

A Long-Term View on Learning to Argue in Facebook: The Effects of Group Awareness Tools and Argumentation Scripts

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Abstract: Social networking sites pose a new arena for argumentative practices and may provide an opportunity to facilitate, and understand argumentative processes in large scale over longer periods of time. Through apps, group awareness tools and argumentation scripts can be implemented in social networking sites, to provide additional, graphically visualized information, and prompt learners to formulate or review sound arguments. This 2×2 field study ($N=105$) examines how Facebook can be harnessed for argumentative learning through group awareness tools and argumentation scripts. We measure domain-specific knowledge outcomes, the process of argumentative knowledge construction and attitude change. The results show a main effect for both conditions on domain-specific knowledge and argumentative knowledge construction, but no difference to the control group on attitude change. The epistemic quality and formal quality increased for the groups with argumentation script. All observed changes become substantial after the fourth week of interactions.

Keywords: argumentation, group awareness, scripts, social networking sites, long-term study

Argumentative knowledge construction in social networking sites

Social networking sites (SNS) afford collaborative processes that may be harnessed for learning (Greenhow, 2008; Greenhow & Robelia, 2009). SNS may offer a rich argumentative context that can pronounce processes of argumentative knowledge construction (AKC). AKC is the deliberate practice of elaborating learning material and discussion topics by constructing formally and semantically sound arguments with the goal of gaining argumentative and domain-specific knowledge (Andriessen, 2006). With SNS being prone to trivial talk, AKC in SNS may greatly benefit from instructional approaches of CSCL (Tsovaltzi, Puhl, Judele & Weinberger, 2014; Tsovaltzi, Judele, Puhl & Weinberger, in review). Moreover, recent research has revealed that while argumentation skills can be fostered by controlled short-term technology-enhanced instructional approaches, no substantial effects on domain-specific knowledge can be attained with these approaches (Wecker & Fischer, 2014). One reason could be that complex and meaningful learning such as argumentative learning takes time (Reimann, Utz, Unterberger & Halb, 2014). Long-term interventions have been suggested before to successfully foster argumentation skills with young adolescents (Kuhn & Crowell, 2011). However, existing approaches have often been too coercive for learners to actively regulate their individual or group AKC processes (Dillenbourg, 2002), and others might be too subtle to have an effect on learners' self-regulation or the co-regulation of the group (Phielix, Prins & Kirschner, 2010). Can SNS, like Facebook, productively host argumentative knowledge construction? How can the combination of rather coercive scripts, and less coercive group awareness tools (GATs), foster the development of learners' AKC?

Argumentation scripts

Argumentation scripts are a prominent approach to foster AKC in CSCL environments (Noroozi, Weinberger, Biemans, Mulder, & Chizari, 2012). *Scripts* are socio-cognitive structures that specify learners' interactions in collaborative learning scenarios, aiming to either activate existing internal scripts, organize, or re-organize internally represented pieces of information, mostly declarative, that may constitute new elements of scripts (Fischer, Kollar, Stegmann & Wecker, 2013). Internal scripts are already represented in the learners' cognitive system that are prone to change and adaptation. External scripts suggest collaborative processes and can change the learners' behavior over time through internalization (Kollar, Fischer & Slotta, 2007). In terms of collaborative argumentation processes, the internalization of an external script can guide learners to structure, discuss about, and reflect on their arguments, which can foster knowledge co-construction, argumentative and domain-specific knowledge (Weinberger, Stegmann & Fischer, 2010), and structure students' discussion of conflicting opinions (Jermann & Dillenbourg, 1999; Felton & Kuhn, 2001). In the ArgueGraph script (Jermann & Dillenbourg, 1999 & 2002; Kobbe, Weinberger, Dillenbourg, Harrer, Hämäläinen, Häkkinen & Fischer,

2007), differences in opinions on seminar topics were represented to the students in order to increase socio-cognitive conflict. Students were then asked to resolve these differences in dyads and reach an agreement by writing arguments derived for their learning materials. Discourse analysis showed that students often provided conditional responses, in accordance with the high-order learning goal of the course.

Group awareness tools

GATs are used in CSCL scenarios to enhance collaboration processes and also to foster domain-specific knowledge by giving students information about other learners, such as individual knowledge (Janssen & Bodemer, 2013). GATs can reveal inconsistent knowledge or differences of views and thus enhance controversial CSCL discussions, and impact group processes, like socio-emotional and motivational processes that are meant to support AKC (Buder & Bodemer, 2008). GATs also make group processes or attitudes explicit, for instance by visualizing how learners evaluate their own and the group's cognitive and social interactions (Phielix, Prins, Kirschner, Erkens, & Jaspers, 2011). Group awareness of knowledge distribution in the group has been shown to counteract negative effects of overly high levels of both mutual trust and mutual skepticism (Engelmann, Kolodziej, & Hesse, 2014). Moreover, GATs have been shown to enable group processes that may support knowledge co-construction, like mutual modelling, (Sangin, Molinari, Nüssli & Dillenbourg, 2011), and group conflict (Phielix, Prins & Kirschner, 2010). There are first indications of positive effects of GATs on learning gains (Sangin et al., 2011). In particular, GATs that visualized cognitive conflict in the form of discrepancies in the group solutions (Bodemer, 2011) or of summary of anonymous opinions (Buder & Bodemer, 2008) have been found to enable collaborative discussion of conflicting perspectives, foster individual learning gains, and increase critical argument elaboration during collaboration, as well as individual and group attitude change. GATs are positively related to performance and process satisfaction (Phielix et al., 2010) and can prove particularly useful for learning in SNS such as Facebook to help group members consider the distribution of knowledge and attitudes, spot their own positions in relation to other members. Such group awareness may foster socio-cognitive conflict, in the sense of social tensions (e. g., why is my position different to others?) and personal dissonance (e. g., how can I bridge two contradicting views?).

Attitude change

Attitude change has been investigated in the context of argumentative knowledge construction in young students (Kuhn, Shaw, & Felton, 1997), showing a tendency to more stable positions with increasing age, and in computer-mediated communication, revealing lack of readiness to consider alternative perspectives when attitude markers are salient (Sassenberg & Boos, 2003). Argumentative processes, like taking into account multiple perspectives and resolving conflicting opinions appear to facilitate attitude change (Eagly & Chaiken, 1995; Erber, Hodges, & Wilson, 1993) and may ultimately lead learners to re-consider initial standpoints (Tsovaltzi et al., 2013). Moreover, vocational training includes practicing attitude and communication at the work place (Nasir, 2002), e.g. for medical doctors (Caralis & Hammond, 1992) and teachers (Ihmeideh & Al-omari, 2010). Theory on attitude change supports that change is the result of dissonance that can be caused by cognitive conflict between different attitudes of the same person (Eagly & Chaiken, 1995; Erber, Hodges, & Wilson, 1993). Such conflicts could potentially be made salient with GATs and productively resolved with scripts. GATs may contribute to making learners' ideas, misconceptions, and contradictions accessible to scrutiny (Nussbaum, 2008). Scripts have been found to effectively specify and support how learners jointly argue to address conflicts (Weinberger et al., 2010).

We investigate the effects of a GAT and argumentation script on domain-specific learning outcomes, learning processes, and attitude change. We conjecture that the GAT will induce socio-cognitive conflict and will translate into argumentative processes. We also conjecture that the argumentation script will foster the quality of arguments in the discussion. Therefore, they will both increase the domain-specific learning gains. The combination of both factors will interact in a positive way. We also hypothesize a positive effect of the GAT on attitude change.

Methods

We conducted a 2×2 quasi-experimental field-study with German teacher trainees ($N=105$) and factors GAT and argumentation script. Participants were taking part in a seminar on "Communication and Interaction". In the intervention, all participants attended weekly seminars where a new theory on communication was presented and discussed. After the seminar, the students had to fill out a questionnaire about their communication attitude. Seminar groups were accompanied by Facebook groups, where students weekly received a theory-related task that required them to interact and discuss online within five days. The study was part of the seminar and lasted the whole semester. Students had to fill out the communication attitude questionnaire on nine sessions and were

instructed to reflect on the seminar theories while filling in the questionnaire. On eight sessions, an argumentation script was given as feedback to the quality of the written arguments.

Before the intervention all participants took a knowledge pre-test, and filled in a questionnaire on socio-demographic data, subjective knowledge in the domain “Communication and Interaction”, computer and Facebook use behavior. In addition they filled in a communication attitude questionnaire and the experimental conditions were familiarized with the GAT. Similarly, after the intervention at the end of the semester, all participants took a knowledge post-test and filled in another questionnaire on their subjective learning gains and their acceptance of the learning environment.

Group awareness tool

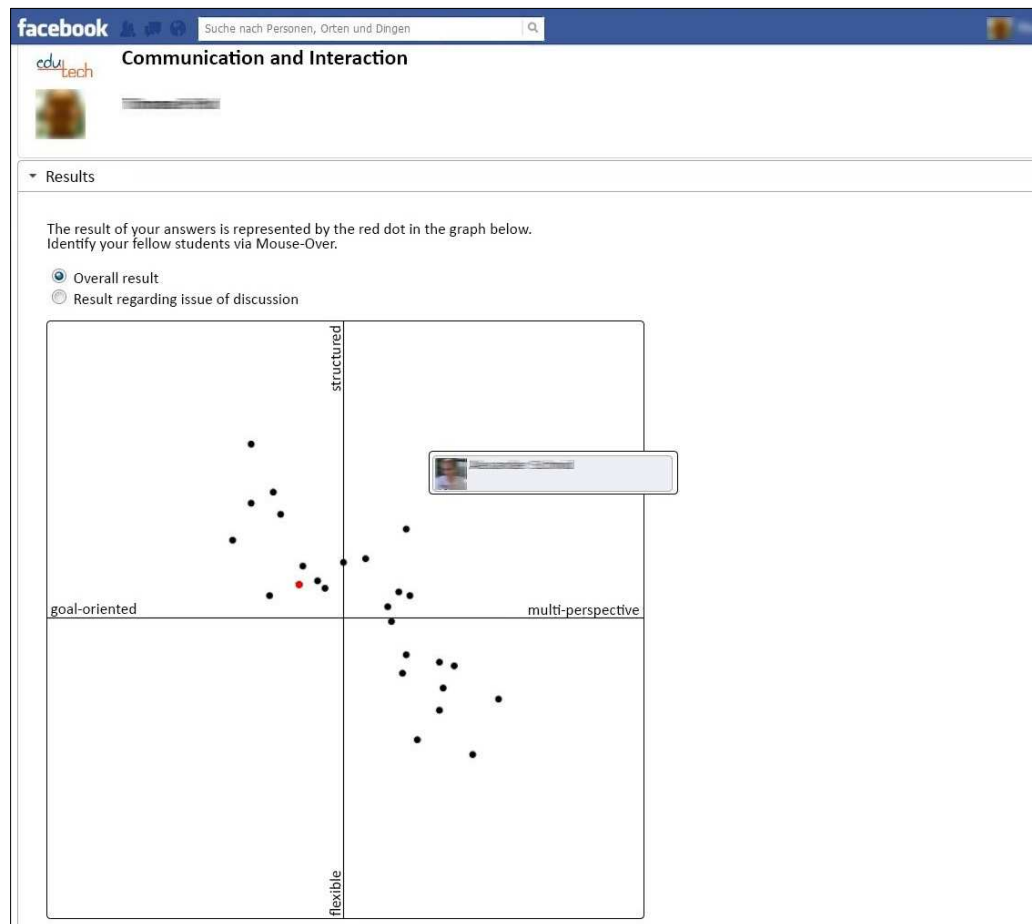


Figure 1. Group awareness tool in Facebook

Students receiving GAT-based support reflected on their hypothetical personal communication attitude as a teacher by answering a case-based communication questionnaire with cases from every-day social interactions in the school. Every scenario was followed by four Likert-scaled answers, focusing on how a teacher may reflect on and behave in the situation. Moreover, the questions differed with respect to whether the emphasis was on multi-perspective / flexible attitudes vs. goal-oriented / structured attitudes, following Buder & Bodemer (2008) and Jermann & Dillenbourg (1999, 2002), both rated on a scale from 0 to 6. The result of the questionnaire was presented to the experimental groups with a GAT implemented as a Facebook app. The app graphically visualized the position of a student with respect to communication attitude in relation to other students. The position in the graphic is represented as relative to the position of the whole seminar group (I vs. the others). The GAT also gave them the opportunity to identify the person behind a position by moving the mouse over the point on the graphic to see the name and a photo of the person (Figure 1), so the discussions were not anonymous. The design of the GAT is oriented on the ArgueGraph script (Jermann & Dillenbourg, 1999) and aims at increasing socio-cognitive conflict. ArgueGraph was adjusted to the Facebook learning environment. That is, considering the Facebook dynamic, which means frequent interactions in the large group and less

discursive discussions compared to a small group CSCL scenario, we used a less coercive instruction and did not force the students to reach an agreement.

Argumentation script

Students in the condition with script-based support received a weekly argumentation script in the form of feedback to arguments posted in the Facebook group discussion. They had to read all arguments of the discussion and “like” the best argument in their own opinion. Feedback was given to every group for the most liked argument and also for the best argument in the opinion of the teacher. The feedback to these two arguments evaluated the epistemic (theoretical concepts and relations) and the formal (reasoning and evidence) quality of arguments for the two selected arguments. It also indicated whether an important part of the argument was missing or illustrated how a sound argument should look like. While the structure and the ontology of the script were standardized, it was also important to adapt the script to the different weekly tasks and the different arguments from each group.

Instruments

Domain-specific knowledge was assessed by a course exam at the end of the semester containing definitions, facts, and higher order discursive processes like theory-based interpretations and argumentations. The knowledge test included 10 multiple choice items and 13 open questions with a high inter-rater reliability $k=.88$, $p=.000$. The internal consistency of the knowledge test was good ($\alpha = .69$).

Process analysis was based on Weinberger & Fischer (2006) on multi-level analysis of AKC processes and on an adapted version for argumentation in Facebook (Tsovaltzi, Judele, Puhl & Weinberger, 2014). We measured epistemic and formal quality of arguments. The formal quality of arguments ($k=.80$, $p=.000$) was measured by the correct formal structure of the argument (e.g. if justifications were used for every argument), the quality of the justification and the quality of the reference. We evaluated the quality of justifications by giving a score of three points for references to scientific results, two points for examples that may be used to explain the content of an argument, and one point for every-day knowledge that provides some potential insight but without scientific evidence. The actual citation of references was evaluated in addition to the justification. The quality of references was rated with two for a scientific reference (e.g. journal paper) and one for a link to a relevant internet site (e.g. wikipedia). The *epistemic quality* ($k=.76$, $p=.000$) was measured by the quality of the used concepts or theories and the relations between them. We evaluated the quality of theories advocated in the arguments by giving a score of three points for a related theory to the discussed topic, which is the theory/theories of the week, two for using the theory of the current week, and one for subjective theories that have no scientific background. A relation drawn between current and other theories was also rated with three and added to the overall score for epistemic quality. The posts from the second seminar sessions in the Facebook group were not analyzed because of a different weekly task. The students were given a task to reflect on non-verbal communication and post a personal experience they had in this week. Therefore there was no discussion in this week and no arguments to analyze.

Communication attitude change was measured using the results of the communication questionnaire. The questionnaire was based on the *situation assessment test for consulting* (Keller, Bruder & Schmitz, 2010) and used scenarios to assess the communication attitudes of the participants. Contrary to the elaborated scenarios in the consulting questionnaire, the scenarios in the communication attitude questionnaire are concise for students to fill in on a weekly basis. Students were asked to reflect on the communication situations in the questionnaire and indicate how they would behave as teachers in the sketched situations. For example, a scenario presented the situation in which most of the students failed in a test. The teacher could either handle this situation by simply ascertaining that they did not study enough, or by discussing with them what they thought was the problem. Furthermore the teacher could offer to repeat the test, or discuss different possibilities with the students such as repeating the test or talking about the situation with the school principle. There are no correct answers to the questionnaire, but different theories from the ones taught in the seminar could support the different options (Puhl, Tsovaltzi & Weinberger, in press). Students expressed their attitude by indicating their agreement on the Likert scale described in the Section Group Awareness Tool.

Findings

There were no significant differences in the socio-demographic data, the Facebook use and the knowledge test prior to the intervention. Log data confirmed that all participants spent time looking at the graph as an indication of reflecting upon it.

Process analysis

Using an ANOVA with repeated measures (sessions 1 and 3-8), the process analysis showed a significant effect for the interaction between time and epistemic quality, $F(6;606)=3.81$; $p<.001$; $\eta_p^2=.10$, and between time and formal quality, $F(6;606)=1.88$; $p=.015$; $\eta_p^2=.053$. Descriptive statistics also show that the epistemic quality did not change in the control group throughout the semester but increased for both groups with argumentation script. The formal quality also only increased for argumentation script and decreased for the control group (Figure 2).

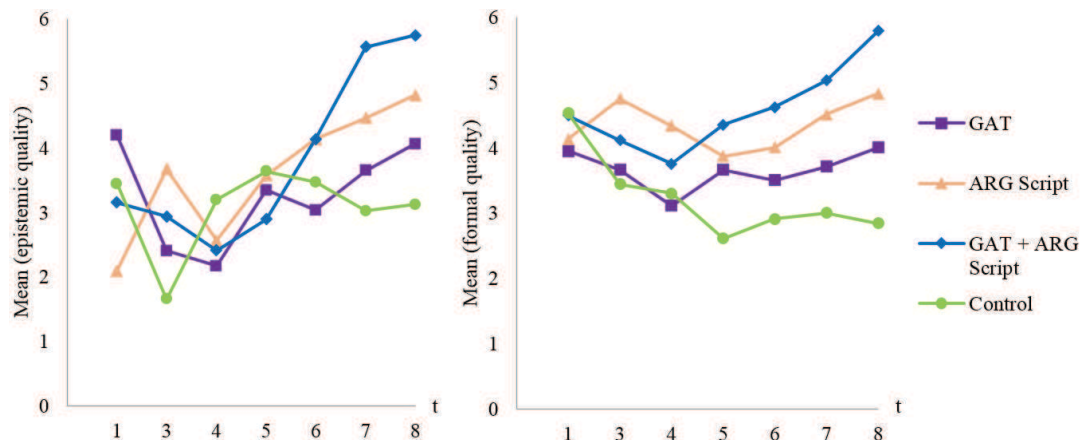


Figure 2. Epistemic and formal quality of arguments

To identify when the argumentative processes took shifted, we did simple contrasts comparing each session from the 3rd to the 8th time with the first session. On the epistemic dimension we found a decrease for three groups from the first time of measurement to the third. Only the experimental group with argumentation script increased the epistemic quality of their arguments. Until the fifth time of measurement all groups are close together and simple contrasts were not significant. Substantial and significant changes occurred from the first to the sixth time of measurement, $F(3;101)=5.70$; $p=.001$; $\eta_p^2=.15$, and all contrasts are significant until the end of the interventions. A similar process was observed on the formal quality of arguments. Descriptive statistics show that all groups are close until the fourth time of measurement, after that they diverged and simple contrasts are only significant between the first and the last time of measurement, $F(3;101)=5.98$; $p=.001$; $\eta_p^2=.15$.

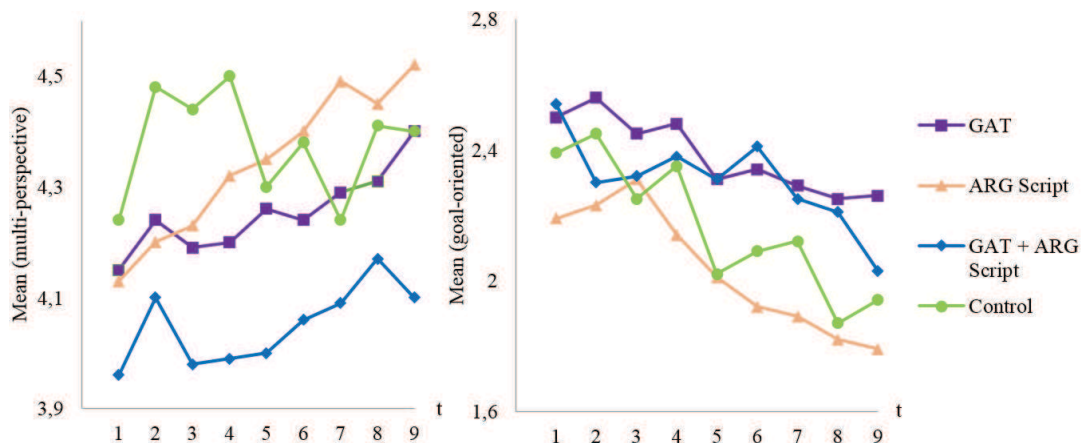


Figure 3. Multi-perspective and goal-oriented communication attitudes

Using an ANOVA with repeated measures, we found significant main effects on communication attitude change over the seminar period for both multi-perspective, $F(8;800)=2.98$; $p=.003$; $\eta_p^2=.03$ and goal-oriented dimensions, $F(8;800)=14.2$; $p<.001$; $\eta_p^2=.12$, but no significant effect for the interaction between time and group. Descriptive statistics also showed that attitudes increase on the multi-perspective dimension for the experimental groups and independent from the groups. Simple contrasts showed a significant main effect for the factor time from the first date of measurement to the second, $F(3;100)=4.33$; $p=.04$; $\eta_p^2=.04$, and also the changes from date one to eight and one to nine are significant, $F(3;100)=5.38$; $p=.004$; $\eta_p^2=.08$ (Figure 3). The

attitudes decrease on the goal-oriented dimension for all groups and simple contrasts are significant for the factor time as of the fifth time of measurement until the last date, $F(3;100)=16.58$; $p=.000$; $\eta_p^2=.25$.

Knowledge outcomes

We found a significant effect for the experimental groups in domain-specific learning gains, $F(3;102)=11.11$; $p<.001$; $\eta_p^2=.25$. Three participants did not take part in the final exam. The descriptive statistics show an increase in learning gains from the control group to the experimental groups (Table 1).

Table 1: Domain-specific knowledge, mean and standard deviation

Group	Control (n=19)	GAT (n=29)	ARG-Script (n=29)	GAT+ARG-Script (n=25)
<i>M (SD)</i>	34.08 (6.53)	39.81 (5.42)	41.34 (4.38)	42.52 (4.33)

Besides significant main effects for the two factors (GAT: $F(1;98)=11.24$, $p=.001$, $\eta_p^2=.10$; Argumentation script: $F(1;98)=23.44$, $p=.000$, $\eta_p^2=.19$), we also found a significant effect for the interaction between GAT and argumentation script, $F(3;102)=4.89$; $p=.029$; $\eta_p^2=.05$. The factor argumentation script shows higher learning gains (Figure 4).

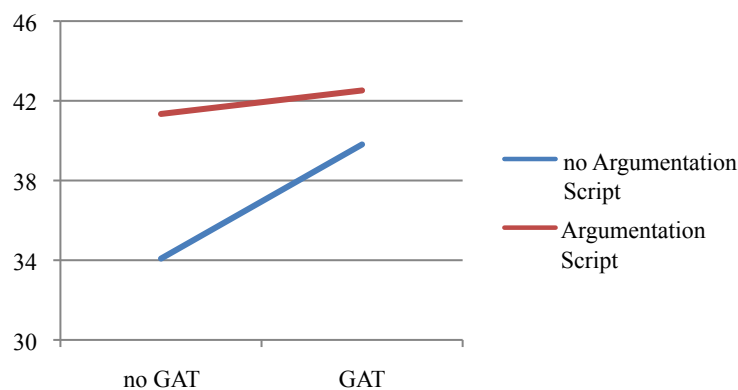


Figure 4. Domain-specific knowledge

The epistemic quality of arguments from the last time interval correlates with domain-specific knowledge $r(102)=.24$, $p<.05$, and formal quality of arguments also correlates with domain-specific knowledge $r(102)=.29$, $p<.01$. Correlations between communication attitudes and learning outcomes are not significant.

Conclusions and implications

As hypothesized, the GAT and the script guided learners to acquire more domain-specific knowledge and improved learners' quality of arguments. The argumentation script seems to outperform the GAT with respect to both of these variables. The combination of both instructional approaches shows the best results on all variables. Notably, the effect of GAT and script on the quality of arguments seems to set in only after 4-5 weeks of the seminar, indicating that it takes time to develop strategies for building high quality arguments and respective knowledge. By the same token, it may be very difficult in short-term interventions to raise quality of arguments and even more difficult to increase domain-specific knowledge (Wecker & Fischer, 2014). It has been argued that learners are overwhelmed in short-term learning environments to consider both, the quality of arguments and acquire domain-specific knowledge. Long-term interventions, in contrast, can realize AKC that facilitates both, argumentative and domain knowledge. Consequently, the relation between AKC processes and outcomes appears to develop over time.

Learners' attitudes shifted on the multi-perspective dimension after the first seminar week from the baseline to the second measurement time. Since the first intervention took place after the second measurement time, the change from first to second time cannot depend on the two factors, but rather on the content of the seminar. The communication theories from the first session specifically address the multi-perceptivity of understanding messages and the students were always instructed to reflect on the seminar theories while filling out the communication attitude questionnaire. Over the entire seminar period, all experimental groups incl.

control group developed on the multi-perspective dimension. All groups declined on the goal-oriented dimension over time. While these attitude changes may derive from the seminar theories independent of GAT or script, it goes to show that learning and attitude change are not linear processes. Over the seminar period there were no significant differences between the groups, which is contrary to prior findings showing that groups with higher coercion awareness tools surpassed groups with lower coercion awareness tools (Puhl et al., in review). This potentially means that interventions of group awareness and higher coercion (e.g. scripts that prompt learner's to reflect on the visualized group awareness revealing conflictual ideas and attitudes) can rather influence attitudes.

This study extended CSCL research on scripts and group awareness tools to SNS. It thus provided insights into long-term effects of these instructional approaches of CSCL. While these approaches do not produce the expected short-term effects on domain-specific knowledge (Wecker & Fischer, 2014), this study shows that such effects can still emerge in the long run.

In contrast to popular views, SNS can serve as a platform for argumentation and learning. The results in this study reveal that learning to argue may take a social environment, in which groups develop shared argumentative practices over time. SNS may offer themselves as such an environment. Two main directions may be taken from here. First, SNS can host long-term studies that can contribute to understanding and facilitating argumentative learning in social communities. Second, massively used online fora like SNS offer the possibility for technological interventions such as the ones investigated here. SNS may be leveraged to develop practices of argumentation on a large scale.

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