

# Inducing socio-cognitive conflict in Finnish and German groups of online learners by CSCL script

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**Abstract** Collaborative learners are often meant to be guided by collaboration scripts to identify, discuss, and resolve differences of opinion and knowledge. How learners engage in and resolve conflict, however, may be highly dependent on learners' cultural background. In this article, we examine the extent to which a peer-critique collaboration script induces socio-cognitive conflicts within Finnish and German groups of online learners. In a 2×2-design (Finnish/German × without script/with script), we analyzed online discussions in a problem-based learning environment of 16 German and 28 Finnish groups of three (132 participants in total) with or without script support. Trained coders rated the extent to which learners engaged in socio-cognitive conflicts, by indicating either agreement or disagreement. The results show that the peer-critique script could develop socio-cognitive conflicts. The German groups were affected more strongly by the script, even though the interaction patterns of unscripted German groups were already more conflict-oriented than those of unscripted Finnish groups. Agreement in Finnish groups mostly indicated that learners integrate arguments of learning partners into their own line of reasoning. Agreement in German groups, however, served coordination and continuation of discourse, e.g., by indicating comprehension of others' ideas. The results showed that learning environments and collaboration scripts need to be designed with respect to culture. Furthermore, the findings emphasized that findings on computer-supported collaboration scripts cannot simply be generalized across different cultures.

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 Cross-cultural studies · Script theory of guidance 30  
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### CSCL across different cultures 32

Recent technological and social developments entail that specific, computer-supported 33  
 learning scenarios are used in different cultures (Weinberger et al. 2007a). Computer- 34 Q4  
 supported collaborative learning (CSCL) often incorporates scaffolding of specific interac- 35  
 tion patterns, which involve engaging and resolving conflicts and which may be highly 36  
 grounded in a culture of origin and not easily portable across cultures (see Tapanes et al. 37  
 2009). Building on prior CSCL research – especially a study by Weinberger et al. (2005) – 38  
 on online learning environments that support argumentative knowledge construction in 39  
 discussion boards with collaboration scripts, we investigate the extent to which a specific 40  
 computer-supported collaboration script can induce socio-cognitive conflict in culturally 41  
 homogeneous groups of Finnish and German online learners and hence, to what extent 42  
 learning by socio-cognitive conflict can be facilitated in cultures with different conflict 43  
 resolution styles. 44

Learning through socio-cognitive conflict: Conflict-oriented consensus building, 45  
 transactivity, and shared thematic focus 46

Many—mainly Western—researchers have built on the Piagetian approach of socio-cognitive 47  
 conflict. Their research shows that critically reviewing each others' contributions for elaborat- 48  
 ing and improving shared knowledge can be highly beneficial for collaborative learning 49  
 (Johnson and Johnson 2009). In the socio-cognitive conflict perspective, collaborative learners 50  
 that engage in *conflict-oriented consensus building*, i.e., learners criticizing, modifying or 51  
 substituting each others' contribution to discourse with the goal to productively resolve the 52  
 conflict and arrive at a joint conclusion (Weinberger and Fischer 2006), may eventually 53  
 accommodate their individual cognitive structures (De Lisi and Goldbeck 1999). 54

Recent approaches to collaborative learning highlight, that conflict-oriented consensus 55  
 building may be one among other social modes that are conducive to learning, not because 56  
 learners mutually challenge each other's mental models, but because learners who argue 57  
 with each other relate to and actually operate on the reasoning of their peers in what has been 58  
 termed *transactive* talk (Berkowitz and Gibbs 1983; Weinberger and Fischer 2006). 59  
 Transactive talk can serve productive resolutions of socio-cognitive conflict and 60  
 construction of shared knowledge (Teasley 1997). Critique is indicative of transactive 61  
 talk when learners pinpoint specific aspects of discourse contributions and modify 62  
 what learning partners have said. For doing so, learners needed to interpret and build 63  
 on what their partners had expressed. 64

Whereas transactivity has been related to the question of *how* learners build on contri- 65  
 butions of their peers in terms of more or less explicitly agreeing or disagreeing with each 66  
 other, in transactive talk learners also need to relate to *what* has been said in terms of talking 67  
 about the same issues to share knowledge and productively resolve socio-cognitive conflict. 68  
 In other words, the question may not be how learners agree or disagree with their peers' 69  
 positions, but also the extent to which learners *share thematic focus*. When learners discuss 70  
 and apply multiple perspectives on one and the same aspect of the task, they thematically 71  
 relate to what their learning partners are saying; and vice versa, learners may share focus in 72  
 collaboratively applying similar concepts to different aspects of a problem. 73

Taking all this together, the socio-cognitive conflict approach would suggest that learners first expound their different perspectives and contribute similar amounts of mainly unshared or divergent knowledge to complex tasks that allowed for multiple perspectives in the first place (Weinberger et al. 2007b). Second, learners are supposed to identify and transactively refer back to the identified different perspectives with the goal of resolving socio-cognitive conflicts and arriving at a joint conclusion. Critique of the socio-cognitive conflict perspective mainly relates to deficits of the individual learners to being willing and able to engage in and resolve socio-cognitive conflict (Limón 2001). We will therefore firstly outline a means of instructional support for inducing and productively resolving socio-cognitive conflict. Another critical perspective casts a more essential doubt on the socio-cognitive conflict approach, i.e., that conflict may have different connotations and afford different resolution styles across different cultures. For instance, learners collecting and integrating different perspectives rather than engaging in conflict-oriented consensus building may likewise engage in transactive talk and benefit from learning together. Drawing conclusions on how to understand collaborative learning and how to design learning environments based on socio-cognitive conflict may be particularly problematic when applied across different cultures with different conflict resolution styles. We therefore secondly discuss how collaborative learning by conflict may or may not align with different cultural standards.

#### Instructional support through external scripts for CSCL

Socio-cognitive conflict can be induced through collaboration scripts that specify, sequence, and distribute roles and activities. Online learning environments implementing computer-supported collaboration scripts or CSCL scripts have become an attractive choice for facilitating groups of online learners (Fischer et al. 2007). To foster critical and reflective activities in CSCL, the interaction of learners has been structured by restricting the set of communicative possibilities (Pfister and Oehl 2009; Salminen et al. 2010) or by prompting learners to take over specific roles and engage in specific discourse activities (Furberg 2009; Schellens et al. 2009; Weinberger et al. 2005). Scripts have been applied in elementary schools, colleges and universities in different, mainly European countries, e.g., Belgium, Germany, Greece, Spain, and Switzerland. Being mainly applied in problem-oriented learning environments, the research focus was on complex and applicable knowledge, as well as on domain-general knowledge, such as argumentative knowledge. Although scripts have been investigated in both field and laboratory studies, mostly near transfer was being investigated (Fischer et al. 2007).

The Script Theory of Guidance (SToG; Fischer et al. 2013) states that internal and external collaboration scripts guide learners' activities in CSCL. The internal collaboration script, on one hand, is the culturally shared, procedural knowledge of a learner on how to act in a specific collaborative learning situation. Thereby, internal scripts guide the learner's understanding and actions in collaborative learning. However, an internal script is not a stable, inflexible structure. Instead, a configuration of script components at different levels is built up dynamically during a particular instance of collaboration. The learner's set of goals and perceived situational characteristics also influence which configuration of internal script components is being activated.

The external collaboration script, on the other hand, is the verbally, textually or graphically represented instructional information on how to interact (including the constraints and affordances of a specific situation as well as including individual activities in the context of collaboration, e.g., reading of texts). The individual activities of learners emerge as a consequence of the way in which the external script representations activate learners' internal collaboration script components.

The SToG defines an optimal external scripting level, suggesting that scripts are most effective if they provide scaffolds for subordinate internal script components that are not already available for the learner, whereas redundant script components would afford conscious processing of unnecessary information. An external script addressing internal script components that are not available will usually lead learners to apply similar, but less functional internal script components (i.e., “argue to persuade” instead of “argue to collaboratively construct knowledge”).

Recent CSCL script research has focused on how to facilitate learners’ argumentation as a means to foster critical and reflective activities and argumentation skills (Noroozi et al. 2012; Stegmann et al. 2007). Stegmann et al. (2007) studied the effects of two different argumentative scripts on argumentative knowledge construction in online discussions: The *script for the construction of single arguments* supported the construction of arguments by providing an interface of the discussion board by a set of input text boxes. Each text box was to be filled out by the learners to construct a completely explicit argument consisting of a claim, warrants, and qualifiers. In addition, the students could write questions and comments or expressions of emotion directly into the main input text box. The *script for the construction of argumentation sequences* automatically pre-set the subject of the posted message. The first message of a discussion thread was labeled “Argumentation”. The answer to an argument was automatically labeled as “Counter argumentation” and a reply to a counterargument was labeled “Integration”. The next message was again labeled counterargument, then integration and so on. Learners were to analyze and discuss problem cases building on Weiner’s (1985) attribution theory. Results of the study showed that the scripts substantially facilitated construction of arguments and argumentation sequences.

Schellens et al. (2009) focused on practicing students’ problem solving skills and developed a script, which provides a list of message types that correspond to the steps of critical thinking, namely problem identification, definition, exploration, applicability, and integration. Learners were to discuss a provocative column on the role of ICT for education from multiple perspectives. When creating a message in a discussion board, students were asked to select from the list of aforementioned message types. Whereas unscripted groups frequently digressed and engaged in superficial and repetitive debates, scripted learners were more focused and more original in what they contributed to the discussion. Overall, the scripted learners significantly exceeded the levels of critical thinking compared to unscripted learners.

Salminen et al. (2012) investigated whether structured (scripted) chat interaction, when compared to unstructured chat interaction, supported secondary school students’ critical and elaborative argumentation. The unstructured chat students used was a regular synchronous textual chat. The structured chat tool consisted of four categorized sets (argument, explore, opinion, comment) of either full or partial sentences called templates (22 in total). The task of the students was to select an appropriate template and, when they selected a partial sentence template, to complete it with their own ideas. The results suggested that the structured (scripted) chat environment evoked students’ counter-argumentation, even on topics that do not spontaneously provoke conflicting viewpoints, like gender equality. The structured chat also seemed to equalize communication between females and males.

Furthermore, Weinberger et al. (2005) developed peer-critique and epistemic scripts for two different CSCL environments, one based on discussion boards and one on videoconferencing technology. The epistemic scripts guided learners to engage in a series of problem solving steps, namely identifying the relevant problem information and applying the respective theoretical concepts to that information. The peer-critique script for discussion boards distributed responsibility for one of three problem cases and the roles of one case analyst and two critics over the groups of three. Results (with a German sample) have shown that the

peer-critique scripts for both CSCL environments (discussion boards and videoconferencing) facilitated learning outcomes. The epistemic script facilitated the problem solving performance of learners working collaboratively, but did not facilitate individual learning outcomes in the videoconferencing environment and hampered individual learning outcomes in the discussion board environment.

## Conflict resolution and culture

How conflicts are being resolved may depend on a number of context aspects, such as scaffolding within a specific learning environment, but also learner characteristics and cultural background. Hofstede (1980) defines culture as “the collective programming of the human mind that distinguishes the members of one human group from those of another” (p. 21). Learners of different cultural backgrounds seem to have different conflict resolution styles (i.e., different internal scripts) that may be more or less suited for transactive or argumentative forms of discourse (Metcalf and Bird 2004). Three conflict resolution styles have been identified in cross-cultural research (Oetzel and Ting-Toomey 2003; Putnam and Wilson 1982): domination, integration, and conflict avoidance. A dominating style is characterized by exertion of control and force, low tolerance for alternative views, and it is oriented towards competition. An integrative conflict resolution style is characterized by compromise, high regard for one’s own and other views, and orientation towards the issue and its solutions. Conflict avoidance is characterized by non-confrontational, obliging behavior, low concern for own view, and orientation towards co-existence.

These three conflict resolution styles have been found to be linked to the cultural dimension of masculinity / femininity identified by Hofstede (Metcalf and Bird 2004; Zhu et al. 2009). Masculine cultures are regarded as more assertive and competitive favoring dominating over integrative conflict styles and less modest and caring than feminine cultures. Yet, most cross-cultural comparisons do not move beyond Hofstede’s dimensions identified by self-reports and do not gear these dimensions to actual behavior or differences of individuals or groups (Hofstede and McCrae 2004; McCrae and Terracciano 2005). For instance, Walsh et al. (2003) examined self-construal and conflict styles in online learning environments by conducting face-to-face or e-mail interviews with three participants each from six cultural groups who had lived in the USA for several years (Anglo-American, Eastern Asian, Indian Subcontinent, Hispanic American, Middle Eastern, and Native American). Walsh et al. (2003) used projective interviews in which participants were asked to imagine and describe their response to three hypothetical scenarios of online learning, one of which concerned conflict in online discussions. Most of the responses on conflict behavior reported represented interdependent self-construal regardless of the participants’ cultural background.

In contrast, Zhu et al. (2009) compared Chinese and Flemish students’ preferences as well as actual behavior in a CSCL environment. Although Chinese students initially expressed a preference for interacting and learning in online discussions, Flemish students appeared to exert higher levels of critical thinking, elaboration, and self-regulation in the actual online discussions. Here, Western and Eastern cultures are being compared that are known to differ largely in many respects.

Hardly any CSCL research compares cultures that are similar with respect to the cultural dimensions but that differ with respect to behavior and conflict styles. One of the few comparisons of online students from similarly individualistic cultures, Finland and USA, finds that Finnish students show more group-focused and reflective contributions, e.g., composing summaries of their discussions that included theoretical references, and U.S.

students contributed more action-oriented and pragmatic messages in terms of asking for or providing solutions to a case (Kim and Bonk 2002). This study, however, evaluates interaction in a joint intercultural seminar without analyzing conflict resolution styles of the respective cultures in controlled settings.

When focusing on two cultures, Finland and Germany that are in the same cultural cluster, i.e., are highly similar with respect to most of the cultural dimensions according to Hofstede (1997), investigating actual behavior differences may elucidate how a specific, conflict-oriented approach to CSDL can play out in two distinct, but similar cultures. Thus, we investigate whether there are such behavioral differences or similarities between two specific cultures that share cultural standards. In the substantial tradition of Hofstede-inspired studies, we simplify by speaking of Finnish and German culture without differentiating between potential cultural sub-groups within those nations (Taras and Steel 2009).

Finns and Germans have been found very comparable with respect to all cultural dimensions, but slightly different with respect to masculinity / femininity, with German culture being more masculine than Finnish culture. Thus, it could be expected that on average Germans exert and expect a slightly more dominant conflict resolution style than Finns (Metcalf and Bird 2004; Metcalf et al. 2006). However, there is yet modest knowledge on behavioral differences between Finns and Germans. Moreover, the empirical basis for predicting behavior such as conflict style based on the scores of Finns and Germans on Hofstede's cultural dimensions is small and based on surveys and expert judgment rather than observations (Metcalf and Bird 2004). Specific behavior in given contexts, e.g., discussions in a specific online environment, may be influenced to a larger extent by situational constraints of that environment than by the shared cultural background of the participants (Walsh et al. 2003). However, cultural background, personality traits, and a given environment may interact in shaping behavior of individuals and small groups of learners (Hofstede and McCrae 2004).

Culturally homogeneous groups may share and thus enforce specific patterns of conflict resolution. Tracing interaction patterns within culturally homogeneous groups as indicative of "programming of the mind" may advance cross-cultural research beyond assessment of diverging value orientations through self-reports. Behavioral data may help to identify the procedural knowledge or internal scripts that learners share within one culture (Weinberger et al. 2007a).

Since conflict resolution styles have been regarded to differ between cultures, socio-cognitive conflict may account for collaborative learning to different degrees in different cultures. Learning by socio-cognitive conflict could be additionally supported, e.g., through arranging conditions beneficial for critical peer interaction or collaboration scripts; however, a profound reason for avoiding conflicts in peer interaction, such as specific cultural standards of learners, may not only be resistant to instructional support for socio-cognitive conflict, but possibly interact with support for socio-cognitive conflict in harmful ways. To what extent can learning through socio-cognitive conflict be facilitated in cultures with different conflict resolution styles?

## Research questions and hypotheses

In this work, we examine to what extent cultural differences can be found on the level of learning activities during online discussions and subsequently on knowledge acquisition. In addition, we examine to what extent instructional means may have different effects on



processes and outcomes of learning within different cultures. We examine the following two research questions.

RQ1: To what extent do culture (Finnish vs. German), a peer-critique collaboration script (with vs. without), and the interaction thereof affect transactivity and shared thematic focus during online discussions?

As elaborated above, we assume certain differences between Finnish and German students in conflict resolution styles and consequently, transactivity. As outlined above, we regard transactivity as a two-dimensional feature of behavior during collaboration. One dimension addresses the *type of consensus building* including conflict-oriented consensus building, integration-orientated consensus building and quick consensus building. A second dimension concerns to what extent learners *share thematic focus*. The differences between cultures may not affect the shared thematic focus (i.e., similarity of content of arguments) of discussion, but may affect conflict-oriented consensus building and integration-orientated consensus building. Based on the reported differences in Finnish and German culture (cf. Hofstede 1980; Metcalf et al. 2006), we expect that Finnish students would show more integration-orientated consensus building while German students would show more conflict-oriented consensus building. Regarding the peer-critique script, Weinberger et al. (2005) found a positive effect of the peer-critique script on transactivity during online discussions of German university students. We assume that the script has a positive effect on transactivity and shared thematic focus in general, i.e., the script may increase shared thematic focus, conflict-oriented consensus building, and integration-orientated consensus building, while it may decrease quick consensus building. However, it is an open question to what extent culture (Finnish vs. German) and the peer-critique script interact, i.e., whether the same instructional means has the same effect on learning processes across cultures. If learners in a specific culture already engage in integration-orientated consensus building spontaneously, the script would be expected to have less effect on integration-orientated consensus building.

RQ2: To what extent do culture (Finnish vs. German), a peer-critique collaboration script (with vs. without), and the interaction thereof affect the knowledge acquisition through online discussions?

A previous analysis (Weinberger et al. 2005) showed a positive effect of the peer-critique script on knowledge acquisition of German University students. We expect to show the same effect in this study. Due to a lack of previous research, we do not explicitly assume differences between Finnish and German students in knowledge acquisition.

## Methods

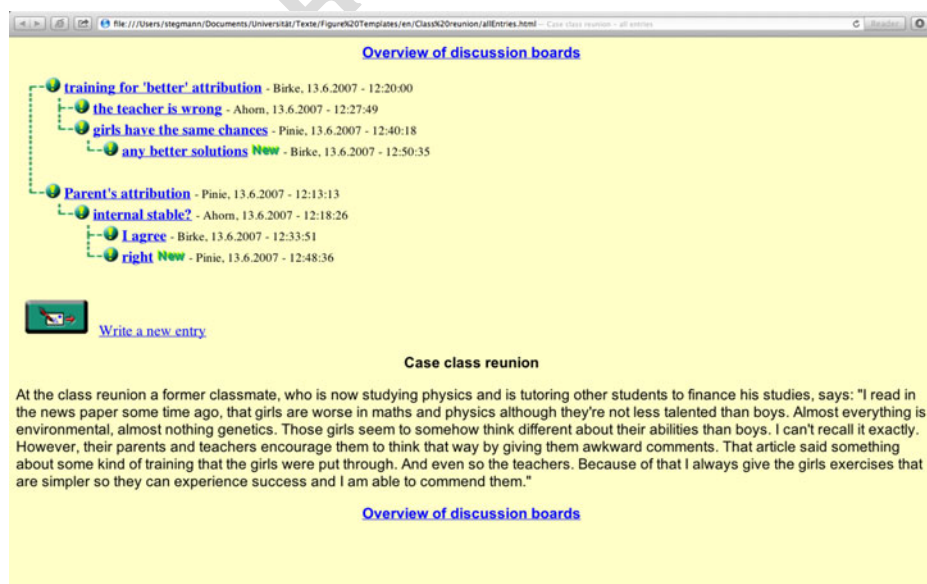
### Participants

In a  $2 \times 2$ -design (Finnish/German  $\times$  without/with peer-critique script) of this quasi-experimental, cross-cultural study, we analyzed online discussions of 28 Finnish and 16 German groups of three (132 participants in total). The study was conducted at the University of Jyväskylä, Finland, and at the University of Munich, Germany. Both Finnish and German participants were students of Educational Psychology in their first few semesters and were controlled for demographics (age, gender, mother tongue) and for uncertainty orientation, learning strategies, prior knowledge, and interest. Culture aside, participants

were randomly assigned to the respective experimental conditions. The quasi-experimental groups did not differ significantly with respect to any of the controlling variables except prior knowledge. Both samples could be regarded as relatively culturally homogeneous as indicated by mother tongue. The German sample was slightly more homogeneous regarding (having hardly any) prior knowledge on the content (attribution theory) to be learned ( $M=0.54$ ,  $SD=0.93$  of the control group and  $M=0.58$ ,  $SD=1.14$  of the script group), and being first semester students, whereas Finnish participants had more prior knowledge ( $M=2.56$ ,  $SD=1.41$  of the control group and  $M=2.47$ ,  $SD=1.34$  of the script group) and were more varied in terms of being in the first three semesters of their bachelor studies. Most of the students in both countries were female (80.8 % of the Finnish and 92.7 % of the German sample). No systematic age differences could be found between the Finnish ( $M=22.75$  years of age,  $SD=4.61$ ) and the German sample ( $M=22.56$  years of age,  $SD=3.86$ ). The students' performance in the CSCL environment was not taken into account in their final course grade.

## Learning environment and experimental procedure

The study was realized using CASSIS (Computer-supported Argumentation Supported by Scripts - experimental Implementation System; Clark et al. 2008). CASSIS was designed to examine the effects of various collaboration scripts on collaborative knowledge construction in asynchronous online discussions experimentally. The main functions of CASSIS are the administration of the experimental procedure (including questionnaires and knowledge tests), a tool for threaded online discussions (see Fig. 1) and an interface to implement various collaboration scripts. Learning material included the entire online learning environment, experimenter guidelines, and the questionnaires and knowledge tests (see Stegmann et al. 2012 for the learning material) were iteratively and independently translated by several domain experts speaking both languages. In the first iteration, the entire learning material



**Fig. 1** Screenshot of the implementation of the online discussion (overview of all contributions to an online discussion)



and the experimenter guidelines were translated. In the second iteration, the learning material, environment, and instruments were then partly translated back to identify and correct deviations of meaning (see van de Vijver and Leung 1997). In the third and final iteration, the learner instructions and the instruments were collaboratively reviewed by the Finnish/German team of researchers.

The task was to learn to apply Weiner’s (1985) attribution theory by analyzing three problem cases. For instance, a problem case would portray a tutor who provides private lessons for math and physics (see Fig. 1). The tutor goes on about how he (erroneously) applies the attribution theory to his teaching and confronts female students with simpler tasks than the male students. Each case contains several pieces of problem case information; multiple perspectives could be taken and discussed in what theoretical concepts of attribution theory to apply and how to analyze each case.

An experimental session took about three hours in total (see Table 1). Prior knowledge tests, individual study time of a short description of attribution theory (Weiner 1985), and introduction to the learning environment took about 1 h. Learners collaborated for 80 min online with the task to apply the attribution theory to three problem cases. Post-tests and debriefing took about half an hour. The pre- and post-knowledge-tests consisted of problem cases similar to the ones learners had to analyze collaboratively.

In the control condition, learners discussed and analyzed three problem cases in distinct discussion boards with the goal of arriving at a joint analysis within 80 min. In the experimental, scripted condition, the collaboration script distributed the roles of case analyst and critic. First, the case analyst contributes an analysis of the problem case. Second, one of the critics writes a critique. This was supported with the prompts “These aspects are not clear to me yet:”, “We have not reached consensus concerning these aspects:”, and “My proposal for an adjustment of the analysis is:” (see Fig. 2). Third, another learning partner in the critic role contributes another prompt-supported critique. Fourth, the case analyst replies to both critiques being supported with the corresponding prompts “Regarding the desire for clarity:”, “Regarding our difference of opinions:”, and “Regarding the modification proposals:”.

**Table 1** Overview of the test procedure

	Duration
(1) Introduction and pre-tests	
Introductory explanations	5 min
Assessment of learning prerequisites (questionnaire)	5 min
Knowledge pre-test	10 min
(2) Individual learning phase	
Introductory remarks	5 min
Individual study phase of the theoretical text	15 min
(3) Collaborative learning phase	
Technical introduction	20 min
Explanation of the procedure	5 min
Collaborative learning phase	80 min
(4) Post-tests and debriefing	
Knowledge post-test	10 min
Assessment of the learning experience (questionnaire)	10 min
Debriefing	5 min
Total time	ca. 3 h

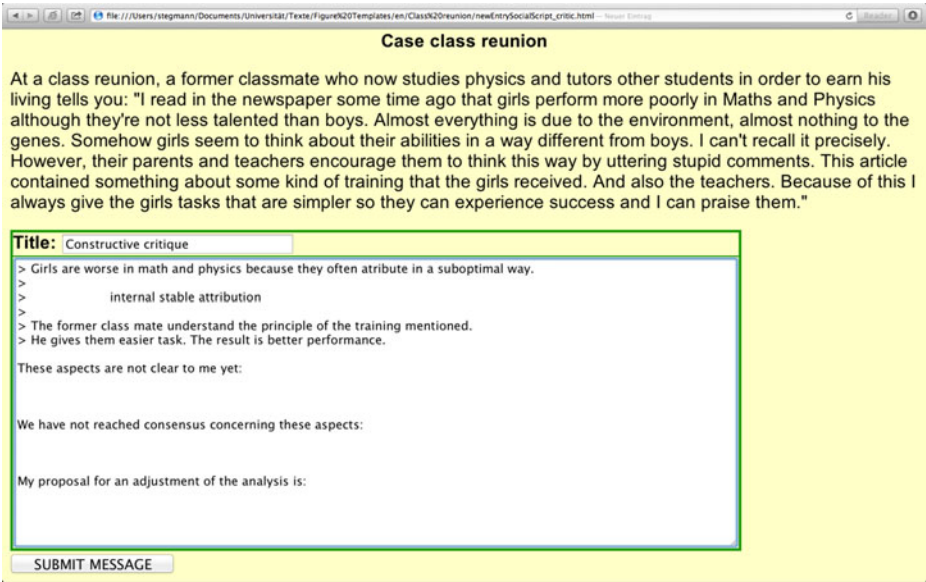


Fig. 2 Screenshot of the implementation of the prompts of the peer-critique collaboration script

Fifth, both critics contribute one more critique each, again supported with the prompts. Sixth, the case analyst composes a final analysis taking the critiques into account. These roles and sequences rotated for all three problem cases (see Table 2). Thus, all learners were the case analyst responsible for one of the cases and took the role of constructive critic for the remaining two cases (see Weinberger et al. 2005).

Table 2 Workflow of activities scripted by the peer-critique collaboration script

Activity of ...					
		Learner A	Learner B	Learner C	Duration
t2.1	1. First analysis ...	of case I.	of case II.	of case III.	16 min
t2.2	2. Constructive critique ...	regarding first analysis of learner C on case III.	regarding first analysis of learner A on case I.	regarding first analysis of learner B on case II.	8 min
t2.3	3. Constructive critique ...	regarding first analysis of learner B on case II.	regarding first analysis of learner C on case III.	regarding first analysis of learner A on case I.	8 min
t2.4	4. Replies on critique and revision of first analysis ...	regarding analysis of case I of learner B & learner C.	regarding analysis of case II of learner A & learner C.	regarding analysis of case III of learner A & learner B.	8 min
t2.5	5. Constructive critique ...	regarding revised analysis of learner C on case III.	regarding revised analysis of learner A on case I.	regarding revised analysis of learner B on case II.	8 min
t2.6	6. Constructive critique ...	regarding revised analysis of learner B on case II.	regarding revised analysis of learner C on case III.	regarding revised analysis of learner A on case I.	8 min
t2.7	7. Final analysis ...	of case I.	of case II.	of case III.	16 min

## Instruments and coding procedure

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Building on the framework of Weinberger and Fischer (2006), four coders – two for each language – were trained to segment and classify the German and the Finnish online discourses. Unit of analysis was each single message ( $n=773$ ) a learner contributed to the online discussion. Due to the fact that Finnish and German quantity and length of words differs significantly (often, two or three German words are just one longer Finnish word; different from German, Finnish is an agglutinative language and there are no articles or prepositions in the Finnish language), amount of letters was used to check whether participation of German and Finnish students was equal. German and Finnish learners used a similar amount of letters to write their messages, but Finnish learners wrote significantly less messages than German learners. Therefore, length (i.e., number of letters) of the specific message is used to weigh the assigned category. Instead of using the simple frequency of specific category, we weighted each message using the sum of letters of the message at hand assigned with a specific category, i.e., a message coded as integration comprising 512 letters was weighted as 512.

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To determine transactivity on the base of the *type of consensus building*, coders rated how and to what extent learners referred to contributions of their learning partners. We differentiated between differently elaborated signs of agreement and disagreement as indicative of three categories of transactivity: conflict-oriented consensus building, integration-oriented consensus building, and quick consensus building. *Conflict-oriented consensus building* means the elaborated critique of learning partners' arguments, e.g., replies like "The attribution of the teacher is not as much de-motivating as it is representative of an external attribution" and "Yes, but the parents are also motivating Michael by sticking to him". *Integration-oriented consensus building* means the elaborated integration of learning partners' arguments into one's own lines of reasoning, e.g., "Based on what you say, I think that Michael's attributions are detrimental". *Quick consensus building* consist of non-elaborated signs of acceptance, e.g., "Yes", "I agree" and "Go on". For each category the weighted number of messages was calculated.

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To measure *shared thematic focus* we assessed the extent to which learners related to contributions of their learning partners regarding a) the problem case information they treated and b) the theoretical concepts they applied. A thematic focus score from 0 to 3 has been given to indicate to what extent learners referred to the same problem case information or the same theoretical concept that their partners had been addressing in the online discussion. A score of 0 was assigned to any message in which the learner did not comment on any aspect of the case or theoretical concept that had been discussed before. A score of 1 was given to messages in which the author commented on at least one already mentioned case aspect or concept. Messages with a score of 2 included either comments on more than one aspect or concept that has been mentioned before or elaborations of at least one of the already mentioned aspects or concepts, i.e., added new information or positions on what has been expressed before. A score of 3 was assigned to messages, in which the author elaborated on more than two of the already mentioned case aspects or theoretical concepts.

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*Knowledge acquisition* In a post-test, learners individually analyzed another problem case. The coders identified correct relations drawn by the learners between theoretical concepts and case information to determine the score for acquisition of application-related knowledge.

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Inter-rater reliability was Cohen's  $\kappa=.81$  for the two German raters and Cohen's  $\kappa=.73$  for the two Finnish raters. Inter-rater reliability between the Finnish and the German coders were  $\kappa=.45$  identified by independent coding of translated learner discussions. We analyzed

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the differences between German and Finnish coding of the same material carefully to detect systematic errors. The analyses showed that the low Cohen's Kappa can mainly be attributed to difficulties in coding conflict-oriented consensus building. Approximately 65 % of this type was coded as equal, but approximately 17.5 % of the messages that were coded "conflict-oriented" by a German coder were coded as another type (and vice versa). Therefore, we concluded that no systematic errors occurred. The rather low objectivity increases the probability of type-II-errors. Therefore, the effect sizes of significant effects are rather underestimated and the power of the study is reduced, i.e., non-significant results cannot be interpreted.

## Statistic procedures

All main and interaction effects are tested using HLM to account for the nested nature of the dataset (i.e., learners within groups of three). The N is constant across all analyses:  $N=132$  level 1 units and  $N=44$  level 2 units. All variables were entered non-centered. Culture is coded 0 for German, 1 for Finnish. Script is coded 0 for without script, 1 for with script. To examine the interaction effect, a dummy variable was entered (culture  $\times$  script). The dummy variable is coded 1 for the interaction condition, 0 for all other conditions. Due to the differences regarding prior knowledge between German and Finnish students prior knowledge was included in all analyses as a level 1 predictor. All findings were reported including an estimation of their effect size (Cohen's  $d$ ; cf. Cohen 1988). We estimated Cohen's  $d$  for each predictor by using  $t$ -values and approximate  $df$  (Cohen's  $d=(2*t)/SQRT(df)$ ). An  $\alpha$ -level of 5 % was used for all statistical tests.

## Results

### RQ1: Effects of culture and scripted collaboration on transactivity.

*Shared thematic focus* Culture and script had medium, but insignificant main effects on the shared thematic focus (see Table 3 for regression coefficients and effect sizes). The score of shared thematic focus for Finnish students was lower than the score of German students. Learners supported by the script had a higher score of shared thematic focus than learners without support by the script. No interaction effect of culture and script was found.

*Conflict-oriented consensus building* German students were much more conflict-oriented than Finnish students (see Table 3 for regression coefficients and effect sizes; negative regression weights for culture indicate that German students had higher scores than Finnish students). This is a strong effect. Even though German students engaged in conflict-oriented consensus building more frequently, the script facilitated German students to be even more conflict-oriented as an interaction effect shows (see Table 3 for regression coefficients and effect sizes; negative regression weights for "culture  $\times$  script" indicated that the combination of Finnish culture and script led to lower scores than expected on the base of the main effects).

*Integration-oriented consensus building* Finnish students clearly integrated arguments of their learning partners into their own line of reasoning more often than German students did (see Table 3 for regression coefficients and effect sizes). The script had no effect on integration-oriented consensus building. No interaction effect was found.

**Table 3** Regression coefficients, standard errors (SE) and effect sizes (Cohen’s d) of transactivity and knowledge acquisition

		Intercept	Prior knowledge	Culture	Script	Culture × Script
t3.3	Shared thematic focus	coeff. 1130*	51	714	1056 <sup>+</sup>	−239
t3.4		SE 417	139	576	580	730
t3.5		d 0.58	0.08	0.27	0.39	0.07
t3.6	Conflict-oriented	coeff. 341***	−17	−244*	403***	−323*
t3.7	consensus building	SE 72	24	99	100	126
t3.8		d 1.01	0.08	0.52	0.86	0.55
t3.9	Integration-oriented	coeff. 88	17	717**	−98	201
t3.10	consensus building	SE 147	49	203	204	258
t3.11		d 0.13	0.08	0.76	0.10	0.17
t3.12	Quick consensus	coeff. 181***	−5	−119*	−103 <sup>+</sup>	69
t3.13	building	SE 42	12	56	59	74
t3.14		d 0.93	0.10	0.45	0.37	0.20
t3.15	Knowledge	coeff. 6.444***	0.488 <sup>+</sup>	−2.174 <sup>+</sup>	−0.021	−0.637
t3.16	acquisition	SE 0.902	0.258	1.210	1.261	1.587
t3.17		d 1.53	0.41	0.39	< .01	0.09

Regression coefficients were not standardized; culture is coded 0 for German, 1 for Finnish; script is coded 0 for without, 1 for with; culture × script is coded 1 for the interaction condition, 0 for all other conditions; <sup>+</sup>  $p<.10$ , \*  $p<.05$ , \*\*  $p<.01$ , \*\*\*  $p<.001$

*Quick consensus building* German students made significantly quicker consensus building than did Finnish students. The script reduced quick consensus building, but the difference failed to be significant, despite a medium effect size. No interaction effect were found (see Table 3 for regression coefficients and effect sizes).

To illustrate the main differences between the Finnish and German discussions, we have selected two discourse examples (see Table 4). The German example has been selected due to its high score on conflict-oriented consensus building. The Finnish example has been selected based on its high score on integration-oriented consensus building. Both discourse sections are highly transactive: The discussants share thematic focus and do not build

**Table 4** Finnish and German discourse examples

	Finnish “integration-oriented example”	German “conflict-oriented example”
t4.3	A Michael’s parents largely attribute his poor performance in Math to heredity, which is a fixed reason. That is not a good thing as Michael may refer back to that and may not try anymore.	Because Michael ascribes his Math deficits to a lack of giftedness and because his parents support that view, there will hardly be any improvement.
t4.4	B The teacher suggests laziness as a possible fixed reason. That may be a better explanation for the person himself.	The teacher’s behavior doesn’t help either (attribution of other).
t4.5	C That’s true. Michael has already fully internalized the idea that he cannot do Math. The Math teacher tried a bit to provoke him when saying that it is just a bad excuse for laziness.	No, the behavior of the teacher has to be judged positively, because she holds variable causes responsible for his failure. If he invested more effort he could do better. That should actually motivate him.



consensus quickly. In both examples, participants discussed the problem case of Michael whose Math grades suffer from disadvantageous attribution patterns. Both examples involved all three learners (A, B, C) of unscripted groups.

Discourse in scripted German groups was particularly critical, whereas scripted Finnish students did not respond or inserted asterisks as a reaction to the prompts. One student wrote: "I wonder why we should disagree or have different opinions in this task. Can't we just concentrate on the case together by considering it from different perspectives?"

RQ2: Effects of culture and scripted collaboration on knowledge acquisition.

Different from earlier studies (Weinberger et al. 2005), the script did not facilitate individual knowledge acquisition, but the German students benefitted more from the problem-oriented online learning environment than the Finnish students. However, the effect did not become significant at the 5 % level. No significant interaction effect was found (for regression coefficients and effect sizes see Table 3).

## Discussion

The results indicated that the German students were more conflict-oriented than the Finnish groups. Compared to their German peers, Finnish students better integrated arguments of their learning partners into their own line of reasoning. Agreement in German groups did not frequently indicate integration of peers' arguments, but more quick consensus building that served coordination and continuation of discourse, e.g., by indicating understanding. These results might be explained by the differences in the internal collaboration scripts that are being shared in the respective German and Finnish cultures. According to the Script Theory of Guidance (Fischer et al. 2013), learners develop internal scripts through repeated participation in collaborative situations. Thus, the internal script for discussions is usually acquired within a specific culture. These results thus alluded to a German culture of dialectics and debate, whereas Finnish argumentative practice is geared towards building consensus where disagreement is avoided. Finnish students have been found to avoid critical argumentative discussions (Steffensen 1996). Marttunen and Laurinen (2002) also found that counter-argumentation among Finnish students' online interaction was scarce and that elaborative agreement was more typical.

The fact that Finnish students made fewer critical contributions in the discussions, however, does not imply that Finnish students have lower argumentation skills. When argumentation skills were compared among Finnish, English and French secondary school students, Marttunen et al. (2005) found that Finnish students outperformed both English and French students in judging conclusions. Internal scripts are dynamically configured depending on the learner's set of goals and on perceived situational characteristics (Fischer et al. 2013). In the context under examination, Finnish students may just not activate their "critical argumentation script". To overcome this, Finnish students may benefit from additional encouragement to write critical analytical comments by an external script that better activates, modifies and extends the existing internal script components for their application during online discussion.

Alternatively, more of the same strategy to foster conflict-oriented discourse may be dysfunctional for some groups of learners. The peer-critique script in its current form may not be compatible with prevalent Finnish internal scripts, i.e., Finnish collaborative learners may prefer to engage in and benefit from other, e.g., integration-oriented modes of

interaction. Complementing internal with some external scripts may be problematic when cultural standards override interpretation of a scenario and activation of scripts. Hence, the optimal scripting level cannot be attained by one and the same external script for learners from two cultures with different internal scripts.

Sub-optimal scripting might also be the reason why the examined script did not facilitate learning outcomes, which is different from earlier studies (Weinberger et al. 2005). Furthermore, this study did not focus on the script internalization. Several findings on scripts show that scripts foster internal scripts without hindering the acquisition of domain-specific knowledge (cf. Weinberger et al. 2010; Stegmann et al. 2012).

While the results generally agree with the theoretical background of the study, certain limitations of the study need to be taken into account when generalizing the findings. Inherent problems of cross-cultural studies are their quasi-experimental design as well as the culture-dependence of the applied measures. The quasi-experimental design leads to the problem that the factor “culture” can be confounded with other, non-culture related differences between conditions that may cause the effects. By choosing similar samples from Germany and Finland, this problem was minimized but not eliminated. The Finnish students had slightly more prior knowledge than the German students. In spite of this prior knowledge lead, Finnish students did not engage in more conflict-oriented consensus building and did not learn more than the German students. Instead, the results showed that German discussions were more conflict-oriented than Finnish discussions as was expected, based on the research to date. Therefore, the results cross-validate the independent variable and make it less likely that the culture factor is confounded with non-culture aspects.

The culture-dependence of the measures also endangers interpretability of the differences between cultures, i.e., differences between cultures may stem from different measurements instead of real differences. While having four coders (two from each country) and using a consistent cross-cultural training procedure may have curbed this problem, the rather low inter-rater-objectivity between German and Finnish coders is a clear sign of this issue. Therefore, the findings on culture should be approached cautiously. However, by investigating an experimentally varied factor (script) in addition to the quasi-experimental grouping of German and Finnish students, the main effects of this script factor and the interaction effects with culture could be interpreted without a concern regarding the culture-dependence of the measurement.

Taken together, the results showed that internal scripts as they played out in online discussions may vary significantly even between similar cultures within Europe. Internal scripts seem to be more similar within cultures than across cultures. To support learners optimally, the level of scripting has to be adapted to the respective internal script. Hence, external scripts and CSCL environments at large need to be designed in a culturally sensitive way.

Several directions for future research can and should be taken from here. One would be to develop scripts that pose a better fit for Finnish learners, e.g., scripts fostering CSCL based on integration-oriented consensus building. For reaching an optimal level of scripting for specific cultures, one might need to find the perfect fit between activating and complementing existing internal scripts. Another important line of research to follow are cross-cultural comparisons to develop and investigate scripts supporting intercultural CSCL, i.e., foreseeing collaboration between learners from different cultures. Would this need to be a script orientated towards the lowest common denominator of two (or more) cultures or could flexible trans-cultural scripts respond to cultures being dynamic and re-negotiated in the moment, especially in intercultural encounters (cf. Weinberger et al. 2007a)?

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