RUNNING HEAD: INFLUENCE OF GROUP MEMBER FAMILIARITY

INFLUENCE OF GROUP MEMBER FAMILIARITY ON ONLINE COLLABORATIVE LEARNING

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Abstract

This study investigated the effects of group member familiarity during computer-supported collaborative learning. Familiarity may have an impact on online collaboration, because it may help group members to progress more quickly through the stages of group development, and may lead to higher group cohesion. It was therefore hypothesized that increased familiarity would lead to (a) more critical and exploratory group norms, (b) more positive perceptions of online communication and collaboration, (c) more efficient and positive collaboration, and (d) better group performance. To investigate these hypotheses, 105 secondary education students collaborated in groups of three. The results of this study indicate that higher familiarity led to more critical and exploratory group norm perceptions, and more positive perceptions of online communication and collaboration. Furthermore, in familiar groups students needed to devote less time regulating their task-related activities. The expectation that familiarity would lead to better group performance was not confirmed. These findings imply that online educators pay attention to the effects group member familiarity has on online collaborative learning.

KEYWORDS: Computer Mediated Communication; Groupware; Information Technology; Collaborative Learning; Teams; Familiarity

Introduction

Over the past 20 years, research on computer-supported collaborative learning (CSCL) has helped support the claim that collaborative activity among students can effectively be supported with computer technology. The accumulated knowledge concerning effective CSCL has also led to detailed design guidelines for CSCL (e.g., Kirschner, Martens, & Strijbos, 2004; e.g., Kreijns, Kirschner, & Jochems, 2003; Strijbos, Martens, & Jochems, 2004). In spite of these design guidelines, researchers still experience problems when students collaborate using computer technology. These include for example, conflicts (Hobman, Bordia, Irmer, & Chang, 2002), communication difficulties (Daft & Lengel, 1986; Fuks, Pimentel, & Lucena, 2006), and shallow, uncritical discussions (Munneke, Andriessen, Kanselaar, & Kirschner, 2007). Although these problems may be caused by poor implementation of the design guidelines mentioned, it may also be the case that research has focused too little on potential moderators that can influence the effectiveness of CSCL (Hollingshead & McGrath, 1995), such as time spent on group work (e.g., one session versus prolonged group work), task type (e.g., open versus closed tasks), group size (e.g., small versus large groups), and group or student characteristics (e.g., estrangement versus familiarity of group members). For example, how well students know each other prior to their collaboration may have an impact on several aspects of their collaboration (Kiesler & Sproull, 1992). Ignoring such moderators may lead to inconsistent and contrasting results, making it very risky to draw generalizations. Furthermore, it is important identify factors that moderate the effectiveness of CSCL, because then they can be taken into account by educational designers enabling the design of more effective and enjoyable CSCL experiences.

The aim of this contribution is to examine the effect of one such potential moderator, namely group member familiarity. Kiesler and Sproull (1992) identified group member *familiarity* as an important factor to consider when designing CSCL. The effects of familiarity on group interaction and performance are related to aspects of Tuckman's (1965) stages of group formation: forming, storming, norming, and performing. It has been hypothesized that when group members know each other well, they will spend less time forming a coherent group, and will establish group norms more easily, and thus, reach the performing stage more quickly. This is thought to have beneficial effects for, among others, *satisfaction* with online collaboration and *group performance* (Adams, Roch, & Ayman, 2005). Furthermore, research has highlighted the importance of prior experiences of online collaborators (Carlson & Zmud, 1999). The more experience students have with, for example, the medium, their group members, or the task at hand, the more effectively they will be able to collaborate online. When students know their group members well, they have acquired knowledge about their partners that they can use to interpret partners' messages, to identify their strengths and weaknesses, and to adapt their communication to their partners' specific needs. Moreover, when students acquire knowledge about their partners they may develop deindividuating impressions of their group members (Walther, 1992), which may help them to overcome the inherent restrictions of the medium (e.g., lack of verbal cues, intonation of voice, and gestures). Also, it can be assumed that trust is higher in familiar group contexts (Carlson & Zmud). Research has shown that it takes some time for trust to develop among group members during online collaboration, while trust (or the lack thereof) has also been found to have effects on the collaborative process (Wilson, Straus, & McEvily, 2006). This all suggests that when students know their group members well, their online collaboration will be more efficient and effective.

Although only a small number of studies has investigated the impact of group member familiarity on CSCL (Adams et al., 2005; Mennecke, Hoffer, & Valacich, 1995; Mukahi & Corbitt, 2004; Orengo Castellá, Zornoza Abad, Prieto Alonso, & Peiró Silla, 2000;

Smolensky, Carmody, & Halcomb, 1990), researchers have demonstrated possible positive and negative consequences of increased familiarity among group members. For example, Adams et al. found that when group members knew each other better, their satisfaction with the group process increased, although their decision accuracy decreased. Similarly, Smolensky et al. found that familiarity had a negative impact on students' interactive behavior, which, in turn led to decreased group performance. In contrast, Mukahi and Corbitt found no relationship between familiarity and students' collaborative activities.

An explanation for the mixed results may be the different operationalizations of familiarity (Adams et al., 2005). Adams et al., for example, following Gruenfeld, Mannix, Williams, and Neale (1996), asked students to rate familiarity with group members on a 4-point scale. Smolensky et al. (1990), on the other hand, did not measure familiarity directly but asked half of their participants to bring two friends to their experiment, so as to create familiar and unfamiliar groups, thus equating familiarity with friendship. In our opinion however, students can be familiar with each other without being friends. In this study, familiarity was operationalized by asking students, before the start of their collaboration, to indicate how well they *knew* the other group members. This way, the collaboration itself does not affect students' judgments of familiarity. On the other hand, asking students to rate familiarity before the collaboration may draw attention to whether they worked with friends or strangers, which may influence students' subsequent collaborative behavior.

Our study differed on several aspects from previous studies on familiarity. In contrast to other studies, students in our sample came from existing secondary education classes, thus most group members knew their teammates to a certain extent, although variations obviously existed. In other studies, (university) students were recruited from a pool of student volunteers (e.g., Adams et al., 2005). Additionally, the study presented here was carried out in an authentic educational context, in which students collaborated online for a longer period of time. In contrast, in other studies the effects of familiarity were often examined in a single online session, while students worked on group tasks with little or no relationship to the curriculum (e.g., Mennecke et al., 1995; Orengo Castellá et al., 2000). Furthermore, most studies that examined the role of familiarity during online collaboration focused on either students' perceptions (e.g., their satisfaction with the collaborative process) or on students' interactive behavior (e.g., use of negative speech). This study will focus on perceptions as well as behavior.

Thus, in order to extend the research findings concerning familiarity, this paper focuses on the effects of familiarity on (a) perceived group norms, (b) perceptions of online collaboration and communication, (c) students' collaborative activities, and (d) group performance. The remainder of this introduction focuses on describing the possible effects familiarity may have on these four variables.

Group norms

As groups include group members who are more familiar with one another, students may be more comfortable expressing *disagreement* (Gruenfeld et al., 1996). As such, familiarity may help group members to adopt critical or exploratory group norms instead of consensus norms (Postmes, Spears, & Cihangir, 2001). This is important because critical or exploratory group discussions have been shown to lead to more effective group work (Wegerif, Mercer, & Dawes, 1999). During critical group discussion, students do not hesitate to question each others' opinions or to disagree with one another (Postmes et al.). Exploratory group discussions are similar to critical group discussions in the sense that students accept criticism from each other and discuss alternatives. In addition, these kinds of discussions should be held in a *constructive* manner. In other words, conflicts and disagreements are welcome, but group members should try to resolve them and come to an agreement (Di

Eugenio, Jordan, Thomason, & Moore, 2000; Erkens, Jaspers, Prangsma, & Kanselaar, 2005). Furthermore, during exploratory discussions group members share relevant information and encourage each other to participate (Wegerif et al.). It is expected that familiar group members will be more likely to develop group norms which value critical or exploratory online discussions because they do not feel the social pressure to agree with other group members (Adams et al., 2005). Unfamiliar group members may be more prone to adapt to such pressure. These critical or exploratory versus consensual group norms will be developed in the norming stage of group formation (Tuckman, 1965). Thus, the following hypothesis may be formulated:

H1 Group member familiarity will contribute to more critical and exploratory group norms.

Perceptions of online communication and collaboration

In familiar groups, group cohesion will likely be higher because group members feel more *comfortable* with the other members (Adams et al., 2005; Mennecke et al., 1995). Furthermore, when group members know each other better, they may be able to communicate and collaborate efficiently (Adams et al.). This will lead familiar group members to perceive their online communication and collaboration within their group as being more positive. Students may also perceive their communication and collaboration more positively in familiar groups because *psychological safety* is higher in these groups (Schepers, de Jong, Wetzels, & de Ruyter, 2008; Van den Bossche, Gijselaers, Segers, & Kirschner, 2006). Indeed, studies by Mennecke et al., Adams et al., and Stone and Josey (2008) found more positive perceptions of communication and collaboration in familiar groups. Therefore, a second hypothesis will be investigated:

H2 Group member familiarity will lead to positive perceptions regarding the collaborative process.

Collaborative activities

As familiarity between group members increases, communication and coordination of collaboration may take less *effort*. For example, the transfer of information relevant to executing the task may be more efficient, and misunderstandings may be less likely to occur. This can be explained by the higher amount of *knowledge* available to familiar group members of other member's skills, expertise and communication styles (Adams et al., 2005). Familiar group members may share a social history, making it easier to understand each other and know each other's strengths and weaknesses. Similarly, familiarity may decrease the need for extensive regulation and coordination of task and group processes. Consequently, a third hypothesis will also be investigated.

H3 Group member familiarity will influence online collaborative activities. More specifically, transfer of information, regulation of task and group processes, and misunderstandings will decrease.

Group performance

In light of the above, it is likely that the increased knowledge of group members' skills and modes of interaction will help familiar groups outperform groups of strangers. For example, familiar groups will experience less process losses (e.g., misunderstandings) and be more inclined to pool information resources to effectively carry out the group task (Gruenfeld et al., 1996). Furthermore, if *H1* is true, then familiar groups may hold more critical and exploratory group norms, which help them engage in *argumentative interactions*. Such argumentative interactions are likely to contribute to quality of the collaboration (Clark, Sampson, Weinberger, & Erkens, 2007; Munneke et al., 2007; Weinberger & Fischer, 2006). Finally, collaboration may be more efficient because familiar groups do not need to devote as much time to regulating and coordinating task and group processes. Therefore, this study will address a fourth and final hypothesis:

H4 Group member familiarity will lead to better group performance.

Method and Instrumentation

Participants

The participants were students who came from five different history classes from two secondary schools. The total sample consisted of 105 eleventh-grade students (47 male, 56 female). The mean age of the students was 16.17 years (*SD* = 0.57, *Min* = 15, *Max* = 18). The participants were randomly assigned to 35 different 3-person groups. It is important to note that students were assigned to groups *within their own class* and did not collaborate with students from other classes or schools.

Tasks and Materials

CSCL environment: Virtual Collaborative Research Institute

Group members collaborated in a CSCL environment called *Virtual Collaborative Research Institute* (VCRI, see Fig. 1), a groupware program designed to support collaborative learning on inquiry tasks and research projects. VCRI has been used in several research projects (e.g., Janssen, Erkens, & Kanselaar, 2007; Janssen, Erkens, Kanselaar, & Jaspers, 2007; Van Drie, Van Boxtel, Jaspers, & Kanselaar, 2005). Students used VCRI to communicate with each other, access information sources, and co-author texts and essays. While working with VCRI, students share several tools, such as a *Sources*-tool which contains information sources that students can use to gather important information, a *Chat*-tool for synchronous communication with group members, a *Cowriter* for shared word processing, which students can use to simultaneously compose their texts or answers, and a *Diagrammer* for making external representations of ideas or arguments (e.g., Munneke et al., 2007; Van Drie et al., 2005). Other tools not shown in Fig. 1 include a *Planner*, and a *Logbook*.

Teachers also used the program to monitor online discussions and group progress. For example, teachers had access to the texts written by the groups in the Cowriter. This provided teachers with information about the progress the groups were making. Furthermore, the teachers could monitor all chat discussion, and could send messages to each group. This way, the teachers could, for example, answer questions raised by the students, could warn students in case of misbehavior and could remind students of important deadlines.

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Inquiry group task

Participants worked together on a historical inquiry task. Topic of the task was “The first four centuries of Christianity.” The task consisted of three parts. First, the groups had to *answer four different questions* using 12 different historical sources. To complete the second part of the task, the groups had to study 40 different information sources and *categorize* them into five different categories. Students had to decide together on which categories they would use. This categorization had to be visualized in a diagram, using the VCRI-diagrammer. Finally, they had to *co-write an essay* of at least 1200 words. The essay had to explain why and how Christianity developed from a small 'cult' into the main religion of the Roman Empire. In sum, the group task was an open-ended task, without a standard procedure and with no single correct answer.

Procedure

In total, the participating students worked eight, 50-minute lessons on the inquiry task. During the lessons, each student worked on a separate computer in a computer lab. Students sat as far from their teammates as possible, in order to stimulate them to use to the VCRI-program to communicate with their other group members. Before the first computer lesson, students received information about the task and their group's composition. Furthermore, students completed a pretest questionnaire, requesting personal information (e.g., age, gender) and which asked them about how familiar they were with the other group members (see Independent measure section below). The pretest questionnaire also contained a multiple choice test consisting of nine items ($\alpha = .66$) measuring students' knowledge and comprehension of the position and persecution of Christians in the Roman Empire.

During the computer lessons, teachers were standby to answer task-related questions. In addition, students were allowed to work on the inquiry group-task during their free periods in the schools' media centers. After the last lesson, a posttest questionnaire was administered containing items on group norm perception and perception of online collaboration. Students expressed their opinions using a 5-point scale ranging from 1 (= completely disagree) to 5 (= completely agree).

Independent measure: Familiarity

Students' perceived familiarity with the other group members served as the independent measure for this study. Based on work by Gruenfeld et al. (1996) and Adams et al. (2005), familiarity was measured by asking each student, *before the start of the collaboration*, to rate his or her two other group members on a 4-point scale, ranging from 1 (= do not him/her know at all) to 4 (= know him/her very well). This question was preceded by four specific 'yes/no' questions (e.g., "I have collaborated with some of my group members before") designed to remind students of situations which they had previously encountered with the other group members in order to help them better judge group member familiarity.

The 4-point ratings a student gave to his or her two group members were summed to create an *overall familiarity score*. This score reflected the level of familiarity of the individual student with his or her two teammates. The four 'yes/no' questions were not included in the calculation of this overall familiarity score, because they only served as reminders of previous situations during which students had encountered their group members. The familiarity score used in this study could therefore range from a minimum of 2 (e.g., a student did not know both group members and thus rated them with a score of 1) to a maximum of 8 (e.g., a student knew both group members very well and rated their familiarity with a score of 4).

Sometimes however, group members disagreed as to how well they thought they knew each other. These disagreements may undermine the reliability of the familiarity measure. Therefore, group members' familiarity ratings of each other were compared. An agreement percentage of 64% was found (Cohen's κ = .50). However, this interrater reliability is a strict measure of reliability, because differences of one point (e.g., one student rated his familiarity with the other with a three, while the other gave a four) are considered disagreements. Therefore, we also computed a correlation between students' familiarity ratings of each other. This correlation between familiarity ratings of group members was highly significant ($r = .79, p < .01$), which shows that there was consistency between group members' familiarity ratings: if student A indicated to be familiar with student B, student B was likely to also indicate familiarity with student A. This indicates an adequate reliability of the familiarity measure.

Additionally, the validity of the familiarity measure was examined by correlating the sum of the four 'yes/no' questions (higher scores reflect higher familiarity) with the familiarity measure. A significant correlation was also found ($r = .70, p < .01$). This provides evidence for the validity of the overall familiarity score.

Dependent Measures

Questionnaire Data

To investigate hypotheses 1 and 2, data from the posttest questionnaire were used. The questionnaire contained three scales for group norm perceptions, and three scales for perception of online collaboration, which are summarized in Table 1. All of the scales had adequate reliability coefficients. Thus, for all scales students' ratings on the individual items were averaged to create a mean score.

Group norm perceptions were measured using three scales. The first scale consisted of three items, and asked students whether they perceived their group as having *critical group norms*. The items were based on the work of Postmes et al. (2001). A sample item of this scale was: "Our group is critical." The second scale tried to measure whether students perceived their group as having *consensual group norms*. This scale was also based on the work of Postmes et al. It contained three items. An example from this scale is: "In this group people generally adapt to each other." The last scale measured whether students perceived their group to have *exploratory group norms*. Exploratory group norms reflect a preference for discussions that are critical, but also constructive. That is, group members are critical of each others' ideas, accept criticism, but also offer explanations for their opinions and criticism. This last scale consisted of seven items, based on the ideas of Wegerif et al. (1999) on exploratory discussion. "During discussions, criticism and counterarguments were accepted" is a sample item from this scale.

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Students' perceptions of online collaboration and communication were also measured using three scales. The first scale addressed *positive group behavior* and consisted of seven items. Behaviors such as helping each other and equal participation among group members are indications of positive group behavior (Webb & Palincsar, 1996). A sample item from this scale is: "We helped each other during collaboration." The second scale tapped into *negative group behavior* and consisted of five items. Conflicts and free riding behavior (O'Donnell & O'Kelly, 1994) are indications of negative group behavior. "There were conflicts in our group" is an example from this scale. The first and second scale have been used in other studies (Janssen, Erkens, & Kanselaar, 2007; Janssen, Erkens, Kanselaar et al., 2007). The final scale addressed students' *perceived effectiveness of their group's task strategies*. This scale was based on the work of Saavedra, Early, and Van Dyne (1993) and consisted of eight items that assessed the choices made and the strategies chosen by the group members. An example from this scale is: "We planned our group work effectively."

Collaborative Activities

To examine the influence of familiarity on students' collaborative activities in the VCRI environment, a coding scheme was used to gain insight into the task- and group-related processes carried out during students' online collaboration.

Description of the coding scheme. When students work together in groups, they have to complete a group product. This requires that they pool their information resources, exchange their ideas and opinions, and ask questions (Jehn & Shah, 1997; King, 1994). This mirrors the production function as described by McGrath (1991) in his Time, Interaction, and Performance theory, as well as the task conveyance activities identified by Dennis and Valacich's (1999) Theory of Media Synchronicity. On the other hand, collaboration also involves a social-relational aspect. Students have to perform social and communicative activities that help to maintain a positive group climate (Kreijns et al., 2003; Kreijns, Kirschner, Jochems, & Van Buuren, 2004; Rourke, Anderson, Garrison, & Archer, 1999). McGrath referred to the group well-being and member support functions that group members have to perform during collaboration. Similarly, Massey, Montoya-Weiss, and Hung (2003) referred to the importance of social and relational communication during online collaboration. Therefore, the coding scheme also contains several codes that refer to the social and communicative aspects of collaboration, such as greeting each other, expressing emotions, and engaging in activities that contribute a positive group climate (e.g., joking, or giving compliments).

However, merely performing task-related and social activities is not sufficient to ensure successful collaboration. It also requires considerable coordination and regulation of these activities (Erkens et al., 2005; Erkens, Prangsma, & Jaspers, 2006). Firstly, metacognitive activities (Schraw & Moshman, 1995) that regulate task performance (e.g., making plans, monitoring task progress, and evaluating plans or ideas) are considered important to successful performance during online collaboration (De Jong, Kollöffel, Van der Meijden, Kleine Staarman, & Janssen, 2005; Van der Meijden & Veenman, 2005). For example, Massey et al. (2003) referred to the importance of project management during online collaboration. Moreover, not only task-related activities have to be coordinated, social activities have to be coordinated and regulated as well (Manlove, Lazonder, & De Jong, 2006). For instance, students have to discuss and plan their collaboration, monitor their collaboration, and evaluate their collaborative process (Johnson, Johnson, & Stanne, 1990). Thus, the coding scheme also contained codes that referred to the regulation and coordination of task-related and social activities.

In total, the scheme contains four dimensions: *task-related activities, regulation of task-related activities*, *social activities*, and *regulation of social activities*. Each dimension contains two or more coding categories, also called collaborative activities. Furthermore, the scheme included several additional categories (e.g., technical remarks) that did not belong to any of the four dimensions. In total, the scheme consisted of 19 categories. Table 2 shows all coding scheme codes.

Segmentation and coding procedure. During online collaboration some students only send one sentence per message, while others type several sentences that combine multiple clauses. Furthermore, even within in a single sentence, multiple ideas or concepts may be expressed (Strijbos, Martens, Prins, & Jochems, 2006). Thus, it may be necessary to segment a chat message into smaller parts that are meaningful in their selves. Therefore, the chat messages were segmented into smaller units, called *dialogue acts* (Erkens & Janssen, in press; Erkens et al., 2005). One dialogue act corresponds to a sentence or a part of a compound sentence that can be regarded meaningful in itself and has a single communicative function.

Segmentation and coding were done using the *Multiple Episode Protocol Analysis* (MEPA) computer program (Erkens, 2005). Messages were segmented into dialogue acts using a *segmentation filter*. A filter is a program, which can be specified and used in MEPA for automatic rule based coding or data manipulation. The segmentation filter automatically segments messages into dialogue acts, using over 150 decision rules. Punctuation marks (e.g., full stop, exclamation mark, question mark, comma) and connecting phrases (e.g., "and if," or "but if") are used to segment messages into dialogue acts. Using filters speeds up segmentation, and ensures segmentation rules are applied consistently. After the segmentation process, the dialogue acts were subsequently coded using the coding scheme.

Interobserver reliability. Two researchers determined the interrater reliability of the coding procedure, by independently coding 796 collaborative activities. The overall Cohen's κ was .94. The category Kappas (Cicchetti, Lee, Fontana, & Dowds, 1978) are also given in Table 2.

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Group performance scores

To measure the effect of familiarity on group performance, an assessment form was developed for each part of the inquiry task. The assessment form for the *first part* (Question answering) addressed (1) *conceptual content and quality of argumentation* of the answers, and (2) *quality of the presentation* of the answers. *Conceptual content and quality of argumentation* were assessed using one item on a 4-point scale. *Quality of the presentation* was assessed using five items (e.g., correctness of the language used, structure of the written answer) that were rated on a 3-point scale. The assessment form for the *second part* of the task part (Categorizing sources) consisted of three items which assessed the quality and completeness of the *constructed diagram* and the quality of the *explanation*. These items were also rated on a 3-point scale. For the *last part* of the inquiry task (Writing an essay), group members needed to collectively write an essay. Comparable to part one, *conceptual content and quality of argumentation* were assessed using three items rated on a 3-point scale. *Quality of the presentation* of the essay was assessed using five items on a 3-point scale. This was done in a similar fashion as for part one of the inquiry task. The five resulting scores were subsequently used as indicators for group performance.

To check the objectivity of the assessment procedure, two researchers scored seven inquiry tasks. The results of this interrater reliability analysis were satisfactory, as Cohen's κ ranged from .73 to .90.

Results

Group norm perception

Table 3 shows the means and standard deviations of familiarity and the three measures of group norm perception, and their intercorrelations. As can be seen from this Table, students reported an average familiarity (M = 4.24, SD = 1.48) with their group members. Furthermore, familiarity correlated significantly with several dependent variables.

Because the data were nested (i.e., students worked in groups), and because there was interdependence between group members' scores (i.e., group members could influence each other) multilevel analysis was used to examine the effects of familiarity (Cress, 2008; De Wever, Van Keer, Schellens, & Valcke, 2007; Kenny, Kashy, & Cook, 2006; Kenny, Mannetti, Pierro, Livi, & Kashy, 2002).

The results of these analyses are summarized in Table 4. The *β*- and *t*-values show that familiarity had a significant positive effect on students' perceived critical ($\beta = .094$, $p = .032$) and exploratory group norms ($\beta = .100$, $p = .003$). Students who knew their other group members well, reported higher perceived critical and exploratory group norms. No effect of familiarity on consensual group norm perceptions was found ($\beta = .061$, $p = .052$). These findings mostly support *H1*.

The two fragments in Tables 5 and 6 illustrate these differences between low and high familiarity groups. The fragment in Table 5 shows a low familiarity group (*Group Mean familiarity* = 1.00) discussing questions they are going to address in their essay. As can be seen, each time a student proposes an idea or solution (lines 3, 8, and 15), this is quickly accepted by the other students. In contrast, in Table 6 the group members (*Group Mean familiarity* = 3.33) are constantly critical of each other's proposals (e.g., lines 6, 8, 10, 13, and 17). Ideas, solutions, and suggestions are often met with a critical question, or a counterargument. These fragments illustrate the abovementioned finding that in high familiarity groups, students adhered to more critical and exploratory group norms.

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Group norm perception

The effect of familiarity on group members' perceptions of their online behavior is also reported in Table 4. Familiarity had a significant positive effect on both perceptions of positive group behavior (β = .103, p = .005) and perceived effectiveness of group task strategies (β = .105, p = .007). Thus, students who are familiar with their fellow group members perceive their collaboration as more positive and rate their group's task strategies as more effective. Furthermore, familiarity was found to have a significant negative effect on perceptions of negative group behavior (β = -.125, p = .003). This indicates that in familiar groups, students report less negative group behavior. In sum, these findings support *H2*.

Collaborative activities

When analyzing the effect of familiarity on students' collaborative activities, two predictors were added to the multilevel model. In addition to familiarity, the number of chat messages typed was also included in the model to account for the fact that some groups typed more messages than others. By including this predictor, the effect of the familiarity could be investigated independent of number of messages typed by students.

Familiarity was found to be a significant predictor for several collaborative activities. On the one hand it had significant positive effects on (a) social support (*SociSupp*, β = 1.717, p = .045), and (b) social resistance messages (*SociResi*, β = 1.611, p = .003). On the other hand familiarity led to significantly less (a) task-related questions (*TaskQues*, β = -0.783, p = .039), (b) monitoring of task activities (*MTaskMoni*, β = -1.985, p = .007), (c) positive evaluations of task activities (*MTaskEvl+*, β = -0.583, p = .034), (d) greetings (*SociGree*, β = -1.304, p = .004), and (e) messages indicating loss of shared understanding (*SociUnd-*, β = -0.747, p = .033). No effect of familiarity was found on the other collaborative activities included in the coding scheme (see Table 2).

It seems that in high familiarity groups, students devoted less effort to task-related activities (they asked less task-related questions), and to regulating and coordinating task-related activities (they discussed less about their plans and strategies, and monitored their task progress less). Furthermore, the negative effect of familiarity on loss of shared understanding indicates that students experienced fewer misunderstandings. Moreover, students in familiar groups were also more engaged in social activities. Remarkably, they engaged more in positive social activities such as joking, as well as in negative social activities such as swearing or seeking conflict. These results are mostly in line with *H3*.

Group performance

To examine the last hypothesis, each group received performance scores for the different parts of the group task (see the Method section for a description). Since these scores were given for the *entire group*, a group-level measure of familiarity needed to be calculated as well. The individual familiarity ratings given by the three students within a group were therefore averaged, thus creating a group-level measure of familiarity. This measure was subsequently used as a predictor for group performance.

Because in this case both variables were measured at the same level, namely the group-level, ordinary regression analyses were used instead of multilevel analyses. Besides familiarity, the *average skill level of the group* was also included as a predictor in the regression model, because this variable is likely to be an important factor that might affect group performance. To determine the average skill level of the group, results from the knowledge pretest were used (see Method section). For each group, the results of the pretest were averaged to create a measure for the average skill level of the group. By including this measure in the regression analysis, we were able to examine the effect of familiarity on group performance while holding the average group skill level constant.

The results of the regression analyses are given in Table 7. Unsurprisingly, the average group skill level contributed positively to several aspects of group performance, namely: the quality of the conceptual content and argumentation of parts 1 and 3 (question answering and writing an essay) of the inquiry task and to the quality of the presentation of part 1 of the inquiry task.

Table 7 also shows the effect of familiarity on group performance. As can be seen, familiarity was not found to have a positive effect on group performance. In contrast, because all regression coefficients were negative, there seems to be a trend toward a negative effect of familiarity on group performance. Furthermore, a significant negative effect of familiarity on the quality of the presentation of part 1 of the inquiry task was found, $\beta = -.27$, $p = .04$. This suggests that familiarity had a negative effect on the way groups wrote and presented their answers to the questions they had to answer. Thus, there seems to be no evidence to support *H4*.

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Conclusions and Discussion

This study investigated the effect of familiarity on CSCL. The results indicate that familiarity influences several aspects of online collaboration. Because familiar group members may be more comfortable expressing their disagreement with their teammates, it was expected that higher familiarity would be associated with more critical and exploratory group norm perceptions (*H1*). This was confirmed as we found that familiar students reported their group norms to be more critical and exploratory than did students in less familiar groups. This is important, because in other research, critical and exploratory group norms have been found to contribute to collaborative learning (Postmes et al., 2001; Wegerif et al., 1999). Furthermore, researchers often report that students do not engage in interactive argumentation (Munneke et al., 2007). That is, they do not ask critical questions, they do not give arguments for their claims, and so on. This study seems to suggest that familiarity can play a role in solving this problem. If groups of familiar students are formed, this may increase the likelihood that students will engage in critical and exploratory discussions.

Because it was expected that familiar groups would communicate and collaborate more fluidly and efficiently, more positive perceptions of the online communication and collaboration process were also anticipated. Indeed, our analyses confirmed that higher levels of familiarity were associated with more positive perceptions and less negative perceptions (*H2*). This demonstrates that in familiar groups, students' collaborative experiences are more positive. In familiar groups for example, students report less domineering or free riding behavior. This is important since these behaviors negatively affect collaboration and learning (O'Donnell & O'Kelly, 1994). These results seem to imply that familiarity helps to make students' online collaborative experiences more positive. This is important because research has shown that students are often not satisfied with the collaborative process in CSCL environments (Fjermestad, 2004). Taking familiarity into account while composing online groups, may therefore be an interesting strategy to counter this finding.

Familiarity was also expected to influence students' collaborative activities (*H3*). Indeed, some expected effects were found. For example, higher familiarity was associated with fewer task-related questions, possibly due to the fact that communication is more efficient in familiar groups. Also, students who reported high levels of familiarity devoted less time to monitoring task-related activities. Again, this may be explained by the fact that coordination and communication and collaboration are more efficiently performed in familiar groups. This is also supported by the fact that students in familiar groups sent fewer messages indicating a loss of shared understanding, for example because there were fewer communication problems and ambiguities. On the other hand, familiar group members also exchanged more messages containing a negative accent. This may again be caused by the fact that group members are more comfortable communicating with each other, and are thus also more likely to voice negative opinions (Gruenfeld et al., 1996). This finding mirrors the finding by Smolensky et al. (1990) that familiarity tended to increase negative speech. It is, however, interesting to note that in familiar groups positive social messages were also sent more often. This finding suggests that negative behavior may not have as much of an impact in familiar groups. Recall that students in familiar groups actually reported *less* negative behavior, which is contradictory to the finding that they actually behaved more negatively. More research is needed to clarify the relationship between familiarity, perceived negative behavior, and observed negative behavior.

The last hypothesis (*H4*) addressed the influence of familiarity on group performance. However, no positive effect of familiarity on performance was found. In contrast, familiarity was found to have a negative effect on one aspect of group performance, while for the other there also seemed to be a trend toward a negative effect of familiarity. This is surprising, because familiar students reported more critical group norm perceptions, perceived the collaboration more positively, and needed to devote less effort to coordination and asking questions. This may be explained in several ways. First, familiar students engaged in negative interactions more often, which may have had a counterproductive effect. These negative interactions can undermine the group climate and the collaborative process, ultimately resulting in a decreased group performance. Previous research seems to confirm this assumption, as Wilson, Straus, and McEvily (2006) found that negative interactions decreased trust among group members, while Smolensky et al. (1990) found a negative relationship between negative interactions and group performance. Second, in familiar contexts, students were more likely to engage in (albeit positive) social talk. Although these kinds of interactions are important for fostering social cohesion and establishing a sound social climate (Kreijns et al., 2003), they divert attention from solving the task at hand and from discussion of the topic of the task. Possibly, in some groups the focus was too much on social activities, which may have been detrimental for the quality of their group products. Third, because the quality of group products was measured at the group level, the statistical power to detect effects of familiarity was relatively small. Finally, other factors, such as motivation, may play a role as well. Highly motivated groups for example, may have performed better on our inquiry group task. This may have suppressed the influence of familiarity on group performance. Future studies should investigate more closely which factors influence group performance.

In a previous study (Janssen, Erkens, & Kanselaar, 2007), we investigated the effects of a visualization called Shared Space on online collaboration. The Shared Space visualizes the amount of agreement and/or discussion students express during their online discussions. This visualization gives feedback about the type of discussions group members are conducting and helps them to monitor and regulate their collaboration. For this previous study, students worked on the same task as the one used in this study. We found that the Shared Space helped students to develop more exploratory group norms. Furthermore, the Shared Space had a positive effect on students' satisfaction with the group process and influenced the way students collaborate. Finally, the Shared Space was found to have a positive effect on one part of the group task. Because the setting of this previous study was comparable to the present study, the results of both studies seem to suggest that lack of familiarity could possibly be compensated by giving students feedback about their collaboration in the form of visualizations such as the Shared Space. While in this study unfamiliar groups reported less critical and exploratory group norms, visualizations, such as the Shared Space, may, for example, help them become aware of this and may also help them to address this aspect of their collaboration. Hence, an interesting approach to future research would be to examine more closely how possible negative effects of group member familiarity may be addressed and overcome by using technological tools of pedagogical interventions.

Several limitations of this study should be kept in mind. Students in this study were 15 to 18 years old. At this age, students may be sensitive to social and peer factors (Leaper & Smith, 2004), which may influence the impact of familiarity. Older or younger students may behave differently in familiar or unfamiliar settings. Furthermore, this study was conducted in an ecologically valid context, therefore it was harder to control important factors. For instance, the participating students had the option to work in the CSCL environment during free periods. Some students used this option quite frequently, while others did not use it all. This may have had an influence on, for example, group performance. Other important factors such as prior knowledge and experience with the medium could not be controlled as well. Clearly, more research is needed to determine whether these factors mediate the effects of familiarity on online collaboration.

Although an effect of familiarity on critical and exploratory group norm *perceptions* was found, this study did not investigate in depth whether students' online discussions also reflected these group norms. In other words, students *perceived* their discussions to be more critical and exploratory, but we do not know for sure if this actually was the case. If there is a difference between students' perceptions and their actual behavior (e.g., students report they are more critical, when in fact they are not), this may be an additional explanation for why no influence of familiarity was found on group performance.

Furthermore, during this study students worked on a complex, open-ended inquiry group task. To complete such as task, quite a lot of discussion but also regulation (e.g., monitoring task progress, devising strategies) is necessary. Such activities may be performed more efficiently in familiar groups (Adams et al., 2005; Gruenfeld et al., 1996). However, during other types of tasks (e.g., idea generation tasks, or closed tasks with only correct or incorrect answers) these activities may be less important, and thus familiarity may have a different effect on students' perceptions and behavior. In sum, the mentioned limitations emphasize the need for additional research into the possibly differential effects of familiarity.

The goal of educational innovation is to make learning more efficient so that learners learn the same amount of material in a shorter time span, and/or make learning more effective so that learners learn more in the same time span, and/or make learning more enjoyable such that the affective learning experience is pleasing and learners will want to learn (Kirschner, 2004). Educational research in general and CSCL-research in particular tend to focus on determining how specific tools, environments, or student characteristics affect either the effectivity and/or efficiency of online collaboration. In the research reported here, although familiarity was not found to have the expected positive effect on group performance, it still had very important positive consequences for the way students collaborated in a CSCL environment. Familiarity clearly led to a more positive, enjoyable collaborative experience for group members. This is an important finding in its own right. When composing online groups, familiarity of group members should therefore definitively be taken into account.

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Figure captions:

Figure 1: Screenshot of the VCRI-environment, showing some of the most important tools.

Table 1: Description, number of items and reliability coefficients of the scales included in the posttest questionnaire.

H_n	Scale(s)	Description	Items	α
1	Critical group norm perception	Based on Postmes et al. (2001): Were students critical of each other?	3	.85
	Consensual group norm perception	Based on Postmes et al.: Was there mostly consensus in the group?	3	.60
	Exploratory group norm perception	Based on Wegerif et al. (1999): Were discussions constructively critical?	7	.73
2	Positive group behavior	Positive behaviors (Webb & Palincsar, 1996) such as equal participation, helping, etc. Higher scores reflect more positive group behavior.	7	.83
	Negative group behavior	Negative behaviors (O'Donnell & O'Kelly, 1994) such as conflicts and free riding behavior. Higher scores reflect more negative group behavior.	5	.66
	Perceived effectiveness of group task strategies	Choices made and strategies chosen to complete group task (Saavedra et al., 1993).	8	.81

Table 2: Collaborative activities (abbreviation in parenthesis) and category Kappas (κ_c) of coding scheme.

	Task-related activities		Social activities	
	Codes	κ_c	Codes	κ_c
Performing	• Info exchange (*TaskExch*)	.93	• Greetings (*SociGree*)	.97
	• Asking questions (*TaskQues*)	.86	• Social support (*SociSupp*)	.90
			• Social resistance (*SociResi*)	.91
			• Mutual understanding (*SociUnd+*)	.94
			• Loss of mutual understanding (*SociUnd-*)	.87
Coordinating / regulating	• Planning (*MTaskPlan*)	.94	• Planning (*MSociPlan*)	.88
	• Monitoring (*MTaskMoni*)	.93	• Monitoring (*MSociMoni*)	.96
	• Positive evaluations (*MTaskEvl+*)	.78	• Positive evaluations (*MSociEvl+*)	1.00
	• Negative evaluations (*MTaskEvl-*)	.91	• Negative evaluations (*MSociEvl-*)	-
Other	• Neutral technical (*TechNeut*)	1.00	• Other / nonsense (*Other*)	1.00
	• Negative technical (*TechNega*)	.89		
	• Positive technical (*TechPosi*)	1.00		

Table 3: Means, standard deviations, and intercorrelations for familiarity, group norms, and perceptions of online behavior ($N = 88$).

	M	*SD*	1	2	3	4	5	6	7
1. Familiarity [a]	4.24	1.48	--	.13	.14	.27*	.28**	-.28*	.26*
Group norm perceptions									
2. Critical [c]	3.25	0.75		--	.34**	.41**	.30**	-.01	.30**
3. Consensual [c]	3.50	0.62			--	.68**	.68**	-.34**	.55**
4. Exploratory [c]	3.71	0.53				--	.76**	-.42**	.65**
Perception of online behavior									
5. Positive [c]	3.79	0.57					--	-.61**	.81**
6. Negative [c]	2.40	0.67						--	-.57**
7. Group task strategies [c]	3.60	0.60							--

Note [a] $N = 101$. [b] Scores along a scale from 2 to 8. [c] Scores along a scale from 1 to 5.
* $p < .05$. ** $p < .01$.

Table 4: Multilevel analyses of the effect of familiarity on group norm perceptions and perceptions of online behavior.

	β	SE β	t	χ^2
Group norm perceptions				
1. Critical	0.094	0.061	1.54^{*}	4.82^{*}
2. Consensual	0.061	0.048	1.27	5.82^{**}
3. Exploratory	0.100	0.039	2.49^{**}	10.60^{**}
Perception of online behavior				
4. Positive	0.103	0.044	2.35^{**}	10.09^{**}
5. Negative	-0.125	0.048	-2.60^{**}	13.09^{**}
6. Effectiveness group task strategies	0.105	0.046	2.26^{**}	6.45^{**}

* $p < .05$. ** $p < .01$ (one-tailed significance).

Table 5: Chat fragment from a low familiarity group (*M* = 1.00).

Line	Student	Chat message
1	105	I think those 4 sub questions are good. So they are final?
2	105	OK. I'm going to think along with you guys
3	104	Which conflicts and differing opinions were there within the Christian community?
4	104	Yeah sounds okay.
5	106	Hmm, that last one is kinda difficult, because the sub questions have to relate to the main question.
6	104	Those first 5.
7	104	Yeah, right.
8	104	How did the conflicts within Christianity influence its development?
9	104	Or something like that
10	106	Yea, perfect! :D
11	104	Ok.
12	104	Wait a minute…
13	105	That will be the fifth.
14	104	I'll sum it all up.
15	104	1) How did Christianity originate and how did it develop? 2) Why did pagans convert to Christianity? 3) What are the principles of Christianity? 4) What kinds of persecutions did the early Christians suffer and why? 5) How did the conflicts among Christians influence its development?
16	106	Nice!

Table 6: Chat fragment from a high familiarity group (*M* = 3.33).

Line	Student	Chat message
1	113	Ok, let's start
2	115	W8 a minute
3	113	:P
4	114	:D
5	115	We should first make those 5 categories, right?
6	113	Shouldn't we decide on them while reading?
7	113	Like, you could think of them then.
8	115	Yeah, when you decide on a category based on 1 source, the rest may not fit within that category.
9	115	If we just think of 5 categories, we can divide all sources over those five.
10	113	But right now we do not have a clue what they are all about?
11	115	Christianity?
12	114	Sharp… reeeeally sharp!
13	113	No, I think we better discuss those categories after we read it all.
14	115	But then you have to remember 13 sources.
15	115	How we'll categorize them?
16	114	OK, but how are we going to categorize it?
17	113	Yeah, but can't you just think of 5 while reading?
18	114	This sucks!

Table 7: Regression analyses for pretest performance and familiarity predicting group performance.

	Pretest performance		Familiarity	
	β	*p*	*β*	*p*
Part 1: Answering Questions				
Conceptual content and argumentation	.39	.01*	-.13	.22
Presentation	.48	.00**	-.27	.04*
Part 2: Categorizing Sources	.02	.45	-.21	.12
Part 3: Writing an Essay				
Conceptual content and argumentation	.32	.03*	-.18	.43
Presentation	.14	.21	-.12	.50

$^{*}p < .05$. $^{**}p < .01$.