of Education, Hebrew University of Jerusalem 91905, Israel,
Email: msschwar@mscc.huji.ac.il, christa.asterhan@mail.huji.ac.il

Abstract: Research on learning and argumentation traditionally focuses on the (socio-)cognitive dimensions and benefits of argumentative dialogue. The papers which are part of this symposium, however, present recent research on intra-personal, non-cognitive variables and how they affect or are affected by electronic collective argumentation. The data are obtained from both e-discussants as well as e-moderators and pertain to factors such as motivation, self-perception, role definitions and expectations. The three contributions provide information on these factors before, during and after e-discussions and help delving in the dynamics of (moderated) e-argumentation.

Theories of collaborative learning and of communicative interaction are often used interchangeably to trace learning *in* and *from* dialogue. The kinds of interactional phenomena evoked by general theories of learning, such as "cooperation", "explanation", or "negotiation" are often diffuse and difficult to identify in real interactions. However, the planes of collaborative learning and communicative interaction are different. One should discern between dialogue analyses that reveal an inexorable intersubjectivity (e.g., Baker, 2003; Barth & Krabbe, 1982) to make communication possible and psychological processes that occur at the intra-subjective, individual level (such as arguments, values, opinions, motivations or beliefs). Terms such as "shared cognition" or "shared understanding" should be understood as pertaining to the plane of communicative interaction, as a state of inter-subjective rationality that enables exchange of ideas and joint elaboration of new ideas. Intra-subjective rationality pertains to the psychological plane, a plane which is necessary to apprehend collaborative learning.

This symposium focuses on the role of non-cognitive, intra-subjective constructs in e-argumentation. We observe participants in e-argumentation (students and moderators) and try to detect their individual motivations, expectations, or beliefs in and from interaction. We show that what feeds the formation of inter-subjectivity at the communication level is far from being uniform, shared by all: Intrinsic motivation can fluctuate and diverge among discussants, some may seek help from a moderator, moderators may use elusive tactics that make them appear as regular discussants, etceteras. The recognition of the interplay between these two planes is especially salient with environments that enable some of the participants (mainly moderators) to participate actively or as supervisors.

The authors of the first presentation examine the commonly held assumption that collaborative learners becoming more similar over time, whereas this pertains to the views held by the different participants or their motivation to learn. In their case, they compared the extent of convergence among actual collaborators on different measures of motivation with that of nominal collaborators. Contrary to commonly held beliefs, their findings indicate that the motivation of learners in small ad-hoc online groups becomes less similar as a result of the interaction.

The second presentation focuses on students' expectations of on-line moderators of argumentative e-discussions and the perspectives. Based on data gathered from samples of secondary school and university students, the role of a teacher/tutor moderator of such discussion is not easily defined and at times even seems contradictory. In addition, the authors analyzed three moderated e-discussions in which moderators operated directly in the discussion space. They then related the nature of moderator interventions with students' responsiveness *during* and their evaluation of the moderator *following* the discussion. These qualitative analyses reveal that generic interventions were not appreciated by discussants and neither were they effective in eliciting responses. In contrast, effective moderators disguised their moderation by using content-specific interventions that seemed to actively contribute to the discussion.

The final presentation also focuses on moderation of e-argumentation, but from a different angle and by using different software. The authors present first results from research with an innovative system that supports moderators and their moderation practices. The particular design of this system supports a supervising style of moderation as opposed to more participative styles. Their results show that in spite of this, actual moderation of teachers was characterized by a participative style. Comparisons of measures of self-reported moderation styles and actual moderation furthermore reveal a discrepancy between how teachers view themselves as moderators and how they behave in real-time moderation.

Motivational dynamics in online argumentation: Is there mutual influence of learning partners on their motivation over the course of a discussion?

Armin Weinberger, Karsten Stegmann, Frank Fischer,
Ludwig-Maximilians-Universität (LMU) München, Department of Psychology, Germany,
Email: armin.weinberger@psy.lmu.de, karsten.stegmann@psy.lmu.de, frank.fischer@psy.lmu.de

Approaches to online argumentation and learning are often based on the assumption that learners are motivated or can be motivated to mutually support each other's learning processes (cf. Cohen, 1994; Slavin, 1996). Moreover, collaborative learning is believed to generally have positive effects on emotional and motivational aspects of knowledge building (e.g., Johnson & Johnson, 2002). Still, there are clear indications of specific motivational problems that cannot be regarded as individual, but as group phenomena, such as sucker effects or social loafing (Latané, Williams, & Harkins, 1979; Robbins, 1995), and thus may lead to learners diverging regarding motivation and individual knowledge gains. Moreover, learners seem to have difficulties to engage in specific learning activities, such as constructing and exchanging arguments in online environments and often require some sort of scaffolding, such as collaboration scripts, which specify, sequence, and distribute roles and activities to learners with the goal of enabling them to participate in online argumentation (cf. Fischer, Kollar, Mandl, & Haake, 2007; O'Donnell, 1999). Scripts may be introduced by a teacher or represented within an online learning environment, e.g., through prompts. By rotating roles, scripts facilitate more and more equal participation in collaborative learning activities compared to unscripted collaborative learning (e.g., Palincsar & Brown, 1984). However, scripts have been argued to have potentially detrimental effects on motivational aspects, such as intrinsic motivation, self-efficacy, and self-determination - especially when script prescriptions interfere with learners' own strategies (Cohen, 1994; Kollar, Fischer, & Slotta, 2007).

Therefore we investigate first (RQ1), to what extent do collaboration scripts influence learners' motivation and participation and the convergence / divergence of learners' motivation and participation in online discussions? Furthermore, collaborative learning has been ascribed potential to facilitate homogeneous participation in learning processes (Cohen & Lotan, 1995). It could be argued that collaborative learners could thus benefit more equally and become more similar with respect to motivational outcomes and individual knowledge gains than individual learners. This could be particularly true for learners in online discussions, who could be supported by additional resources (Scardamalia & Bereiter, 1996) and for whom status effects could be equalled out (Dubrovsky, Kiesler, & Sethna, 1991). There is some empirical evidence from classroom research, however, pointing towards the fact that learners within classes are becoming more and more dissimilar regarding knowledge and motivation (Merton's Matthew-effect, 1968; Marsh's big-fish-little-pond effect, 1987). So far, there is little research on how learners in ad-hoc online groups influence each other and converge or diverge regarding their motivation. We therefore also focus on the question (RQ2), to what extent (scripted and unscripted) learners in online discussions influence each other in terms of convergence or divergence of motivation and participation?

Method

We have conducted several studies focussing on different kinds of script aiming to support different aspects of online argumentation and learning showing that different scripts have specific effects on processes and outcomes of online learning (see Weinberger, Stegmann, Fischer, & Mandl, 2007). For instance, we include scripts that foster epistemic activities of how to apply theoretical concepts to complex problem cases, formal argumentative aspects such as warranting a claim, and specific social modes of learners, such as critically comment on each others' analyses. We re-analyze this data with respect to motivational aspects. In total, 107 groups of three (N = 321 students) enter this re-analysis. Their learning task was to analyze and discuss problem cases in 80 minutes using concepts of Weiner's attribution theory (1985) via a learning environment based on asynchronous discussion boards. To investigate the influence of scripts on motivation, we compare the motivation measures of scripted vs. unscripted learners. To investigate the mutual influence of learning partners within small groups, we compare *real groups* of learners who have actually interacted with each other with *nominal groups* (as used by Fischer & Mandl, 2005 and Jeong & Chi, 2006) randomly built post-hoc, i.e. learners being randomly selected from different real groups having participated in the same online learning experience, but not having interacted with each other. We assessed four different aspects of motivation related to the online learning experience in a post-test, namely intrinsic motivation, extrinsic motivation, self-efficacy, and self-determination by questionnaire (see Prenzel, Eitel, Holzbach, Schoenhein, & Schweiberer, 1993). Moreover, we have assessed participation of the learners in the collaborative learning processes by word count in the online discussions. We have assessed convergence / divergence of these measures by distances between the learning partners within real and nominal groups regarding the respective measures (see Weinberger et al., 2007).

Results and Discussion

Results regarding RQ1 show that when taking different types of scripts together, scripts neither have an effect on motivation or participation of the individual learners, nor an effect on motivation and participation convergence / divergence within the small groups of learners. Against assumptions (see Cohen, 1994), the re-analysis of several script studies does not show negative effects of scripts on motivation. Possibly, the scripts under investigation were well designed and adapted to the skill levels of the respective learners and thus, not detrimental for learners' motivation.

Regarding RQ2, results show that learners in real groups are significantly more divergent than nominal groups with respect to intrinsic motivation ($F(2; 105) = 9.06$; $p < .01$; $\eta^2 = .08$). The results show that learners do not become more similar in the course of interaction. Instead, the results point towards divergence effects on motivation of learners in small ad-hoc online groups similar to prior empirical evidence of divergence of learners in classrooms. Possibly, motivational group level phenomena that have been observed in classrooms over longer periods of time also show in a relatively short time span in ad hoc online groups. Collaborative learners may adjust their motivation momentarily based on the interaction with their learning partners. Possibly according to observations of the efforts learning partners invest, learners may gain motivational levels different from learning partners.

On-line moderation of collective argumentation: Student perspectives and the effectiveness of moderator interventions

Christa S. C. Asterhan, Baruch B. Schwarz
School of Education, Hebrew University of Jerusalem 91905, Israel,
Email: christa.asterhan@mail.huji.ac.il, msschwar@mscc.huji.ac.il

Research on (on– and off-line) collaborative learning is deeply rooted in constructivism and focuses on the role of peer collaboration in learning and development. Whereas important insights have been obtained on collaboration mechanisms and the role of task design, the role of the teacher has not been considered with the same intensity, especially not in computer-mediated environments (Lund, 2004). Whereas the prescriptive literature on human e-moderation is abundant (e.g., Salmon, 2000), empirical research is sparse and it has mainly focused on the facilitation of e-courses and moderation of a-synchronous discussion formats (e.g., Anderson, Garrison, Rourke & Archer, 2001), but not on moderation of synchronous discussion environments.

In a review and commentary of the literature on human support in CSCL, Lund (2004) proposes a taxonomy of human supportive roles in CSCL and distinguishes between the following types of moderation: *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. *Social* support focuses on the social relations between the discussants 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.

As mentioned by Lund (2004), different characteristics of CSCL software impose different constraints on the human support it affords, which in turn may affect effectiveness and desirability of certain of types of moderation. Therefore, what is considered effective moderation in synchronous discussion environments may be different from moderation of, for example, e-courses. In this presentation we will present findings from two studies: The first study focuses on students' perspectives on what constitutes effective e-moderation in the particular case of collective argumentation in a graphical, synchronous discussion environment. In the second study, we draw relations between characteristics of moderator interventions during on-line discussions and moderation effectiveness in terms of discussants' evaluations *following* and their responses *during* the interaction.

The type of discussions we focus on in our investigations concern synchronous argumentative discussions with graphical representations. All e-discussions were conducted within the Digalo environment (http://zeno8.ais.fraunhofer.de/digalo/index.html) which enables synchronous, textual talk through mediation of geometrical shapes that represent different dialogical moves. A user has to choose a particular contribution shape from a fixed set of options (e.g., argument, claim, question, explanation), write his/her contribution to the discussion in the shape and link it to one or several contributions in the discussion map. The context in which we collected the data on e-moderation was one in which the moderator and the discussants shared the same channel of communication, but the moderator's contributions were identified by a distinguished color. In other words, their communications could be seen by all discussants and were an integrative part of the discussion map.

Study 1. Students' perspectives of good moderation

A sample of 9th graders from three parallel classroom in the same school (N=74) and a sample of graduate students that participated in a course on Educational technology in the classroom (N=16) participated in this study. Participants in both samples had previously participated in moderated as well as un-moderated argumentative discussions, conducted in the Digalo environment in a co-located setting. Following the moderated discussions, students were administered a short open question format questionnaire in which they were asked to describe effective Digalo moderation.

Content analyses of their responses revealed the following findings: First of all, it is striking that some aspects of moderation were not mentioned often. Interaction support was hardly alluded to in either sample. In contrast with face-to-face classroom discussions, synchronous on-line communication allows for simultaneous posting of messages and there is no need for supervising turn-taking. In contrast with a-synchronous learning environments, on the other hand, participants are on-line at the same moment and are dedicated to interaction for a certain pre-defined time interval. Moreover, our students did not only share a *digital*, but also a *physical* space (co-location). Furthermore, in contrast to e-courses (Packham, et al, 2006), managerial/organizational aspects of moderation were not considered critical. Even though synchronous discussions are part of a learning sequence, in which the organizational role of the teacher is extremely important, 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 advise and feedback (Lund, 2004; Packham, et al., 2006) were not mentioned (higher education sample) or explicitly called undesirable (secondary education sample). Among the 9th graders, more than half of the boys, but only 6% of the girls, either clearly indicated that they did not want teacher moderation or gave reasons both in favor and against it. The majority of the reasons mentioned for this resistance alluded to student autonomy: they should be able to freely express their own opinions and to work and collaborate independently, without teacher interference.

Students also mentioned aspects of social support, such as the importance of a good moderator to maintain a supportive relation 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 of argumentative discussions should scaffold reasoning, without revealing or imposing any personal opinions on the discussion. The undergraduate sample particularly emphasized the need for active involvement and speed to timely intervene and react to discussants.

Study 2. Effectiveness of moderator interventions: Generic scaffolding and content-specific prompts

In a previous study we identified five different moderation profiles of on-line argumentative discussions (Gil, Schwarz & Asterhan, 2007). In the present study we further elaborate on these findings by attempting to relate between certain qualities of moderator interventions and their effectiveness in terms of discussants' evaluations and responsiveness. For this purpose we analyzed three moderated Digalo discussions. We adopted an exploratory, qualitative approach that led us to examine the difference between generic and content-specific types of moderator interventions. Generic scaffolding prompts that are meant to elicit explicit articulation of individual understanding, explanations and elaborations have been found to be particularly effective for learning process, both in the tutoring literature (e.g., Chi, Siler, Jeong, Yamauchi & Hausmann, 2001) as well as teacher scaffolding of individual student and classroom reasoning (e.g., Yackel, 2002).

However, our results show that the use of generic scaffolding prompts in this synchronous environment were not appreciated by discussants and did often not elicit the expected responses from discussants. Content-specific prompts, on the other hand, in which the moderator for example paraphrases the former contribution and builds on it, 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 had to "disguise" their moderation strategies, so that they appeared as regular participants that actively contributed to the dialogue and not only limited their moderation to generic scaffolding or orchestrating prompts. In light of these findings, we revisited earlier data of five different e-discussions (Gil, et al, 2007) and found a similar pattern.

We propose the following two explanations for the difference between our findings and the above mentioned literature: First of all, it is likely that the lack of non-verbal cues, in combination with the scattered and non-chronological nature of a discussion in this type of synchronous on-line communication formats significantly diminishes the extent of overall inter-subjectivity between discussants. Moreover, the lack of a linear order of postings in a discussion map (whether by discussion thread or by time line) may in addition burden the cognitive load of participants. As a result, a (moderator) communication has to be more explicit and specific, both in order to be noticed as well as to be properly understood.

Another reason for the preference for a more involved and content-specific style of moderation may be found in the specific design of the environment: In our settings, the moderator's contributions are and remain part of the discussion map which, in contrast to regular face-to-face communication, is visualized on-screen. The discussants' evaluations of moderation practices revealed that generic prompting annoyed the participants since it was interpreted to testify of detachment and a lack of interest. Visually, his/her postings are an integrative part of the discussion map and may therefore be regarded 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 not actively participating in the discussion, the moderator is not perceived as contributing to the discussion. If this is true, then different moderator-discussant interaction designs should yield different results: For example, it is possible that if the moderator comments will be communicated through a separate channel, instead of being posted *within* the discussion map itself, generic scaffolding prompts and orchestrating types of moderator interventions may prove to be more effective and/or appreciated. In this presentation we will present preliminary findings from ongoing research that compares direct moderation within the discussion environment with moderation through a new system developed within the ARGUNAUT project (IST-2005027728), which will be described in the next contribution.

The E-Moderation Challenge: Teachers' Styles and Strategies during E-Discussions using Argumentation Maps

Astrid Wichmann, Andreas Harrer, H. Ulrich Hoppe, Department of Computer Science and Applied Cognitive Science, University of Duisburg-Essen, Forsthausweg 2, 47057 Duisburg, Germany,
Email: Wichmann@collide.info, Harrer@collide.info, Hoppe@collide.info

Introduction

Most studies on e-discussions and scientific argumentation in real and virtual classrooms have focused on supporting learners by providing adequate collaborative tools, representations and interfaces (cf., e.g., Andriessen, Baker, Suthers, 2003). The role of teachers in these e-discussions is often not clearly defined. The technology itself, by supporting interaction and collaboration on a peer-to-peer level, invites teachers to participate and act as equal status discussants. In a pioneering study, Gil and colleagues (Gil, Schwarz, Asterhan, 2007) have identified moderation styles that teachers adopt in synchronous e-discussions. These moderation styles differ in terms of interaction and active involvement in the discussion. In spite of these first indications, little is known about teachers' perceptions of their role during discussions and about relations between these perceptions and their actual moderation behavior (Gall and Gall, 1993).

From the point of view of giving learners opportunities for self-directed, autonomous learning neither the involved nor the authoritative style of teacher participation may really be desirable. Rather, it could be preferable to have teachers acting in a more subtle and indirect way by limiting their interventions to keeping the discussion on track and ensuring basic rules of social behavior and mutual respect. This perspective and orientation is not adequately supported by current (synchronous) collaboration tools and calls for a new type of technology, namely e-moderation technology.

Project Context and Research Questions

Even for only one ongoing discussion at a time, e-moderation is a complex task: Moderators have to decipher a discussion that develops non-linearly in order to perceive difficulties, misunderstandings, social processes patterns as well as individual participation. Based on this perception, the e-moderator must intervene in order to maintain or improve the quality and flow of the on-going discussion. The complexity of fulfilling these requirements is so high that teachers tend to leave students alone during the discussion and reflect on these only in aftermath. The goal of the EC-funded ARGUNAUT project (IST-2005027728) is to provide moderators of educational e-discussions with tools to support productive e-discussions through better moderation (De Groot et al., 2007). Support is provided in two ways: First, moderators are provided with awareness tools that display characteristics of the ongoing discussions. This feedback to the moderator is based on situational indicators, which are either pre-coded or automatically derived from classified examples. In addition, support is provided through remote interventions in the discussion space. ARGUNAUT's moderator's interface does not allow for direct peer-to-peer type of interactions with the discussion environments but conveys functions of remote control to issue specific types of feedback into one of the (potentially multiple) e-discussion spaces. The functions provided by the intervention panel are, among others, sending text messages, highlighting student contributions and pop-up boxes. The moderator's interface also allows for replaying previously recorded discussions. In replay mode, the intervention and classification functions can be used for annotating discussions.

The central research question of this study is to investigate how teachers perceive their roles as moderators and which strategies they use to moderate discussions in their classrooms. The second focus is to

look at teachers' actual use of functions of the ARGUNAUT intervention panel while moderating computer-mediated discussion maps. We are also interested in potential discrepancies between declared moderation strategies and actual behavior using the panel. The study is conducted in the larger context of providing recommendations for designing the ARGUNAUT facilities.

Method

Twenty experienced teachers participated in a workshop in which they were introduced to argumentation, e-argumentation and moderation of discussions. The discussion topics were selected according to the teachers' subject areas. Two questionnaires were administered, one assessing the participants' general moderation style and one assessing their specific moderation strategies. The moderation style questionnaire assessed whether they saw themselves as active participants in classroom discussions (participative style) or rather accompanying discussions, as outside observers (supervision style). The second questionnaire aimed at identifying particular moderation strategies. During the moderation activity, pairs of teachers moderated an e-discussion either with the ARGUNAUT moderator's interface (with the remote control intervention panel) in replay mode, or while watching a video of the same discussion as they wrote down interventions in a paper-and-pencil mode. In both cases, the same pre-recorded discussion on issues of "migration" was used. All interventions were analyzed according to a category system broadly differentiating between participative and supervision style of moderation. Teachers' statements were categorized as participative behavior when they showed active involvement in the discussion as equal participants on a content level. Statements indicating "supervision style" would not directly elaborate arguments or contribute on a content level but rather aim at supporting the flow of the discussion and basic rules of interaction. This can either result in interventions in forms of feedback requests for specific information, or encouragement, similarly to Chi's categorization of tutor's tactics (Chi, et al, 2001).

Results

Results from the questionnaire on moderation style and strategies indicated a clear tendency towards a supervision style: Teachers rated significantly higher on the supervision scale (M=3.55, SD=.67) than on the participation scale (M=2.69, SD=.83). Results also indicated that most teachers would intervene in situations of violation of ground rules and social aspects of discussion situations. When the focus was on students' construction of arguments (cognitive dimension) teachers indicated that they would moderate much less. Also, teachers expressed their preference for actively moderating situations in which students showed passive behavior (non-participation).

Since the two simulated moderation conditions (video with paper & pencil vs. ARGUNAUT replay with moderator's interface) were not systematically varied in this study, we have not distinguished these in our first summary analysis. Overall, 41 interventions were specified. Most interventions were found when a ground rule was violated and these interventions corresponded to supervision style. The situation was different in cases of cognitive challenges and of active knowledge construction. In these cases, teachers adopted a more participative moderation style. A comparison between teachers' responses to the questionnaires and their actual moderation of argumentation maps indicated a certain discrepancy: For situations of ground rule violations or for social challenges, they moderated in a way consistent with what they had expressed in their questionnaires (i.e., adopting supervision style). However, in situations with cognitive issues or challenges in the discussions (i.e., during segments of e-discussions in which discussants were engaged in reasoning) teachers had opted for a supervision style in the questionnaire. In contrast, the analysis of the *actual* moderation of similar e-discussion situations revealed that several pairs of teachers in fact moderated such segments. Most of these moderations consisted of participative thoughts and feedback (social validation) but rarely formulated requests for knowledge elaboration or other cognitive challenges.

Perspectives

From the perspective of designing moderation support tools for teachers in classroom or for remote moderators it is important to know if teachers are willing and able to stick to supervision style moderation instead of the more involved participation style. The ARGUNAUT approach provides subtle monitoring functions without direct control of e-discussions. In this sense, it is geared towards supporting supervision style. We expect that this condition would even allow for one moderator to supervise several discussions at a time, a situation in which involved participation is hardly possible. On the other hand, we saw that teachers tended to get involved in the discussions by acting as equal participants when cognitive challenges came up.

In the final discussion of the workshop, teachers raised skepticism regarding the possibility of using moderation tools in classroom discussions, but they did see such tools as potentially helpful for remote discussion scenarios. This questioning of using moderation tools in face-to-face classroom situations might also have to do with the intention to maintain the central control of classroom on the part of the teacher. As yet, we do not have clear empirical evidence for this assumption.

The discrepancies we found between the beliefs teachers expressed when filling in questionnaires and the styles and strategies they adopted in moderating e-discussions suggests that the complexity of the dynamics of synchronous e-discussions leads teachers to behave in an ad hoc fashion. The awareness tools and the possibilities for interventions provided by ARGUNAUT will probably open new opportunities for different moderation strategies and styles. There is hope that the further development and evaluation of the ARGUNAUT environment will lead to more insight into teachers' roles and intentions as moderators of e-discussions.

References

Anderson, T., Rourke, L., Garrison, D. R., & Archer, W. (2001). Assessing teaching presence in a computer conference context. *Journal of Asynchronous Learning Networks, 5(2), 1-17.*

Andriessen, J., Baker, M., & Suthers, D. (2003). Argumentation, Computer Support, and the Educational Context of confronting cognitions. In Andriessen, J., Baker, M., & Suthers, D. (Eds.), Arguing to Learn: Confronting Cognitions in Computer-Supported Collaborative Learning environments (pp. 1-25). Dordrecht: Kluwer.

Baker, M. (2003). Computer-mediated argumentative interactions for the co-elaboration of scientific notions. In J. Andriessen, M. Baker & D. Suthers (Eds.), *Arguing to learn: confronting cognitions in computer-supported collaborative learning environments* (Vol. 1, pp. 1-25). Dordrecht: Kluwer.

Barth, E. M, & Krabbe, E. C. W. (1982). *From axiom to dialogue: A philosophical study of logics and argumentation*. Berlin: Walter de Gruyter.

Chi, M. T. H., Siler, S. A., Jeong, H., Yamauchi, T., & Hausmann, R. G. (2001). Learning from human tutoring. *Cognitive Science*, 25(4), 471-533.

Cohen, E. G. (1994). Restructuring the classroom: Conditions for productive small groups. *Review of Educational Research, 64*(1), 1-35.

Cohen, E. G., & Lotan, R. A. (1995). Producing equal-status interaction in the heterogeneous classroom. *American Educational Research Journal, 32*, 99-120.

De Groot, R., Drachman, R., Hever, R., Schwarz, B., Hoppe, U., Harrer, A., De Laat, M., Wegerif, R., McLaren, B. M., & Baurens, B. (2007). Computer Supported Moderation of E-discussions: the ARGUNAUT Approach. In C. A. Chinn, G. Erkens, & S. Puntambekar (Eds.), *Proceedings of the Computer Supported Collaborative Learning Conference 2007: International Society of the Learning Sciences*. Mahwah (NJ): Lawrence Erlbaum.

Dubrovsky, V. J., Kiesler, S., & Sethna, B. N. (1991). The equalization phenomenon: status effects in computer-mediated and face-to-face decision-making groups. *Human-Computer-Interaction, 6*, 119-146.

Fischer, F., Kollar, I., Mandl, H., & Haake, J. (Eds.). (2007). *Scripting computer-supported collaborative learning*. New York: Springer.

Fischer, F., & Mandl, H. (2005). Knowledge convergence in computer-supported collaborative learning: The role of external representation tools. *The Journal of the Learning Sciences, 14*(3), 405-441.

Gall, M. D., and Gall, J. P. (1993). Teacher and student roles in different types of classroom discussions. Paper presented at the annual meeting of the American Educational Research Association, Atlanta.

Gil, J., Schwarz, B. B., & Asterhan C. S. C. (2007). Intuitive moderation styles and beliefs of teachers in CSCL-based argumentation. In: C. A. Chinn, G. Erkens, & S. Puntambekar (Eds), *The Computer Supported Collaborative Learning (CSCL) Conference,* Vol. 8 (219-229).

Jeong, H. & Chi, M.T.H. (2007). Knowledge convergence during collaborative learning. *Instructional Science*, *35*, 287-315.

Johnson, D. W., & Johnson, R. T. (2002). Social interdependence theory and university instruction - Theory into practice. *Swiss Journal of Psychology, 61*(3), 119-129.

Kollar, I., Fischer, F., & Slotta, J. (2007). Internal and external scripts in computer-supported collaborative inquiry learning. *Learning and Instruction, 17*(6), 708-721.

Latané, B., Williams, K., & Harkins, S. (1979). Social Loafing. *Psychology Today, 110*, 104-106.

Lund, K. (2004). Human support in CSCL: what, for whom and by whom? In J-W. Strijbos, P.A. Kirshner, R. L. Martens, & P. Dillenbourg (Eds), *What we know about CSCL and implementing it in higher education*, CSCL Vol. 3 (167-198). Norwell, MA: Kluwer Academic Publishers.

Marsh, H. W. (1987). The big-fish-little-pond effect on academic self-concept. *Journal of Educational Psychology, 79*, 280-295.

Merton, R.K. (1968). The Matthew effect in science. *Science*, *159*, 56-63.

O'Donnell, A. M. (1999). Structuring dyadic interaction through scripted cooperation. In A. M. O'Donnell & A. King (Eds.), *Cognitive perspectives on peer learning* (pp. 179-196). Mahwah, NJ: Erlbaum.

Packham, G., Jones, P., Thomas, B., & Miller, C. (2006). Student and tutor perspectives of on-line moderation. *Education & Training, 48*(4), 241-251.

Palincsar, A. S., & Brown, A. L. (1984). Reciprocal teaching of comprehension-fostering and comprehension-monitoring activities. *Cognition and Instruction, 1*, 117-175.

Prenzel, M., Eitel, F., Holzbach, R., Schoenhein, R.-J., & Schweiberer, L. (1993). Lernmotivation im studentischen Unterricht in der Chirurgie [Motivation to learn in student instruction in surgery]. *Zeitschrift für Pädagogische Psychologie, 7*, 125-137.

Robbins, T. L. (1995). Social loafing on cognitive tasks: An examination of the "sucker effect". *Journal of Business and Psychology, 9*(3), 337-342.

Scardamalia, M., & Bereiter, C. (1996). Computer support for knowledge-building communities. In T. Koschmann (Ed.), *CSCL: Theory and practice of an emerging paradigm* (pp. 249-268). Mahwah, NJ: Erlbaum.

Slavin, R. (1996). Research for the future. Research on cooperative learning and achievement: What we know, what we need to know. *Contemporary Educational Psychology, 21*, 43-69.

Weinberger, A., Stegmann, K., & Fischer, F. (2007). Knowledge convergence in collaborative learning: Concepts and assessment. *Learning & Instruction, 17*(4), 416-426.

Weinberger, A., Stegmann, K., Fischer, F., & Mandl, H. (2007). Scripting argumentative knowledge construction in computer-supported learning environments. In F. Fischer, H. Mandl, J. Haake & I. Kollar (Eds.), *Scripting computer-supported communication of knowledge - cognitive, computational and educational perspectives* (pp. 191-211). New York: Springer.

Weiner, B. (1985). An attributional theory of achievement motivation and emotion. *Psychological Review, 92*, 548-573.

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

Acknowledgements

The research presented by Weinberger *et al* was funded by Deutsche Forschungsgemeinschaft (DFG).The research presented by Asterhan and Schwartz and by Wichmann, *et al* was supported by the EC-funded ARGUNAUT project (IST-2005-027728).