Please cite as follows: Asterhan, C. S. C. (in press). Introducing online dialogues in collocated classrooms: If, why and how. In: L. B. Resnick, C. S. C. Asterhan & S. Clarke (Eds), *Socializing Intelligence through academic talk and dialogue*. New York, NY: Routledge, for AERA books.

Introducing Online Dialogues in Collocated Classrooms: If, Why, and How.

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These are exciting times for scholars of dialogic instruction and learning. As extensively shown in this volume, over 35 years of research has accumulated evidence on the impact of structured dialogue on student learning and cognitive development. The fact that these findings are consistent across theoretical frameworks, research paradigms, and educational settings is encouraging and significantly adds to the robustness of the findings. However, the majority of this research has looked at face-to-face (F2F) interactions. Today, a considerable amount of communication among teachers, among students, and between teachers and students has migrated to the digital sphere, either alongside or instead of F2F communication.

A wide variety of tools is available for computer-mediated communication (CMC). For example, at the time of writing, the most frequently used tools are Facebook, videoconferencing, instant messaging (chat), e-mail, blogging, and WhatsApp (instant group messaging by phone). Media and communication theories (e.g., Brennan, Galati, & Kuhlen, 2010; Clark & Brennan, 1991; Herring, 2011; Kiesler, Siegel, & McGuire, 1984;) have meticulously mapped media on a range of dimensions, such as immediacy of feedback (synchronicity), receiving audience (public, private), direction of communication (uni-, bi-, or multi-directional), anonymity, production costs, and access to different channels of information (audio, visual, textual). Media theory proposes that these characteristics shape the way we communicate with one another (e.g., Collins et al., 2000; Walther, 1996; Kraut, Fussell, Brenna, & Gergle, 2002; Kiesler et al., 1984).

Since communication media are different, they are likely to have different affordances and constraints for establishing academically productive talk. We already know quite a bit about what academically productive talk looks like in F2F settings. Difficulties in producing such dialogues in classrooms are also well documented. Which modes of communication would then best support academically productive dialogue? Are there certain affordances to be found in CMC technologies that could address some of the difficulties experienced in F2F settings?

The answer to this seemingly simple question is rather complex. One would have to take into account the differences between the many available CMC tools and plot these against the different types of educational settings and educational goals for learning dialogues (e.g., peer-to-peer/tutoring/teacher-led dialogue; primary/secondary/higher education; after/during school; informal/formal/workplace learning, and so on). Such a detailed matrix would be of tremendous

value, since educational practitioners would be able to pick the communication mode that best fit the aim of a particular dialogue activity. However, we are far from being able to build such a classification scheme. Even though many studies have looked at the effects of media technologies on a range of human-human interactions, most have not focused on educational settings. Neither have they taken into account the above-mentioned variability in educational settings and goals. To move forward, empirical research will have to specify the kinds of CMC technologies that are used and the educational goals and settings of the dialogic activities.

In this chapter I will present the research progress in one particular cell of such a (future) matrix. I will focus on the blending of synchronous, textual CMC in co-located settings (i.e., where students also interact in person) to establish small-group, peer discussions. In the first part, I will discuss how textual CMC may address some of the documented difficulties in establishing productive peer-to-peer discussions in classrooms. In the second part, I will turn to the role of the teacher in these online discussion activities.

1. O**nline group discussions in co-located classrooms**

In spite of the great potential of peer collaboration, research has shown that its success varies. Differences in learning outcomes can be predicted by the extent to which students engage in specific dialogue patterns, such as elaborating, explaining, critiquing, and building on each other's ideas (e.g., Asterhan & Schwarz, 2007, 2009; Chi & Menekse, this volume; Webb, 2009). In addition, social dynamics often prevent group members from capitalizing on ideas generated by others. Inhibiting factors are, among others, competitiveness (Asterhan, 2013; Asterhan & Babichenko, 2013; Chiu & Khoo, 2003), domination and unequal participation (Barron, 2003), differences in social status (Cohen & Lotan, 1995) and differences in social competencies (Barron, 2003). Conducting group discussions in computer-mediated communication environments may, under certain conditions, address some of these difficulties. First, oral talk is ephemeral. The content of computer-mediated textual conversations[1], on the other hand, can be retrieved and reviewed at a later time (Brennan & Lockridge, 2006). This reviewability offers several pedagogical advantages for follow-up activities. Children may be asked to review the quality of their own or other students' discussion protocols, identify different types of reasoning, and provide suggestions on how to improve. But even in the absence of such teacher-initiated follow-up activities, the mere acts of writing a textual contribution, reviewing and editing it prior to posting, and then seeing the post within the discussion thread encourages reflection (Guiller, Durndell, & Ross, 2008; Herring, 2011; Kim, Anderson, Nguyen-Yahiel, & Archodidou, 2007). This is true for both asynchronous and synchronous modes of CMC.

Secondly, CMC is often more to the point and less ambiguous than oral F2F conversation. Paradoxically, the reason is due to the absence of non-verbal communication cues in CMC, such as prosody, facial expression, and gestures (Clark & Brennan, 1991; Kiesler et al., 1984). In conversation, interlocutors jointly construct meanings by engaging in a process of "grounding" (Clark & Brennan, 1991; Clark & Schaefer, 1989)—actively seeking for and providing evidence that they understand one another. However, grounding requires more effort in mediated

[1] In this chapter I refer specifically to textual modes of CMC, without access to audio or video. Most of the research has been done on textual CMC (Herring, 2011) , and there is no added value to having access to video or audio when discussants share the same location.

communication between distant interlocutors than in co-located settings, because the former contains less information (Kraut, Fussell, Brenna, & Gergle, 2002). As a result, computer-mediated communication then often contains less "social", off-topic communication, is more structured, and less ambiguous than communication conducted in person (Kraut et al., 2002; Walther, 1996; see also Jonassen & Kwon, 2001; Newman, Webb, & Cochrane, 1995). The CMC characteristics reviewed thus far, reviewability, reflectivity and preciseness have particular promise when the main goal of the discussion activities is the development of students' discourse competencies and discourse norms.

Third, moving some classroom discussions online may also address issues of unequal participation in peer group work. In most online communication environments, and unlike in F2F settings, participants do not need to compete for speaking rights, since they can post contributions simultaneously and at their own pace. This often leads to increased and more egalitarian participation (Hampel, 2006; Weasenforth, Biesenbach-Lucas, & Meloni, 2002). Moreover, online modes of communication are more democratic (Herring, 2004), because students lack non-verbal cues to assess, for example, social status. In online discussion, participants are less inhibited, self-disclose more frequently, and are more inclined to reveal their personal, individual standpoints (Hamburger & Ben-Artzi, 2000; Hamburger, Wainapel, & Fox, 2002; Suler, 2004) and to take academic risks (Blau & Caspi, 2008).

This so-called *disinhibition effect* (Suler, 2004) of CMC may be particularly important when cognitive diversity is pivotal for effective group functioning, as in the case of critical argumentation or in creative idea generation. One of the hypothesized benefits of working in groups for creative idea generation is that groups bring more relevant information to bear on a problem, particularly if its members come from diverse backgrounds and areas of expertise. However, research in F2F settings shows that this potential is rarely realized and that groups often fail to share unique information. Instead, they focus on what is shared (e.g., Larson et al., 1996; Stasser & Birchmeier, 2003; Stasser & Titus, 2003) and tend toward reaching early consensus (e.g., Aldag & Fuller, 1993). Premature consensus seeking is also a common concern of argumentation research (Asterhan, 2013; Mercer, 1996; Weinberger & Fischer, 2006). It is not always easy to get students to engage in critical argumentative discourse, even when they receive explicit instructions and guidelines (Asterhan & Schwarz, 2007; 2009; de Vries, Lund, & Baker, 2002). In previous work, we have suggested that this difficulty is not merely the result of cognitive difficulty or of well-known group processes that are problematic, but also of social concerns (Asterhan, 2013; Asterhan, Schwarz, & Butler, 2009). Engaging in a critical discussion with a disagreeing peer may be perceived by many students as a threat to their social status, their interpersonal relations with group members, and their desire to be perceived as competent and knowledgeable. Participants may prefer to concede upfront in order to avoid expressing dissenting perspectives and to deal with critique. Computer-mediated discussions between co-located partners may provide just enough of a buffer for participants to become less "inhibited" by such social concerns.

Using computer-mediated discussion tools for learning dialogues in classrooms may also pose difficulties, however. Since there is no wait-time for turn-taking, interlocutors in synchronous group discussions may "speak" at the same time and simultaneous discussion threads evolve at a rapid pace. When communication sequencing is vertically organized and posts appear in chronological order, as is the case with most common chat-based tools, conversational overlap

and sequential incoherence quickly occur. Unrelated messages from other participants often intervene between an initiating message and its response (Condon & Cech, 1996; Murray, 1989), and in the course of writing a reaction, the posting one is reacting to may have already disappeared from view. Not surprisingly, discussants then tend to address recently posted messages (Hewitt, 2003), with rapid topic decay as a result (Herring, 2001).

Fortunately, these difficulties may be addressed by designing discussion software that supports the visual organization of different emerging discussion threads, and allows participants to move between discussion threads and interlink between postings and threads. In discussion environments such as Digalo (Asterhan & Schwarz, 2010; Schwarz & Asterhan, 2011; Schwarz & de Groot, 2007) and Knowledge Forum (Scardamalia & Bereiter, 2006), for example, participants are free to post their contributions anywhere in a two-dimensional discussion map and link it to any posting of their choice. They can flexibly create new threads and merge discussion threads when needed.

[Insert Figure 1 About Here]

In a recent study we asked secondary school students from different classrooms to compare their experiences with F2F and online discussions in the classroom (Asterhan & Eisenmann, 2011). The teachers of these students participated in an in-service PD project that promoted the implementation of argumentative dialogues in online and F2F classroom modes, so students had experience with both formats. With regard to the online discussion mode, we found that students reported higher participation rates, more interaction with fellow students, and fewer classroom disturbances. but no differences were found on the academic dimensions of the discussion activity (learning, motivation and clarity). When we contrasted the experiences of students who either defined themselves as predominantly “active” or predominantly “silent” during F2F classroom discussion activities, we found that the differences between communication mode preferences were most profound for the “silent” students. “Silent” students also reported that the CMC format was more motivating and more understandable for them.

The question remains, however, whether practice in the online discussion mode could also improve students’ discourse competencies in F2F discussions. Recent research by Iordanou (2013) suggests that it does. In this study, sixth graders engaged in electronic peer-to-peer dialogues and in reflective activities based on transcriptions of these dialogues. By the end of the intervention, they exhibited significant increases in their use of argumentative stratagems in both online *and* F2F discussion modes. Findings by Clarke, Chen, Stainton, Katz, Greeno, Resnick, Howley, Adamson, and Rose (2013) have also shown improved participation in F2F classroom discussion following online discussion activities. However, more research is warranted since it is not clear whether all children improved equally well or whether a F2F discussion program could have yielded similar outcomes. Thus even though these studies show that children’s improved discussion competencies may extend from one mode to another, there is still no direct empirical evidence for an *advantage* of online discussion modes for fostering such competencies, over F2F modes of practice.

More empirical research is also needed to test the effects of synchronous online discussions on students’ learning of academic content. It is clear from the above-mentioned literature that synchronous online dialogue is in many ways different from its F2F counterpart. However, do these differences promote learning? Very little comparative research addresses this question

directly. Sins et al. (2011) found that high school students' chat-mediated discussions contained less surface reasoning, compared to F2F discussions during the same scientific inquiry task. However, these differences did not affect group performance outcomes. We recently conducted a similar study in which we also compared the effects of communication mode, but this time in a more controlled setting. We looked at each student's individual conceptual understanding of a complex scientific concept (diffusion). All students were individually tested for conceptual understanding prior to, immediately after, and a week following the interaction. They all read a textbook passage on diffusion and then engaged in a scripted verbal interaction with a confederate (i.e., a collaborating lab member pretending to be a regular participant). The confederate asked each individual student a set of identical questions designed to elicit students' explanations and elaborations on diffusion. Our findings confirmed those of Sin et al. As expected, in the F2F condition students' conversational turns were longer overall and included more off-task content. However, there were no differences in the number of new elaborations students generated, nor on their individual learning gains. Thus, the outcomes of these two studies seem to indicate that even though the two communication modes may indeed lead to differences in dialogue characteristics, these differences do not necessarily translate into different learning outcomes.

In summary, online discussion modes may offer several pedagogical advantages over their F2F counterparts. These mainly concern the issues of equal participation, free expression of (dissenting) ideas, and communication coherence. However, more empirical research is needed to tease apart when, how, and for whom online discussion activities promote the development of dialogic competencies. For example, what is the sweet spot of CMC for academically productive talk, which allows for just the right amount of social distancing to increase equitable participation and free expression, but does not dampen motivation and engagement (as is often the case in asynchronous CMC, Roseth et al., 2011)? It is also unclear whether moving peer discussions online has any benefits for the learning of academic content. Recent findings from an adjacent research field show that this may be dependent on the type of interaction, namely whether it concerns learning from consensual, informative dialogue or learning from critical dialogue with a disagreeing peer (Asterhan & Babichenko, 2013). More research is needed to explore these possibilities further.

2. Teacher support of online group discussions

Research on F2F settings has shown the positive effects of carefully calibrated teacher support during small-group discussions (Gillies, this volume; Webb, 2009, this volume). Studies in computer-supported collaborative learning, on the other hand, have traditionally focused on student-student interactions and how technology design shapes them. Until recently, there has been an absence of empirical studies that describe how teachers behave during and intervene in online group activities (Asterhan & Schwarz, 2010; Greiffenhagen, 2012; Urhahne, Schanze, Bell, Mansfield, & Holmes, 2010). This may not come as a surprise, given that much technological innovation in education has aimed to transform teaching and learning from teacher-led instruction to more pupil-centered practices (Cuban, 2001). Even though the role of teachers has never been explicitly renounced, the lack of attention to teachers, both in empirical research as well as in educational technology design, illustrates the commonly held view that technology can replace human teacher support.

However, software support tools for student learning often lack crucial features of genuine scaffolding such as ongoing diagnosis, calibrated support, and progressive fading (Puntambekar & Hubscher, 2005). Traditionally, genuine scaffolding had been accomplished by human experts, such as teachers and parents. Therefore, recent research has turned toward investigating the role of human facilitation of online learning interactions. Empirical research on teacher support of co-located e-discussions, in particular in secondary school classrooms, is still sparse. Following are some of the findings and insights from our own work in this field.

What does online human guidance of synchronous group discussions look like?

Pedagogical models of online teacher support have attempted to describe the many different goals that instructors have to accomplish (e.g., Denise, Watland, Pirotte, & Verday, 2004; Goodyear et al., 2001). These can be broadly summarized in the following five categories (Lund, 2004): *Pedagogical* support aims to improve students' learning, understanding, and reasoning; *Social* (or emotional) support focuses on the social relations between discussants and on maintaining student motivation; *Interaction* support aims to maintain student participation and interaction; *Managerial* support focuses on task design, completion, and monitoring; and *Technical* support aims at detecting and assisting with operational and technical issues.

Depending on the settings, different teacher support goals will receive more or less emphasis. In distant e-learning such as adult e-courses, almost all communication is computer-mediated and asynchronous, and there are none-to-few F2F meetings. Not surprisingly, pedagogical frameworks for support in such settings strongly emphasize motivation and socialization for maintaining student engagement and preventing attrition (e.g., Salmon, 2004). When small-group online discussions are integrated in a sequence of F2F classroom activities, on the other hand, motivation and socialization are maintained through other channels and teacher moderation almost solely focuses on pedagogical and interaction support (Asterhan, 2011; Asterhan & Schwarz, 2010; van Leeuwen et al., 2013).

In addition to the different goals of teacher support, there are also issues of format and style. Research from a range of F2F settings such as tutoring (e.g., Chi, Siler, Jeong, Yamauchi, & Hausmann, 2001), peer collaboration (e.g., Gillies, 2004; Webb et al., 2008) and teacher-guided classroom dialogue (e.g., Resnick et al., 2010) has unequivocally shown the effectiveness of prompts that aim to scaffold student reasoning and learning without including any topic-specific content. Scaffolding prompts such as "*Why do you think X?*", "*Can you please elaborate?*", "*Can anyone think of a different explanation?*" do not include any direct reference to topic content, and can be used to encourage student reasoning on nearly any topic. The question, however, is whether these types of scaffolding prompts will be as effective in online settings. We have reason to believe this may not be the case. In a recent study, we found that students did not appreciate nor respond to this type of generic scaffolding prompt in synchronous, threaded e-discussions (Asterhan & Schwarz, 2010). Content-specific scaffolding prompts, on the other hand, were very effective at eliciting responses, and were also highly valued by discussants. Instead of asking "Could you please explain?", the moderators would write something like, "I don't think I understood what you mean here. Because one could think you mean that [enter specific content] or that [enter specific content]. Which is it?" Alternatively, the moderators would strategically challenge student arguments by posting content-specific critical questions pointing to alternative viewpoints.

In a synchronous e-discussion with four or five discussants, participants typically engage in multiple discussions. They hop between discussion threads, posting a contribution to one thread, returning to see whether anyone reacted to their last posting in the previous thread, and so on. This creates a temporal schism between the interlocutors of two adjacent discussion contributions. When discussant A reads a posting by person B and formulates a reaction to it, A has temporarily re-established inter-subjectivity with B, through text, even though discussion partner B is most likely to be inattentive at that moment, and engaged in a different discussion thread (in other words, only virtually present in the relevant discussion thread). It is possible that general scaffolding prompts such as "Why do you think that?" are effective in the continuous stream of oral conversation where discussants are more or less collaboratively and simultaneously attending to the same verbal content. But this is not the case in online group discussions, even in synchronous mode, because the actions of participants in "synchronous" group discussions are not completely synchronized. As a result, moderators may have to be more explicit and specific to convince discussants to invest the effort needed to establish inter-subjectivity with the virtual presence of a moderator and react to his/her post.

Does online teacher guidance improve student discourse?

Descriptive studies of e-moderation practices in blended learning settings such as the ones reviewed above do not compare conditions of guided and unguided discussions. It is therefore not possible to determine whether teacher guidance actually has a positive impact on the quality of peer discussions, or whether it interferes with group functioning. To properly answer this question a controlled experiment is needed. In a recent in-vivo experiment (Asterhan, Schwarz, & Gil, 2012), we were able to show that teacher guidance positively affected the quality of ninth graders' small-group argumentation. Based on differences in moderation behavior that were documented in a field study (Asterhan, 2011), we defined two types of human guidance for improving student online argumentation. *Epistemic guidance* aims to assist the group in presenting clear, sound arguments and counterarguments, and in considering different perspectives. *Interactional guidance*, on the other hand, aims to improve group argumentation by exploiting the social situation, that is, through encouraging students to express their opinions, to listen, and to respond to students with different viewpoints. Groups of three to four students were randomly assigned to one of three conditions (epistemic teacher guidance, interactional teacher guidance, and no teacher guidance), and the timing and content of the teacher interventions was tightly controlled, according to condition. The results showed that epistemic guidance improved the argumentative quality of discussions, but did not improve rates of participation or interactivity between students. Vice versa, teacher support that focused on the interactional aspects of peer argumentation increased participation and interactivity, but did not improve argumentative quality. This study shows that teacher guidance in online environments can have an effect on student discussions that reasonably fits the intended goal of moderation.

Scaling up facilitation: support tools for teachers

Studies have shown what moderation of synchronous peer discussions looks like and the impact it has. These studies provide important proof of concept; however, moderators in these studies only had to support one group. iIn an average-sized classroom, teachers will have to deal with several small groups working simultaneously. The amount of information available to a teacher can rapidly become overwhelming, since all students in a classroom are "talking" at the same time and teachers have full access to all verbal content. Monitoring group and individual

progress as well as providing tailored support to several groups simultaneously is a daunting task.

One of the advantages of computer-mediated interactions is that online actions are unobtrusively logged. This log file can be used for automated detection of group processes that may require intervention (McLaren, Scheuer, & Mikšátko, 2010). One way to make use of this information is to develop pedagogical agents that guide and intervene in the group process (e.g., Dyke, Adamson, Howley, & Penstein Rose, 2012; Stahl, this volume). In a recent development initiative, we opted for a different approach. Instead of *replacing* human expertise, we set out to combine the advantages of both technology and of human expertise. We developed a system called Argunaut to support instructors in their attempts to provide real time, online support of simultaneous student discussions (described in Hoppe, de Groot, & Hever, 2009; Schwarz & Asterhan, 2011). In the Argunaut system, results of automated detection of group processes are made available to human teachers with the help of teacher-tailored visualizations (i.e., awareness tools), alerts, and selection tools. This information is constantly updated in real time and appears in different forms, from more delicate to more intrusive, to be specified by each individual user. It includes, for example, social network analyses to detect interaction patterns (e.g., when no one is reacting to a certain person, or when a certain person is singled out for negative feedback), activity patterns (e.g., to find out whether certain types of dialogue patterns are common or rare), keyword searches (e.g., to find out if students use target concepts), and visualizations to track not only group processes but also individual developments in reasoning quality. The system does not suggest *whether*, *when*, and *how* the teacher should intervene. These decisions are left to human judgment.

We would argue that this *combination* of intelligent support and human expertise seems a more promising approach for real-time group support than replacing human expertise with pedagogical agents. Even the most sophisticated methodologies for automated detection of group processes have an error rate that may be low in terms of standards of computational linguistics, but is too high to form the basis for real interventions. As Stahl (this volume) reports, even the slightest mistake by a pedagogical agent may disrupt group processes and render the agent irrelevant in the eyes of students. At least for now, human judgment seems to be an important mediator to detect errors and to correct them before intervening. In addition, human expertise may be particularly crucial for ill-defined problem solving activities that involve multiple participants, such as small group student discussions on social dilemmas. These activities do not have short, canonically correct answers and their quality cannot be judged by frequent use of certain keywords or word-pairs. Moreover, successfully guiding such discussions requires a profound understanding of the group's dynamics and participants' personal histories. In a recent study (Schwarz & Asterhan, 2011), we showed that human expertise and judgment is often called for to (1) adequately evaluate the social and historical dimensions of these complex interpersonal situations; (2) flexibly and instantly adapt support for individual and group processes in ways that were unforeseen; and (3) phrase interventions so that they are sensitive to these subtleties.

In summary, research on peer-led, group dialogue in F2F settings has shown the importance of carefully calibrated teacher support during these interactions (Gillies, this volume; Webb et al., this volume). In a field that has often conceptualized technology as substitutes for human teachers, very few research or development efforts have focused on the role of teachers during online dialogue. First findings from the research that led to the development of Argunaut

indicate that, just like in F2F settings, the quality of online peer interactions can be improved with real-time teacher support. However, the type and form of teacher interventions that are effective in these environments may very well prove to be different from their F2F counterpart.

In conclusion

The ubiquity of digital communication technologies and their increasing use for educational purposes have given birth to new research venues that explore the intersection of dialogue, CMC technologies, and education in a variety of ways. This multidisciplinary undertaking spans a wide range of scholarly efforts, which vary in terms of theoretical framing and research methodology, the type of research questions studied, and the settings selected for investigation, The chapters in this section of the book offer a taste of some of this variability.

In this chapter, we began with this question: Given the goals and characteristics of a certain educational setting, which communication technologies would best support academically productive talk? I argued that in order to move beyond the general predictions of communication theories, we have no choice but to investigate empirically some specified part of the many different types of technologies and educational settings.

I presented first findings on a particular way of blending online tools for dialogic learning, focusing on a specific online communication mode (synchronous, textual, co-located) used in a specific type of educational setting (small-group peer discussions in formal education). Even though the findings are specific to those settings, they raise general questions about the affordances of CMC for learning through human interaction and dialogue in general, and general questions about the role of the teacher and about teacher-student interaction in digital environments.

We hope these first insights bring us one step closer to a better and more complete understanding of the role of digital communication technologies and how teachers and learners (could) employ them to produce academically productive talk. Needless to say, much more empirical research is needed. However, when considering media differences and media effects on dialogues we should also remember the following:.

First, information and communication technologies change rapidly with new features being introduced and existing features being blended in new platforms. Research findings that are not grounded in theory will therefore become quickly outdated. Second, communication practices are not only shaped by the technical features of a particular type of media, but also by the way users choose to consume and domesticate these technologies in their everyday activities (Haddon, 2006). For example, even though Facebook *could* be used for academic learning exchanges, and the technical features certainly afford it, studies from 2007-2011 report that students predominantly used it for social purposes and were wary of using it for academic goals (Hew, 2011). However, findings from data we collected in Israel this year(2013) clearly show that both high school pupils, college students, and even teachers (Asterhan, Rosenberg, Schwarz, & Solomon, 2013) now use Facebook to organize in study groups to discuss lesson content, share resources, and tutor each other. Thus, consumption patterns of specific online communication technologies also evolve over time.

Finally, what we have been referring to as "academically productive talk" is based on extensive research in F2F settings that relate dialogue characteristics with learning outcomes and cognitive development. However, instead of asking which media technology would be the best fit for a particular, predefined type of dialogue, we should also be open to the opposite. The characteristics of what constitutes "productive talk" may be different in various CMC environments. Some of the findings reported in this chapter show that this is a reasonable expectation.

References

Aldag, R. J., & Fuller, S. R. (1993). Beyond fiasco: A reappraisal of the groupthink phenomenon and a new model of group decision processes. *Psychological Bulletin, 113*, 533-552.

Asterhan, C. S. C. (2011). Assessing e-moderation behavior from synchronous discussion protocols with a multi-dimensional methodology. *Computers in Human Behavior*, 27, 449–458. DOI:10.1016/j.chb.2010.09.008

Asterhan, C. S. C. (2013). Epistemic and interpersonal dimensions of peer argumentation: Conceptualization and quantitative assessment. In: M. Baker, J. Andriessen & S. Jarvela (Eds), *Affective learning together* (pp 251-272). New York, NY: Routledge, Advances in Learning & Instruction series.

Asterhan C. S. C. & Babichenko, M. (2013). Learning Complex Scientific Concepts through Peer Argumentation: The Effect of Human Presence and Discourse Style. Paper presented at the annual meeting of the American Educational Research Association, San Fransisco, CA.

Asterhan, C. S. C. & Eisenmann, T. (2011). Introducing synchronous e-discussions in co-located classrooms: A study on the experiences of 'active' and 'silent' secondary school students. *Computers in Human Behavior, 27*, 2169 - 2177. doi:10.1016/j.chb.2011.06.011 Asterhan, C. S. C., & Schwarz, B. B. (2007). The effects of monological and dialogical argumentation on concept learning in evolutionary theory. *Journal of Educational Psychology, 99*, 626-639.

Asterhan, C. S. C. & Schwarz, B. B. (2009). The role of argumentation and explanation in conceptual change: Indications from protocol analyses of peer-to-peer dialogue. *Cognitive Science, 33*, 373-399.

Asterhan, C. S. C. & Schwarz, B. B. (2010). Online moderation of synchronous e-argumentation. *International Journal of Computer-Supported Collaborative Learning, 5,* 259 – 282 Asterhan, Rosenberg, Schwarz & Solomon, 2013

Asterhan, C. S. C., Schwarz, B. B., & Butler, R. (2009) 'Inhibitors and facilitators of peer interaction that supports conceptual learning: The role of achievement goal orientations', in N. A. Taatgen & H. van Rijn (eds), *Proceedings of the 31st Annual Conference of the Cognitive Science Society*, Mahaw, N.J.: Erlbaum.

Asterhan, C. S. C., Schwarz, B. B. & Gil, J. (2012). Small-group, computer-mediated argumentation in middle-school classrooms: The effects of gender and different types of online teacher guidance. *British Journal of Educational Psychology, 82,* 375-397. doi:10.1111/j.2044-8279.2011.02030.x

Asterhan, C. S. C., Rosenberg, H. Schwarz, B. B., & Solomon, L. (2013). Secondary School Teacher-Student Communication in Facebook: Potentials and Pitfalls. In Y. Eshet-Alkalai, A. Caspi, S. Eden, N. Geri, Y. Kalman, Y. Yair (Eds.),*Proceedings of the Chais conference on instructional technologies research 2013: Learning in the technological era.* Raanana: The Open University of Israel

Barron, B. (2003). When smart groups fail. *The Journal of the Learning Sciences, 12*(3), 307-359.

Blau, I., & Caspi, A. (2008). Do media richness and visual anonymity influence learning? A comparative study using Skype™. In Eshet, Y., Caspi, A., Geri, N. (Eds.) *Learning in the Technological Era* (pp. 18-24). Ra'anana, Israel: Open University of Israel.

Brennan, S. E. , Galati, A. & Kuhlen, A. K. (2010). Two Minds, One Dialog: Coordinating speaking and Understanding. In B. H. Ross (Ed), *The Psychology of Learning and Motivation*, Vol. 53 (, pp. 301-344). Burlington: Academic Press.

Brennan, S. E., & Lockridge, C. B. (2006). Computer-mediated communication: A cognitive science approach. In K. Brown (Ed.), *ELL2, Encyclopedia of Language and Linguistics, 2nd Edition* (pp. 775-780). Oxford, UK: Elsevier Ltd.

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

Chi & Menekse, this volume

Chiu, M. M., & Khoo, L. (2003) 'Rudeness and status effects during group problem solving', *Journal of Educational Psychology*, 95: 506-523.

Clark, H. H., & Brennan, S. E. (1990). Grounding in communication. In L. B. Resnick, R. M. Levine, and S. D. Teasley (eds.), Perspectives on socially shared cognition (127-149). Washington, DC: American Psychological Association.

Clark, H. H., & Schaefer, E. (1989). Contributing to discourse. *Cognitive Science, 13*(2), 259-294.

Clarke, S.N., Chen, G., Stainton, C., Katz, S., Greeno, J.G., Resnick, L.B., Howley, I., Adamson, D. and Rosé, C.P. (2013) The Impact of CSCL Beyond the Online Environment. *Proceedings of the 10th International Conference on Computer Supported Collaborative Learning*, Madison Wisconsin, June 2013.

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

Collins, A., Neville, P. & Bielaczyc, K. (2000). The Role of Different Media in Designing Learning Environments. *International Journal of Artificial Intelligence in Education, 11*, 144-162

Condon, S. L. & Cech, C. G. (1996). Discourse Management Strategies in Face-To-Face and Computer-Mediated Decision Making Interactions. *Electronic Journal of Communication/La revue électronique de communication* 6(3).

Cuban, L. (2002). *Oversold and underused: computers in the classroom*. Cambridge, MA: Harvard University Press.

De Vries, E.,, Lund, K., & Baker, M. (2002). Computer-mediated epistemic dialogue : Explanation and argumentation as vehicles for understanding scientific notions. *Journal of the Learning Sciences, 11*, 63-103.

Denise, B., Watland, P., Pirotte, S. & Verday N. (2004). Roles and Competencies of the e-Tutor. Proceedings of the 2004 Networked Learning Conference. Retrieved April 14, 2009 from: http://www.networkedlearningconference.org.uk/past/nlc2004/proceedings/contents.htm

Dyke, G. Adamson, D., Howley, I., & Penstein Rosé, C. (2012). Towards Academically Productive Talk Supported by Conversational Agents. *Intelligent Tutoring Systems*, *Lecture Notes in Computer Science*, *7315*, 531-540

Gerber, S., Scott, L., Clements, D. H. & Sarama, J. (2005). Instructor influence on reasoned argument in discussion boards, *Educational Technology Research and Development,* 53, 25-39.

Gillies, R. M. (2004). The effects of communication training on teachers'and students'verbal behaviours during cooperative learning. *International Journal of Educational Research, 41,* 257–279.

Gillies, this volume

Goodyear, P., Salmon, G., Spector, J. M., Steeples, C., & Tickner, S. (2001). Competences for online teaching: a special report. *Educational Technology, Research and Development*, *49*(1), 65–72. doi:10.1007/BF02504508

Greiffenhagen, C. (2012). Making rounds: The routine work of the teacher during collaborative learning with computers. *International Journal of Computer-Supported Collaborative Learning,7*, 11–42

Guiller, J., Ross, A. & Durndell, A. (2008). Peer interaction and critical thinking: face-to-face or online discussion? Learning and Instruction, 18, 187-200.

Haddon, L. (2006) The Contribution of Domestication Research to In-Home Computing and Media Consumption, The Information Society: An International Journal, 22:4, 195-203.

Hamburger, Y. A., & Ben Artzi, E. (2000). The relationship between extraversion and neuroticism and the different uses of the Internet. *Computers in Human Behavior,* 16, 441–449.

Hamburger, Y. A., Wainapel, G., & Fox, S. (2002). On theh interne no one knows I'm an introvert: Extraversion, neuroticsm and internet interaction. *Cyperpsychology & Behavior, 5*, 125–128

Hampel, R. (2006). Rethinking task design for the digital age: A framework for language teaching and learning in a synchronous online environment. *ReCALL, 18*, 105-121. UK: Cambridge University Press.

Herring, S. (2001). Computer-mediated discourse. In D. Schiffrin, D. Tannen, and H. Hamilton (Eds), *The Handbook of Discourse Analysis* (pp. 612-634). Oxford: Blackwell Publishers.

Herring, S. C. (2004). Computer-mediated discourse analysis: An approach to researching online behavior. In S. A. Barab, R. Kling, & J. H. Gray (Eds.), *Designing for virtual communities in the service of learning* (pp. 338–376). New York: Cambridge University Press.

Herring, S. C. (2011). Computer-Mediated Conversation: Introduction and Overview. *Language@Internet, 8.* Retrieved at 10/28/2013 from http://www.languageatinternet.org/articles/2011/Herring

Hew, K. F. (2011). Students' and teachers' use of Facebook. *Computers in Human Behavior, 27,* 662-676.

Hewitt, J. (2003). How habitual online practices affect the development of asynchronous discussion threads. *Journal of Educational Computing Research, 28,* 31-45.

Hoppe, H. U., De Groot, R., & Hever, R. (2009). Implementing Technology-Facilitated Collaboration and Awareness in the Classroom: Roles for Teachers, Educational and Technology Researchers. In B. B. Schwarz, T. Dreyfus, & R. Hershkowitz (Eds.), *Transformation of Knowledge through Classroom Interaction: New Perspectives in Learning and Instruction* (pp. 130-142). New York, NY: Routledge.

Iordanou, K. (2013). Developing Face-to-Face Argumentation Skills: Does Arguing on the Computer Help? *Journal of Cognition & Development, 14,* 292-320

Jonassen, D. H., & Kwon, H. I. (2001). Communication patterns in computer-mediated versus face-to-face group problem solving. *Educational Technology Research & Development, 49,* 33-51.

Kiesler, S., Siegel, J., & McGuire, T. W. (1984). Social psychological aspects of computer-mediated communication. *American Psychologist, 39,* 1123-1134.

Kim, I-H., Anderson, R. C., Nguyen-Jahiel, K. & Archodidou, A. (2007). Discourse patterns during children's collaborative online discussions. *The Journal of the Learning Sciences, 16*(3), 333-370.

Kraut, R. E., Fussell, S. R., Brennan, S. E., & Siegel, J. (2002). Understanding effects of proximity on collaboration: Implications for technologies to support remote collaborative work. In P. Hinds & S. Kiesler (Eds.), *Distributed work* (pp. 137-162). Cambridge, MA, US: MIT Press.

Larson, J. R., Christiansen, C., Abbott, A. S., & Franz, T. M. (1996). Diagnosing groups: Charting the flow of information in medical decision making teams. *Journal of Personality and Social Psychology, 71,* 315-330.

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.

McLaren, B.M., Scheuer, O., & Mikšátko, J. (2010). Supporting collaborative learning and e-Discussions using artificial intelligence techniques. *International Journal of Artificial Intelligence in Education (IJAIED), 20,* 1-46. DOI 10.3233/JAI-2010-0001

Mercer, N. (1996). The quality of talk in children's collabroative activity in the classroom. *Learning & Instruction, 6,* 359-377.

Murray, D.E. (1989). When the Medium Determines Turns: Turn-taking in Computer Conversation. In H. Coleman (Ed.), *Working with Language* (pp. 251-266). New York: Mouton de Gruyter.

Newman, D. R., Webb, N., & Cochrane, B. (1995). A content analysis method to measure critical thinking in face-to-face and computer supported group learning. *Interpersonal Computing and Technology, 3*, 56-77.

Puntambekar, S., & Hubscher, R. (2005). Tools for scaffolding students in a complex learning environment: What have we gained and what have we missed? *Educational Psychologist, 40*, 1–12. doi:10.1207/s15326985ep4001 1

Resnick, L. B., Michaels, S., & O'Connor, C. (2010). How (well structured) talk builds the mind. In D. Preiss & R. Sternberg (Eds.), *Innovations in educational psychology: Perspectives on learning, teaching and human development* (pp. 163–194). New York: Springer.

Roseth, C. J., Saltarelli, A. J., & Glass, C. R. (2011). Effects of face-to-face and computer-mediated constructive controversy on social interdependence, motivation, and achievement. *Journal of Educational Psychology, 103*, 804-820.

Salmon, G. (2004). *E-moderating: The Key to Teaching and Learning Online*. London: Taylor & Francis.

Scardamalia, M., & Bereiter, C. (2006). Knowledge building: Theory, pedagogy, and technology. In K. Sawyer (Ed.), *Cambridge Handbook of the Learning Sciences* (pp. 97-118). New York: Cambridge University Press.

Schwarz, B. B. & Asterhan, C. S. C. (2011). E-moderation of synchronous discussions in educational settings: A nascent practice. *Journal of the Learning Sciences, 20*, 395-442. doi: 10.1080/10508406.2011.553257

Schwarz, B. B., & De Groot, R. (2007). Argumentation in a changing world. *The International Journal of Computer-Supported Collaborative Learning, 2*(2-3), 297-313.

Sins, P.H.M., Savelsbergh, E. R., van Joolingen, W.R., van Hout-Wolters, B.H.A.M. (2011). Effects of face-to-face versus chat communication on performance in a collaborative inquiry modeling task. *Computers & Education, 56*, 379–387.

Stahl (this volume)

Stasser, G., & Birchmeier, Z. (2003). Group creativity and collective choice. In P. B. Paulus & B. A. Nijstad (Eds.), *Group creativity* (pp. 85–109). New York: Oxford University Press.

Stasser, G., & Titus, W. (2003). Hidden profiles: A brief history. Psychological Inquiry, 14, 3&4, 304-313.

Suler, J. (2004). The online disinhibition effect. *Cyberpsychology & Behavior*, 7, 321–326.

Urhahne, D., Schanze, S., Bell, T., Mansfield, A., & Holmes, J. (2010). Role of the teacher in computer-supported collaborative inquiry learning. *International Journal of Science Education, 32*, 221–243.

van Leeuwen, A., Janssen, J., Erkens, G., & Brekelmans, M. (2013). Teacher interventions in a synchronous, co-located CSCL setting: Analyzing focus, means, and temporality. *Computers in Human Behavior, 29*, 1377–1386.

Walther, J. B. (1996). Computer-mediated communication: Impersonal, interpersonal and hyperpersonal interaction. *Communication Research, 23*, 3-43.

Weasenforth, D., Biesenbach-Lucas, S., & Meloni, C. (2002). Realizing constructivist objectives through collaborative technologies: Threaded discussions. *Language, Learning & Technology, 6*, 58–86.

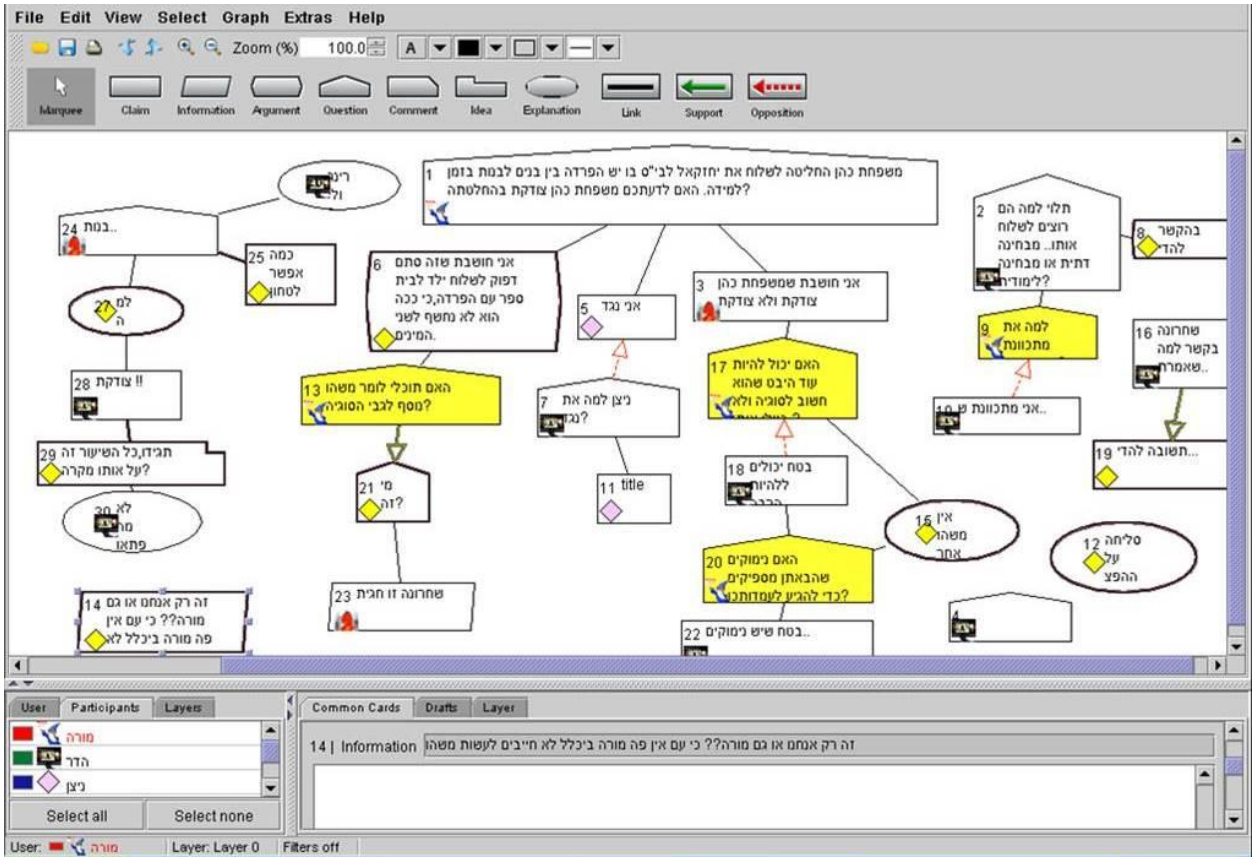
Webb, N. M. (2009). The teacher's role in promoting collaborative dialogue in the classroom. *British Journal of Educational Psychology, 79*, 1-28.

Webb et al (this volume)

Webb, N. M., Franke, M. L., Ing, M., Chan, A., De, T., Freund, D., & Battey, D. (2008). The role of teacher instructional practices in student collaboration. *Contemporary Educational Psychology, 33*(3), 360-381.

Weinberger, A., & Fischer, F. (2006) 'A framework to analyze argumentative knowledge construction in computer-supported collaborative learning' *Computers & Education*, 46: 71-95.

Figure 1. A screenshot of a Digalo discussion in Hebrew between four 9th graders*



* Note that only the titles of posts are visible in this screenshot. Hovering over a contribution with a mouse reveals its textual content in full.