



Perceptions and experiences of, and outcomes for, university students in culturally diversified dyads in a computer-supported collaborative learning environment



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ARTICLE INFO

Article history:

Keywords:

Computer-supported collaborative learning
Cultural diversity
Higher education
Multicultural groups

ABSTRACT

The introduction of computer-supported collaborative learning (CSCL), specifically into intercultural learning environments, mirrors the largely internet-based and intercultural workplace of many professionals. This paper utilized a mixed methods approach to examine differences between students' perceptions of collaborative learning, their reported learning experiences, and learning outcomes when they collaborated in a CSCL environment working with a culturally similar or dissimilar partner. Culturally diverse student dyads worked together to perform an online learning task in the domain of life sciences. Our sample of 120 BSc and MSc students was comprised of 56 Dutch and 64 international students, representing 26 countries. The results showed that students from an individualist cultural background had a more negative perception of collaborative learning than did students with a collectivist background, regardless of group composition. For women, working in a culturally similar dyad consisting of students from an individualist cultural background resulted in a more negative perception of collaborative learning than did working in this type of group for men or women working in a culturally similar dyad consisting of students from a collectivist cultural background. Students from an individualist cultural background achieved better learning outcomes than did students with a collectivist background, regardless of group composition. These findings suggest that cultural background adds an important dimension to collaborative learning, which requires students to manage collaboration that is not only virtual but also intercultural.

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1. Introduction

International and multidisciplinary group work represents a growing trend in professional environments as workplaces become increasingly global. Advances in computer and information technology have brought new opportunities to connect people across physical distance and time barriers. The introduction of this technology into, specifically intercultural, learning environments allows them to mirror the contemporary internet-based and intercultural workplace of many professionals in a range of fields. For instance, projects in industry, multi-functional design, academia, health care, web design, and international law frequently involve professionals working together in virtual multidisciplinary teams

spread across the globe (Sheppard, Dominic, & Aronson, 2004). Therefore, university students should not only be competent in their chosen content domain, but also experienced in working in international and multidisciplinary groups. According to McNair, Paretto, and Kakar (2008) virtual and geographically dispersed teams with members from different fields of expertise are “ubiquitous in the contemporary workplace, but our graduates are ill-prepared for the challenges of such collaborations” (p. 386). In response to this need, many universities are using new collaborative technologies as learning environments to better prepare students for the working world that awaits them after graduation (McDonald & Gibson, 1998).

To address the challenges of the rapidly changing workplace facing students today, educators and instructional designers need to develop learning environments that are responsive to these multidimensional characteristics: teams can be virtual, multidisciplinary, and multicultural. Issues facing virtual teams have become increasingly prominent in education research in the last twenty

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years, and there is a well-documented body of research on computer-supported collaborative learning (CSCL) that has focused on various aspects of group learning processes and outcomes (e.g., Koschmann, 1999; Noroozi, Weinberger, Biemans, Mulder, & Chizari, 2012; Tanis & Postmes 2007). One of the main goals of CSCL is to provide an environment that supports and enhances collaboration between students so as to improve their learning processes (Kreijns, Kirschner, & Jochems, 2003). The multidisciplinary approach to collaboration is increasingly investigated in education research to better understand how teams might create something new by interacting across traditional disciplinary boundaries (Hermann, Rummel, & Spada, 2001). However, there are relatively few studies focusing on multidisciplinary teams working together using collaborative technologies (exceptions include Noroozi, Weinberger, Biemans, Mulder, & Chizari, 2013; Rummel & Spada, 2005). Culture adds another dimension to collaborative learning, requiring students to manage collaboration that is not only virtual and cross-disciplinary, but also intercultural.

The use of technological learning environments does not eliminate cultural influences from collaborative learning, but rather poses new challenges (Chase, Macfadyen, Reeder, & Roche, 2002; Reeder, Macfadyen, Chase, & Roche, 2004). In the present research, we consider culture to be “the collective programming of the mind which distinguishes the members of one human group from another...the interactive aggregate of common characteristics that influence a human group’s response to its environment” (Hofstede, 1980, p. 25). According to Cole (1996) each culture has a unique set of mediated learning experiences and the cultural context of cognition influences the way in which a learner attains knowledge. Students coming from different cultural backgrounds can thus differ in terms of cognitive styles, human relations, rules of behavior, communication style, attitudes and belief systems (Hofstede, 1991; Schwartz, 1990; Trompenaars, 1993). In terms of collaborative learning, cultural background can thus influence one’s understanding of the required collaborative processes and perceptions of the types of actions that are required and likely to be effective in a given learning situation (e.g., Lal, 2002; Lans, Oganisjana, Täks, & Popov, 2013; Woodrow, 2001).

Previous research suggests that student perception of collaborative learning is a key dependent variable of educational interventions (So & Brush, 2008; Zhu, 2009). Early studies in the field mainly focused on the quality of collaborative learning products or individual learning results, but often overlooked the fact that the outcome is mediated by the quality of group learning processes (Lim & Liu, 2006). Many social and cultural factors that significantly impact the interactional processes are yet to be taken into account in CSCL studies (Lim & Liu, 2006; Weinberger, Clark, Hakkinen, Tamura, & Fischer, 2007). To this end, the present study provides an empirical investigation of differences in university students’ perceptions of collaborative learning, reported learning experiences, and learning outcomes when they used a CSCL environment to collaborate with a partner who was either culturally similar or dissimilar.

2. Theoretical background

In CSCL, two or more students, each holding certain patterns of thinking, feeling, and acting on how to engage in a collaborative situation, work together to solve problems or build knowledge supported by specifically designed software (Prinsen, Volman, & Terwel, 2007). Students may differ in the way in which they collaborate and comply with various collaboration activities based on their procedural knowledge (i.e., experiences, feelings, information, strategies, and knowledge on any kind of activity) (Kolodner, 2007) and the conditions influencing group dynamics, such as

group composition, group size, collaborative media, and learning task (Dillenbourg, 1999; Rummel & Spada, 2005). In addition, process factors of the online collaboration itself (e.g., turn-taking, managing time, task distribution, giving and receiving feedback) might pose challenges that inhibit successful and productive group work (Cox, Lobel, & McLeod, 1991; Kirschner, Beers, Boshuizen, & Gijsselaers, 2008). Building on previous research (e.g., Cox et al., 1991; Lim & Liu, 2006; Weinberger et al., 2007; authors), this study investigated whether culturally diverse CSCL groups of students need to overcome an additional level of complexity due to culture-related differences.

The effects of cultural background can be examined either at an individual level or at a group level. There is growing concern in the CSCL literature that analyses of individual-level data cannot be treated independent of the group-level data. This relates to the data structure that forms the basis for the analyses, specifically the issue of non-independence often associated with group research in general and with CSCL research in particular. In the present research we analyze the effects of individual cultural background in relation to the cultural group composition in a dyadic CSCL setting. The way one person behaves in a social situation at least partially depends on and/or influences the way his or her collaborators behave in that situation. In CSCL research, the data of individuals is necessarily nested in the data of groups and the influence of a specific group and setting on the learning process that emerges can therefore differ from group to group.

Before describing the methodology, the findings from previous research on cultural effects on social behavior and cognitive processes in online collaborative learning will be described.

2.1. Cultural diversity and gender-related differences in CSCL groups: Influences on perception, learning processes, and learning outcomes

Group composition variables, which can include cultural homogeneity/heterogeneity, have been found to be of crucial importance for the functioning and overall success of a collaborative learning group (Liang & McQueen, 2000; Lim & Liu, 2006; Popov, Brinkman, Biemans, Mulder, Kuznetsov & Noroozi, 2012; Smith & Smith, 2000). Cultural background differences can either benefit or disrupt “the web of intra-group dynamics” (Halverson & Tirmizi, 2008, p. 12). Some of the key benefits of culturally diverse CSCL groups include: (1) more equal participation for non-native-speaking students appears to be promoted more by online discussions than by face-to-face discussion (Warschauer (1999); (2) enhancement of intercultural awareness (Amant, 2002); (3) development of the social, cognitive, and perspective-taking abilities of students is stimulated (Bonk, Appelman, & Hay, 1996; Lim & Liu, 2006); (4) sharing of different perspectives, different background knowledge, skills, and decision-making strategies to the task at hand (Maznevski, 1994).

Intercultural CSCL offer benefits but also pose challenges, which likely arise in terms of coordinating different perceptions, reasoning, and communication styles of students from different cultures (Kim & Bonk, 2002; Reeder et al., 2004; Vatrappu, 2008; Wertsch, 1998; Zhu, 2009). Previous research suggests that students’ perceptions of collaborative learning may affect their collaborative behavior and learning outcomes (e.g., Dijksterhuis & Knippenberg, 1998; Kim & Bonk, 2002; Lizzio, Wilson, & Simons, 2002; Zhao & McDougall, 2008; Zhu, 2009). While accomplishing a task collaboratively, students from different cultures may have different perceptions of collaborative learning, which can lead to conflict because of the mismatch of their perspectives, feelings, and expectations (Brockner, 2003; Reeder et al., 2004; Zhao & McDougall, 2008; Zhong, Liu, & Lim, 2008). According to a number of theories in the fields of social psychology and cognitive psychology (e.g., dominant theory, group composition theory, similarity-attraction,

and self-categorization theory), culturally similar groups tend to conform to social behavioral norms, communication styles, and perception of the learning environment, which encourage effective in-group relationships, stronger social bonds, and faster communication, while minimizing conflict, anxiety, and disagreements (Byrne, Griffitt, & Stefaniak, 1967; Lim & Liu, 2006). In contrast, culturally dissimilar groups “often suffer from process losses in terms of misunderstandings and coordination difficulties when working on tasks together” (Weinberger et al., 2007, p. 69). A number of studies have demonstrated that group dynamics in culturally dissimilar groups might differ to a large extent from those in culturally similar groups (for an overview, see Williams & O’Reilly, 1998). For example, when Kim and Bonk (2002) investigated the online collaborative behavior of Finnish, American, and Korean students in web-based conferences, they found distinct patterns of collaborative behavior: American and Finnish students showed more task-oriented behavior while Korean students showed more relationship-oriented behavior. Similarly, Setlock, Fussell, and Neuwirth (2004) have documented clear differences in the communication strategies of Asians (i.e., individuals from India and East Asia) versus Westerners (i.e., individuals from North America), which can undermine the effectiveness of collaborative learning methods. More specifically, differences in argumentation were revealed with Westerners tending to focus on mostly points of disagreement but Asians discussing each point regardless of whether there was agreement or disagreement. Culturally dissimilar groups of students may sometimes confront such differences and therefore have to overcome an additional level of complexity stemming from such cultural background differences when collaborating online.

Process losses due to coordination difficulties have been reported to be one of the major impediments to online collaboration in general (Strijbos, Martens, Jochems, & Broers, 2004) and online collaboration between culturally diverse students in particular, because of their culture-related differences on how to act and interact (Anderson & Hiltz, 2001). Group members are often challenged by procedural issues related to coordination, evaluation of ideas, planning and task division when it comes to decision making at any stage of group work—no matter what the composition of a collaborative group. But culturally dissimilar groups need to handle all these issues as well as being likely to experience challenges related to agreeing on ‘legitimate’ approaches to problem solving, uncertainty associated with working with people from different cultural backgrounds, and miscommunications (Behfar et al., 2006). The difficulties that characterize mixed-culture groups often result in decentralized thinking, divergence in collaborative learning activities, misunderstandings, and lack of agreement on the general course of action to be taken. When the need for effective communication becomes larger, the lack of visual cues and nonverbal information in an online environment can further complicate the flow of communication and mutual understanding resulting in impaired coordination of processes in culturally dissimilar groups in particular.

Students in culturally dissimilar CSCL groups may feel uncertain and anxious about each other, and seek ways to predict their partner’s behavior and correctly interpret his/her feedback. Several aspects of online communication (e.g., reduced social presence, lack of nonverbal and social cues) might further hinder mutual understanding between collaborative partners (Anderson & Hiltz, 2001; Berger & Gudykunst, 1991), especially when they do not know each other and are collaborating for the first time (Janssen, Erkens, Kirschner, & Kanselaar, 2009). This may be particularly true for culturally dissimilar CSCL groups when even awareness of the difference in backgrounds between members in a group may result in a certain bias, faulty assumptions, and misinterpretations.

Apart from cultural aspects there are many other elements of diversity that affect group processes. Gender differences have been

also found to have an effect on an individual’s behavior when working in groups in face-to-face setting as well as in CSCL systems (Gabrenya, Latané, & Wang, 1983; Kugihara 1999; Prinsen et al., 2007). Men tend to be more individualistic and women relational (collectivistic), regardless of cultural values (Tsaw, Murphy, & Detgen, 2011). As an example of the effects of gender and culture on behavior in groups, Gabrenya et al. (1983) found differences between men and women across cultures with regards to social loafing (i.e., a group member does not contribute to the group work his/her full potential or undermines group working process). Chinese students displayed less social loafing than American students and women displayed less social loafing than men across cultures (Tsaw et al., 2011). Social loafing violates the whole idea of collaborative learning and negatively influences group climate, group participation and overall group performance (Latane, Williams, & Harkins, 1979).

In the context of CSCL research, few studies focus on the effects of gender and very little research has been done on the joint effects of gender and culture on learning processes and outcomes. A study conducted by Wolfe (2000) suggests that gender and students’ ethnic backgrounds tended to affect their participation in computer-mediated environments. Specifically, Wolfe (2000) found that the relative participation of white women increased by over 50% in the computer-mediated environment compared to face-to-face classroom discussion, whereas this was not the case for the Hispanic women, who strongly preferred the face-to-face discussion environment. Other researchers have found that women communicated differently than men in CSCL systems. Specifically, women used more responsive dialog acts, while men used more informative and imperative dialog acts (Erkens & Janssen, 2008). Prinsen et al. (2007) reviewed thirteen studies on gender issues in computer-mediated communication (CMC) and CSCL. They have found the following: (1) group gender composition affected students’ learning achievement; (2) degree of participation in terms of number of words per message and elaboration of the responses for males was lower than for females; and (3) females were more likely to initiate the conversation with questions and request information while males tended to provide more explanations and express disagreement more frequently. Taken together, previous research findings indicate that an examination of gender effects in conjunction with the importance of cultural background of group members may prove useful in explaining the dynamics of culturally diversified groups working in a CSCL environment.

The next section presents a research review of conceptual models for understanding culturally diverse CSCL student groups.

2.2. Conceptual models for operationalizing culture

There are three primary areas of research regarding the relationship between students’ cultural backgrounds and learning in online collaborative learning environments. These studies have focused mostly on: (1) differences in how students from different cultural backgrounds perceive online group processes (e.g., Al-Harthi, 2005; Anakwe & Christensen, 1999; Thompson & Ku, 2005); (2) how the linguistic and cultural backgrounds of collaborative partners impact their actual actions/behaviors/engagement in online collaborative situations (e.g., Lim & Liu, 2006; Oetzel, 2001); and (3) differences in students’ motivation with respect to online collaborative learning environments (e.g., Wang, 2007). The majority of these studies operationalized culture either by connecting culture to nationality and/or ethnic origin (usually in cross-cultural comparison studies), or by applying various classifications of culture.

Over the last sixty years, a number of cultural models have been developed to characterize the differences in cultures. Salas, Burke, Wilson-Donnelly, and Fowlkes (2004) identified over 64 cultural

dimensions represented in the scientific literature. The most widely accepted cultural dimensions focus on differences in human relations, rules of behavior, cognitive style, orientation to time, communication style, power distributions, attitudes and belief systems across cultures (Hofstede, 1991; Salas et al., 2004; Schwartz, 1990).

In spite of strong evidence about the impact of culture on individuals' social behavior, communication, and cognition, there is no established framework for applying the existing body of knowledge on culture to culturally diverse groups in online collaborative learning. In most of the general cultural models, Hofstede's (1991) Individualist–Collectivist (I–C) dimension has proved to be one of the most robust concepts. The I–C dimension defines the extent to which a culture shapes an individual's (1) dependence on the self (individualists) or the group (collectivists); (2) attitude towards goals – individualists are geared specifically to personal goals while collectivists tend to contribute to group success; (3) behavioral motives – collectivists are more impelled by the common group identity, social norms and commitments, whereas individualists tend to act based on their own values, beliefs and personal motives (Hofstede, 1991; Triandis, 1994).

Research replicating and supporting the robustness and validity of Hofstede's (1991) dimensions of culture is large in scope and quantity, exceeding 1500 published studies (Metcalfe & Bird, 2004) and Hofstede's cultural orientation framework has more than 5000 citations in the Web of Science (Taras, Roney, & Steel, 2009). However, this framework has been challenged in recent years by a number of researchers. The critiques of Hofstede's framework are mainly related to Hofstede's original research database/sample and its generalizations regarding national cultures (for a review of these critiques, see Ess & Sudweeks, 2005 or McSweeney, 2002). Despite these critiques, Hofstede's framework remains the dominant approach to classify and compare national cultures.

The I–C dimension has been widely used in educational research to describe differences in culturally-based learning styles, specifically for studying group collaboration (e.g., Goncale & Staw, 2006; Oetzel, 2001). A number of studies utilized the I–C dimension to investigate the differences among culturally diverse students in online learning environments (e.g., Anakwe & Christensen, 1999; Oetzel, 2001; Tapanes, Smith, & White, 2009). For instance, Anakwe and Christensen (1999) examined differences stemming from individualistic and collectivistic cultural orientations in terms of students' perceptions of distance learning in two American universities. Their research findings suggest that individualistic students' motives, their styles of interaction and ways of performing are more compatible with features of distance learning in comparison with collectivistic students. Another study, conducted by Tapanes et al. (2009), had similar findings stating that collectivistic students are less motivated to participate in asynchronous learning networks compared to individualistic students.

The influence of the I–C cultural orientation on group work processes and collaboration dynamics has been studied at both individual and national levels. The present research investigated the effects of the I–C dimension on perceptions of collaborative learning, reported experiences, and learning outcomes of students who were members of a collectivist or individualist culture as determined by Hofstede's country-level ratings. Hofstede's I–C dimension is used here only at the level of national differences across cultures and not at individual level within cultures. Consequently, we focus on the variance in perception patterns that result from inter-cultural rather than inter-individual differences. According to Rosé, Fischer, and Chang (2007) "because of the important role of social processes, in particular processes of communication that are heavily influenced by culturally based expectations and norms, the area of computer supported

collaborative learning is an ideal field in which to begin investigations of multinational experimental studies" (p. 2).

2.3. Research questions

This paper addresses several research questions:

When paired in similar or dissimilar dyads (in terms of the members' individualistic or collectivistic cultural orientation) in a computer-supported collaborative learning environment, to what extent do students:

- RQ1. ...differ in their perceptions of collaborative learning?
- RQ2. ...differ in their learning outcomes?
- RQ3. ...differ in their reported learning experiences?

RQ4. Do the effects of cultural orientation and dyad composition on students' perceptions of collaborative learning, learning outcomes, and reported experiences in the computer-supported collaborative learning environment differ by gender?

3. Method

3.1. Participants

The participants were 120 MSc or final-year BSc students enrolled at a university in the domain of life sciences in the Netherlands. In our sample, 56 were Dutch and 64 were international. Of the international students: 29 came from Europe (outside the Netherlands), 16 from Africa, 8 from Asia, 3 from Oceania, 6 from South America, 1 from Central America, and 1 from North America. Our study's international participants represented a total of 26 countries. The mean age of the students was 24.73 ($SD = 3.4$) years, and 57% were female. Before participating in this study, the international students had been living in the Netherlands for an average of six to eight months, and all students, regardless of cultural background, had some short-term previous travel experience, including internships and traveling for work outside of their home countries for both academic and non-academic purposes. All study participants were required to demonstrate English language proficiency when enrolling at the university where this research was conducted. The students interacted with the study personnel and with each other in English. The dyads that were composed of two members of the same country communicated in English as well, except for two dyads who communicated in Dutch but only a small part of their discussions.

3.2. Design

The study participants were students from two disciplinary backgrounds: (1) international land and water management studies ($N = 60$), and (2) international development studies ($N = 60$). These two complementary domains of expertise were required to successfully accomplish the learning task in this study. The concepts to be learned were community-based social marketing (CBSM) and its application in sustainable agricultural water management (SAWM). The students' task was to apply these concepts in fostering sustainable behavior among wheat farmers in a province of Iran (see Noroozi, Biemans, Weinberger, Mulder, & Chizari, 2013; Noroozi, Teasley, Biemans, Weinberger, & Mulder, 2013, for further description of the learning task, the CSCL platform, and the concepts of the SAWM and CBSM). Upon completion of the task, each student was expected to deliver an individual solution plan for designing an effective program that fosters sustainable farmer behavior. The students were compensated €15 per hour for their participation in the initial experiment, but not in the subsequent interview.

All students were randomly assigned to dyads based on their disciplinary backgrounds, such that every dyad included one student with a water management disciplinary background and one student with an international development disciplinary background. Students did not know each other before the study.

After the experiment, 78 out of 120 students individually filled in a questionnaire about their perceptions of collaborative learning in the CSCL environment, and 58 out of those 78 students agreed to be interviewed about their CSCL experiences as well. The remaining students did not complete the questionnaire or interview and therefore were excluded from the analysis. This resulted in high attrition rate. The study personnel initially intended to administer questionnaire and interview all students who worked together in dyads in order to cope with the inherently nested nature of the data in the further analyses. A total of 120 students were contacted after the experiment and 34 students gave straight refusals to participate in the interview and complete the questionnaire due to the students' availability schedules. The study personnel failed to reach 6 students by phone and e-mail, and 2 students did not show up for the planned interviews.

Students' cultural backgrounds were determined by asking them to indicate their countries of origin during the introductory session. Countries of origin were coded according to Hofstede's individualist–collectivist dimension (individualism (IDV) index, see Hofstede, Hofstede, & Minkov, 2010), standardized and set into a range from 0 (most collectivistic) to 100 (most individualistic). Based on collection and analyses of data from over 100,000 individuals from 50 countries, Hofstede developed his original framework of national cultures values as a result of using factor analysis to examine the results of a world-wide survey of IBM employee values. The original Hofstede's IDV index was computed based on the standardized scores of the 15 work goal questions (for a full list of questions, see Hofstede, 1980). Thus, these scores were utilized to quantify cultural differences between countries in the present study. Further analysis in this study was based on the responses of students from countries in two selected categories: low IDV (scores less than or equal to 51) and high IDV (scores higher than or equal to 60). Students from countries that represent the

middle category based on the individualism index (i.e., scores between 51 and 59, in total one student and his collaborative partner) were removed from the analysis.

We followed previous research (e.g., Gouveia, Clemente, & Espinosa, 2003; Murray-Johnson et al., 2001) in dichotomizing the IDV index. For example, Gouveia et al. (2003, p.59) suggest that Spain (individualism index 51) is “half way between collectivism and individualism [...], that is, between Latin America and Europe.” According to Hofstede and his colleagues (Hofstede et al., 2010) Spain is a Collectivistic society, whereas Poland, with a score of 60 is seen as Individualist. As in these previous studies, out of a list of all students in our sample, we ranked them by IDV index scale and took the bottom half for this category (scores less than or equal to 51) and were considered as collectivists and the top half as individualists (scores higher than or equal to 60). Leaving out the middle group, so that cultural orientation (individualists and collectivists) can be used as a fixed factor, has also been done previously in studies investigating possible effects of culture (Murray-Johnson et al. 2001). See Table 1 for a list of countries of the participants included in the analyses and their associated Hofstede's IDV index (Hofstede et al., 2010).

As for the questionnaire data, in total there were 76 students, after removing one dyad representing the middle category of the IDV index as described above. With respect to cultural backgrounds of the remaining 76 students: 28 students worked in culturally similar dyads consisting of two individualistic members (II), 17 students worked in culturally similar dyads consisting of two collectivistic members (CC), and 31 students worked in culturally dissimilar dyads consisting of one individualistic and one collectivistic member (CI or IC). Both orders (CI and IC) were used to investigate the extent to which cultural background and group composition are related to students' perceptions of the collaborative learning experience. An overview of the distribution of the participants over the dyads, their cultural composition, countries of origin and number of the dyads is presented in Table 2.

Interview data were collected for 58 students, i.e., 18 students who worked in culturally similar dyads consisting of individualistic members, 14 students who worked in culturally similar dyads

Table 1
Individualism values for countries of the participants included in the analyses.

Geographical region	Country	Number of students	IDV index*	Collectivist/individualist cultural orientation
Europe	The Netherlands	37	80	I
Europe (excluding the Netherlands)	Germany	5	67	I
	Spain	3	51	C
	Bulgaria	2	30	C
	Poland	1	60	I
	Italy	1	76	I
	Croatia	1	33	C
Africa	Nigeria	3	20	C
	Ethiopia	4	27	C
	Ghana	5	20	C
	Rwanda	1	27	C
	Kenya	1	27	C
Asia	Indonesia	2	14	C
	Laos	1	20	C
	Japan	1	46	C
	Vietnam	1	20	C
	China	2	20	C
South America	Chile	1	23	C
	Peru	1	16	C
	Bolivia	1	12	C
Central America	Honduras	1	20	C
North America	United States of America	1	91	I

* Individualism values for countries in sample, using Hofstede's individualism (IDV) index (Hofstede et al., 2010; <http://www.geert-hofstede.com/>, downloaded September 8th, 2012).

Table 2
Number of dyads and their cultural composition.

Dyad compositions in terms of countries of origin	Number of dyads and their composition in terms of cultural orientation*		
	CC	CI/IC	II
D, Af		5	
D, D			15
D, As		3	
D, SA		3	
D, E		3	4
D, NA			1
E, As		1	
E, E	1	1	1
E, Af	1	2	
As, Af	2		
As, SA	1		
As, CA	1		
Af, Af	3		

Notes: D(utch), E(urope – excluding the Netherlands), Af(rica), As(ia), SA(South America), CA(Central America), and NA(North America); C = collectivist; I = individualist.

* Number of dyads included in the analyses, if at least one member filled in the questionnaire.

consisting of collectivistic members, and 26 students who worked in culturally dissimilar dyads consisting of one individualistic and one collectivistic member.

3.3. Procedure

In a pilot study with eight students we first ensured adequate levels of task difficulty, comprehensibility of the learning material, and the technical functioning of the learning environment

The experimental session took about four hours and consisted of five phases (Fig. 1) during which students were seated at individual computers and had face-to-face contact with the study personnel. During phase 1, individual students received an introduction to the study (5 min). They were then asked to complete several questionnaires on demographic variables, computer literacy, and prior experience with collaboration (30 min).

During phase 2, the individual learning phase, students first received introductory explanations on how to analyze the case (5 min). They were then given 5 min to read the problem case and 10 min to study a three-page summary of the theoretical text regarding SAWM and CBSM, the demographic characteristics of the

farmers, and the location of the case study. Students were allowed to make notes, and to consult the text and their notes during the experiment. Students were next asked to design an effective program for fostering sustainable behavior on the basis of their own domain of expertise (20 min.). After phase 2, students were allowed a 10-min break.

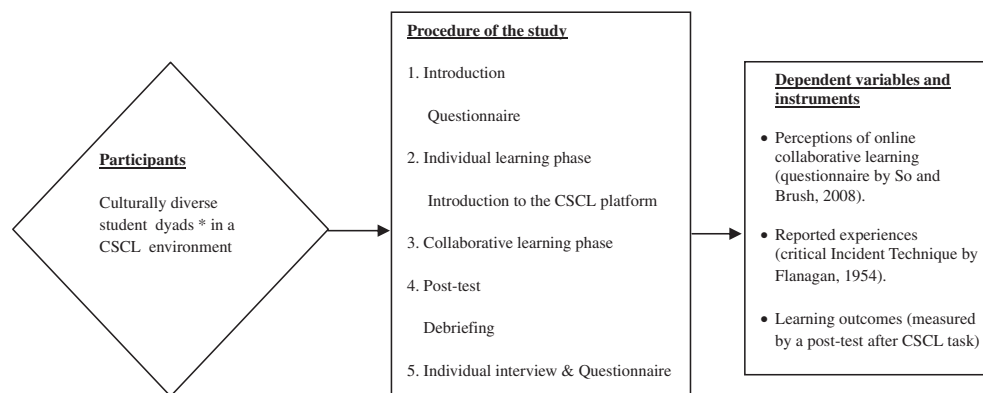
In phase 3, the collaborative learning phase, students were oriented to the CSCL platform and introduced to the procedure of the collaboration task (10 min). For the following 90 min, students were asked to collaborate, discuss, negotiate with their assigned partners to develop possible solutions for the task (i.e., designing an effective program for fostering sustainable farmer behavior), and to ultimately reach an agreement about a solution.

During phase 4, the post-test and debriefing phase, students were asked to work on a comparable case-based assignment individually (20 min) using what they had learned in the collaboration phase. They were asked to analyze and design an effective plan for fostering sustainable behavior among Nahavand, a province in Iran, wheat farmers in terms of irrigation methods that could be applied for fostering SAWM as a CBSM advisor. This comparable case-based assignment was used as a transfer task when students needed to apply specific skills, knowledge, and/or attitudes that were learned in one situation to another learning situation (Perkins & Salomon, 1992). Finally, the students got a short debriefing for about 5 min.

Within two days of the experiment, all students were contacted to participate in phase 5, an individual interview on their CSCL experiences (30 min.). As described above, 58 students agreed to be interviewed and filled out the questionnaire on their perceptions of collaborative learning in CSCL. Twenty more students completed the questionnaire only.

3.4. Learning platform

An asynchronous text-based discussion board called SharePoint was customized for the purpose of our study for the collaboration phase. Immediate (chat-like) answers were not enabled in the learning environment (Fig. 2). Instead, the interactions were asynchronous, resembling e-mail communication to exchange the text messages. Each message sent to a partner consisted of a subject line, date, time, and the message body. While the SharePoint platform set author, date, time, and subject line automatically, the students had to enter the content of the message as in any typical discussion board (see Noroozi, Biemans, et al., 2013; Noroozi,



* Each dyad consisted of one student with water management disciplinary background and one student with international development disciplinary background.

Fig. 1. Design of the empirical study.

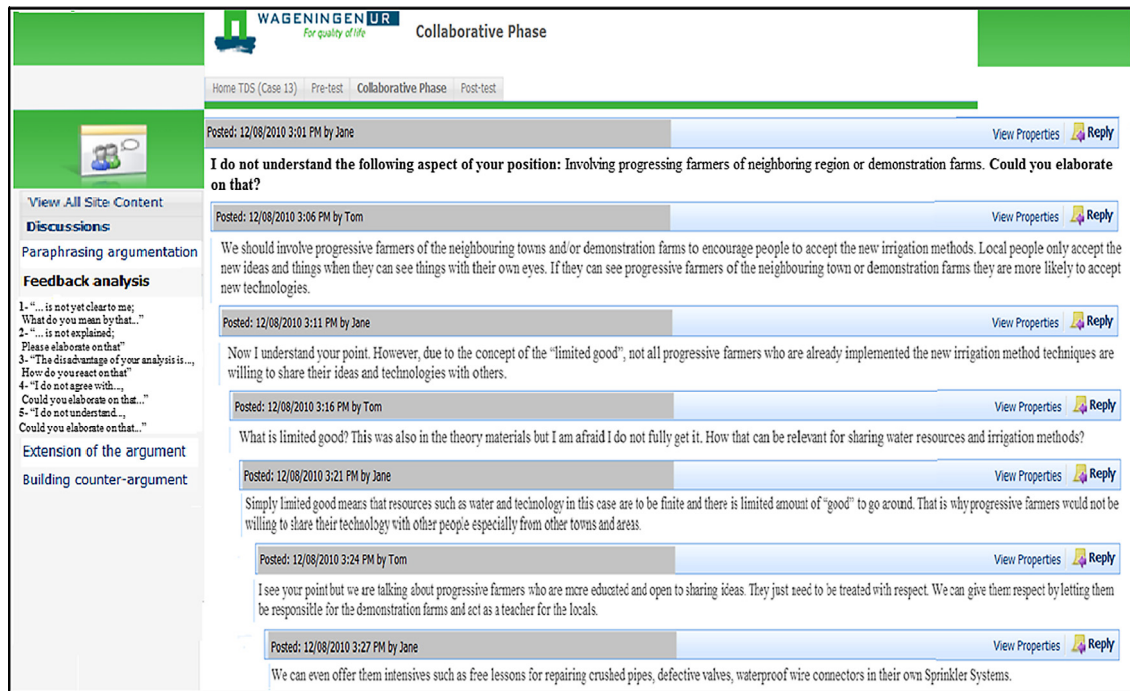


Fig. 2. Screenshot of the customized SharePoint CSCL platform.

Weinberg, et al., 2013 for a further description of the learning environment and also screenshots of the platform).

3.5. Instruments

3.5.1. Perceptions of collaborative learning in a CSCL environment

To answer the first research question about students' perceptions of collaborative learning in the CSCL environment, the data collected in phase 5 was analyzed utilizing a post-collaboration questionnaire about students' perceptions of collaborative learning developed by So and Brush (2008). The questionnaire measured students' perceptions of collaborative learning at the individual level using a Likert-scale to rate agreement or disagreement for eight items using a 5-point scale (1 = strongly disagree; 2 = disagree; 3 = neutral; 4 = agree; 5 = strongly agree). The questionnaire items were:

- "My collaborative learning experience in the computer-mediated communication environment was better than in a face-to-face learning environment."
- "I felt that I was part of a learning community in my group."
- "I actively exchanged my ideas with my collaborative partner."
- "I was able to develop new skills and knowledge with the help of my collaborative partner."
- "I was able to develop problem-solving skills through peer collaboration."
- "Collaborative learning in my group was effective."
- "Collaborative learning in my group was time consuming"(reverse-coded).
- "Overall, I am satisfied with my collaborative learning experience in this study."

The Cronbach's alpha coefficient was .72 for the Collaborative Learning Scale in So and Brush's research (2008). We computed the Cronbach's alpha reliability coefficient for this scale in our research study and it was also acceptable (.79). The range of the total scale scores was 8–40. Higher scores reflect a more positive perception of collaborative learning in the CSCL environment.

3.5.2. Learning outcomes

Building on Noroozi, Teasley, et al. (2013) as well as Noroozi, Weinberg, et al. (2013), the measure of individual performance was operationalized as the quality of the individual problem solution plan produced by each student in the post-test. The quantitative strategy adopted for measuring the quality of individual problem solution plans was to focus on the extent to which individual students were able to support their theoretical assumptions in relation to the case with justifiable arguments, discussions, and sound interpretations. Two expert coders independently rated individual problem solution plans using a 5-point scale ranging from "inadequate problem solution plan" to "high-quality problem solution plan." Both the inter-rater agreement between two coders (Cohen's kappa = .84) and the intra-coder test-retest reliability for each coder for 10% of the data (89% identical scores) were sufficiently high. We then assigned 0 points for inadequate problem solution plan, 1 point for low quality, 2 points for rather low quality, 3 points for rather high quality, and 4 points for a high-quality problem solution plan. Based on these points, we calculated the mean quality score for the individual problem solution plans in all conditions.

3.5.3. Students' reported CSCL experiences

Instances of students' positive and negative collaborative experiences in the CSCL environment were collected using Critical Incident Technique (CIT). Using semi-structured interviews, the CIT fosters recall of critical events or incidents, including the actions and decisions made by interviewees and others (Flanagan, 1954). The CIT asks individual students to describe how they actually behaved in particular situations and to give reasons for decisions they made. While there have been some reliability concerns when using this method related to evidence of memory degradation and correlation between recalled events with performance, it is widely used in a variety of social science research settings, including performance appraisal, industrial psychology, competency management, health, and education, (e.g., Klein & Armstrong, 2004; Wiersma, Van den Berg, & Latham, 1995) and in cross-cultural studies (e.g., Dekker, Rutte, & van den Berg, 2008). The four-step CIT protocol

was developed by Flanagan (1954) and adapted for this study. The interview questions addressed students' opinions, values, and feelings with respect to their most successful and most challenging collaborative experiences during the study. Students were told that a particular collaborative situation was considered to be positive or negative if an interviewee believed that the observed behavior contributed significantly to the outcome. The study students were asked to answer interview questions fully, giving specific examples and spending some time thinking about their answers before they started to verbalize their thoughts.

The first author conducted all interviews. At the beginning of each interview, the interviewer informed the student that the conversation and their identity would be kept confidential, and asked for permission to record the interview. A standardized, semi-structured interview format was used for this study because it was not known in advance what categories would emerge for data analysis.

3.6. Analyses

The effects of cultural orientation (collectivistic/individualistic) and gender (female/male) on students' learning outcomes and their perceptions of collaborative learning in a CSCL environment were examined through conducting multi-level analyses (MLAs). According to several researchers (Cress, 2008; De Wever, Van Keer, Schellens, & Valcke, 2007), MLA properly addresses the statistical problem of non-independence often associated with CSCL-research or dyad research more generally. Many statistical techniques (e.g., regression analyses, *t*-test, ANOVA) assume score-independence, and violating this assumption compromises the interpretation of the output of the analyses (e.g., *t*-value, standard error, *p*-value). MLA entails comparing the deviance of an empty model and a model with one or more predictor variables to compute a possible decrease in deviance. The latter model is considered better when there is a significant decrease in deviance from the empty model (tested with a χ^2 -test).

To answer the research questions, three different MLA models with fixed effects were conducted. The first model addressed RQ1 and RQ2 by examining the effects of students' cultural orientation and student gender on their learning outcomes and perceptions of

CSCL at the individual level. The second model addressed RQ4 by examining the effects of mixed dyad composition, at the group level (dissimilar/similar cultural orientation and gender within dyads), on students' learning outcomes and their perceptions of CSCL. The last model examined the interplay between student gender and mixed culture dyad composition on students' learning outcomes and their perceptions of CSCL.

Non-independence was determined by computing the intra-class correlation coefficient and its significance (see Kenny, Kashy, & Cook, 2006) for all dependent variables relating to students' learning outcomes and their perceptions of collaborative learning. All reported χ^2 -values concerning students' perceptions of collaborative learning were significant ($\alpha < .05$) and, therefore, the estimated parameters of these predictor variables (effects of cultural orientation, gender and different dyad compositions) were tested for significance. Only one of the reported models concerning student's learning outcome revealed a significant χ^2 -value. The model with cultural orientation and gender, irrespective of dyad composition, justified the use of MLA. Models in which students were paired in dissimilar or similar cultural orientation and gender dyads were, in this study, unsuited to predict differences in students' learning outcomes.

To answer RQ3 on the students' reported learning experiences in the CSCL environment, the recordings of the interviews were transcribed and coded using the inductive thematic analytical technique described by Hayes (2000). Atlas.ti was used to organize and analyze transcript data (for a more detailed description of this software, see Friese, 2012). To begin analyzing the interview data, an open coding approach was used to identify shared meaningful themes among interviews. First, all interview transcripts were read carefully to identify meaningful units of the interviewees' responses to all interview questions. Second, those selections of text addressing the same issue were grouped together in analytic categories and given tentative definitions. An instance of a theme usually consisted of a whole paragraph or a sentence. Codes were assigned to a text chunk of any size (usually a single response to an interview question), as long as that chunk represented an issue of relevance. The same unit of text could be included in more than one code. Third, the data were systematically reviewed to refine

Table 3

Themes and categories identified from the interviews and percentages in each category of mentions of a certain aspect, calculated for each dyad type.

Main themes	Theme categories	IC (<i>n</i> = 13)	II (<i>n</i> = 18)	CC (<i>n</i> = 14)	CI (<i>n</i> = 13)
1. Exposure to online collaborative learning	1.1. Lack of nonverbal, visual and social context cues (.85)*	①**	④	③	②
		92%	44%	57%	77%
	1.2. Advantages of text-based communication format (.83)	①	②	④	③
		77%	72%	43%	54%
	1.3. Important elements and strategies for successful online collaborative learning (.79)	①	③	④	②
		92%	61%	29%	62%
2. Technical issues	2.1. Technical issues (.84)	①	④	②	③
		92%	33%	57%	46%
3. Interaction issues between collaboration partners	3.1. Use of specific disciplinary terminology (.73)	①	④	③	②
		100%	39%	43%	76%
	3.2. Feedback/reaching an agreement (.72)	①	①	④	③
		100%	100%	36%	54%
	3.3. Perceived disparity in contributions between the partners (.77)	①	④	③	②
		46%	17%	29%	39%
4. Peer perception: perceived similarities and differences between partners	4.1. Trust in terms of expertise (.83)	①	②	④	③
		69%	33%	28%	31%
	4.2. Combination of disciplinary backgrounds (.82)	①	③	④	②
		92%	67%	57%	69%
	4.3. Creation of cultural identity (.79)	①	③	④	②
		46%	28%	21%	39%

* Cohen's kappa coefficient.

** ①②③④ rank-ordered score, based on the highest percentages of the reported experiences per each coding category (① is the highest rank).

the coding scheme. The initial coding scheme was reviewed and refined through conversations among authors. The inductive thematic analysis resulted in 86 categories, which were grouped into 10 overarching categories. Afterwards, these 10 categories were classified into 4 key large themes (see Table 3 for a full list of themes). We applied Patton's (1990) dual criteria for judging categories in terms of internal homogeneity and external heterogeneity, i.e., data pertaining to a theme must cohere together meaningfully, while the themes should be distinct from each other. Using an iterative process, the 3rd author acted as a second coder, assigning preliminary codes at the level of the 10 umbrella categories to a selection of the transcripts, followed by a final refinement of the coding scheme. Using the final coding scheme, all transcripts were coded a second time by both coders to ensure the coherence and replicability of the themes. To assess inter-rater reliability, Cohen's kappa was calculated for each of the 10 categories. For each theme, the resulting kappa indicated good or very good agreement between the two coders (see Landis & Koch, 1977), ranging from .72 to .85.

Subsequently, we calculated what percentage of the instances in each coding category referred to a certain aspect of that issue. This was done for each dyad type to examine the relative importance students attributed to these various aspects of CSCL experiences and to examine how these experiences varied across the four types of dyads. To demonstrate these variations we arranged the calculated percentages for each coding category in a rank order (see Table 3).

4. Results

4.1. Students' perceptions of collaborative learning and their learning outcomes

4.1.1. Effects of cultural orientation and gender irrespective of dyad composition

Inspection of the mean scores concerning students' learning outcome and their perception of collaborative learning revealed several differences between students (see Table 4). MLA including cultural orientation and gender, irrespective of dyad composition, showed two effects for cultural orientation (see Table 5). First, students with a collectivist cultural orientation had a significant lower learning outcome than students with an individualistic orientation ($\beta = -0.25, p = .00$). Second, students with a collectivist cultural orientation had a significant higher score for their perception of collaborative learning than students with an individualistic orientation ($\beta = 1.36, p = .04$). No significant effects for gender were obtained.

4.1.2. Effects of dyad composition

Although, inspection of the mean scores concerning students' learning outcomes and their perception of collaborative learning revealed differences (see Table 6), the MLA did not show significant effects for dyad compositions (see Table 7). Students working in culturally similar or dissimilar dyads did not significantly differ regarding their perception of collaborative learning ($\beta = 0.06, p = .58$). Furthermore, students working in dissimilar or similar gender dyads also did not differ much regarding their perceptions of collaborative learning ($\beta = 0.16, p = .22$). There was, however, an interaction effect between working in dissimilar or similar cultural orientation dyads and gender concerning students' perception of their collaborative learning (see Table 8 and Table 9). More specifically, MLA showed that women working in a similar individualistic dyad had a lower score for their perception of collaborative learning than (1) women working in a collectivistic dyad ($\beta = -2.79, p = .00$) and (2) men working in a similar individualistic

Table 4

Means and standard deviations for students' cultural orientation and gender concerning their learning outcome and perception of CSCL.

	Learning outcome M (SD)	Perception of CSCL M (SD)
<i>Cultural orientation</i>		
Collective	2.41 (0.81)	28.85 (6.17)
Individualistic	2.87 (0.91)	26.07 (4.84)
<i>Gender</i>		
Female	2.81 (0.87)	26.77 (5.96)
Male	2.54 (0.92)	27.81 (5.19)

Table 5

Estimates for random intercept model for the effects of cultural orientation and gender concerning students' learning outcome and perception of CSCL.

	Learning outcome		Perception of CSCL	
	β	SE	β	SE
γ_{00} = Intercept	2.63	0.12	27.47	0.62
β_1 = Collective vs. individualistic orientation student	-0.25**	0.80	1.36*	0.62
β_2 = male vs. female student	-0.02	0.07	0.45	0.63
<i>Variance</i>				
Group level	0.28		30.28	
Individual level	0.48		-0.40	
Deviance	228.68		468.10	
Decrease in deviance	3.29*		7.06**	

* $p < .05$.

** $p < .01$.

Table 6

Means and standard deviations for different dyad compositions concerning students' learning outcome and perception of CSCL.

	Learning outcome M (SD)	Perception of CSCL M (SD)
<i>Cultural orientation</i>		
Dissimilar	2.54 (0.85)	26.16 (6.60)
Similar	2.79 (0.91)	28.09 (4.63)
<i>Gender</i>		
Dissimilar	2.58 (0.88)	26.32 (5.76)
Similar	2.85 (0.89)	28.59 (5.14)

Table 7

Estimates for random intercept model for the effects of dyad composition concerning students' learning outcome and perception of CSCL.

	Learning outcome		Perception of CSCL	
	β	SE	β	SE
γ_{00} = Intercept	2.71	0.12	27.32	0.66
β_1 = similar vs. dissimilar cultural orientation dyad	0.07	0.22	0.82	0.65
β_2 = similar vs. dissimilar dyad gender	0.16	0.12	1.03	0.66
β_3 = cultural orientation * dyad gender	-0.12	0.12	-0.03	0.66
<i>Variance</i>				
Group level	0.33		30.84	
Individual level	0.48		-0.40	
Deviance	236.34		467.41	
Decrease in deviance	-4.38		7.75**	

* $p < .05$.

** $p < .01$.

Table 8

Means and standard deviations for dissimilar/similar cultural dyad compositions concerning students' learning outcome and perception of CSCL.

		Learning outcome Cultural orientation		Perception of CSCL Cultural orientation	
		Dissimilar	Similar	Dissimilar	Similar
		<i>M (SD)</i>	<i>M (SD)</i>	<i>M (SD)</i>	<i>M (SD)</i>
Gender	Female	2.64 (0.79)	2.93 (0.91)	24.25 (6.76)	29.42 (3.51)
	Male	2.38 (0.97)	2.62 (0.90)	29.33 (5.14)	27.08 (5.16)

dyad ($\beta = -2.51, p = .04$). The MLA models concerning students' learning outcomes were unsuited to explain differences in variance.

4.2. Students' reported CSCL experiences

In addition to the quantitative analyses describe above, we conducted a qualitative analysis of interview data to help us further uncover students' underlying ideas behind the differences in their perceptions of the collaborative learning experiences found in the questionnaire data. The following four main themes emerged from our interview data: (a) exposure to online collaborative learning, (b) technical issues, (c) interaction issues between collaboration partners, (d) peer-perception: perceived similarities and differences between partners (Table 3). Each theme includes several sub-categories. The rank ordering of the calculated percentages to each category revealed that students who worked in culturally dissimilar dyads mentioned more frequently various aspects of their learning experiences than did the students who worked in culturally similar dyads. Particularly, individualists who collaborated in dyads with collectivists more frequently reported positive or negative experiences in all categories compared to the other three dyad types. Students who worked in culturally similar dyads (II and CC) tended to show a comparable frequency of the reported CSCL experiences, based on the calculated percentages of the instances in each coding category (see rank-ordered scores in Table 3).

Students' experiences relating to several of the categories played out differently depending on their cultural backgrounds and cultural dyad composition. These differences along with the interview excerpts are described below to summarize the students' reported experiences in the CSCL environment.

While many students felt constrained by the limitations of the CSCL system due to the lack of nonverbal, visual and social context cues, most students from individualist cultures in all types of dyads reported that it was sometimes difficult to get one's messages across successfully and to be sure that a collaborative partner understood without having direct contact with him or her. In contrast to individualists' focus on the messages sent, most students from collectivist cultures tended to talk about a lack of visual cues in the context of their own difficulty understanding their partners' perspectives. They reported that they could not orient themselves to what their partners thoughts and prepare their responses accordingly:

Chris (male, collectivist, culturally similar dyad)¹: "You have to think something standing on other's shoes so that I can feel what other is saying. So I couldn't see him and I couldn't understand his position. I need to learn my partner of what that I'm talking to, what kind of background he has and I need to learn the way he acts to me, reacts to me, direct, indirect."

¹ Here, and in all subsequent interview excerpts, the student's alias (giving no obvious indication of a student's country of origin) appears next to the excerpt, his/her gender, I-C cultural orientation, and type of group composition. All interview excerpts are direct quotes. Some of them are grammatically incorrect, since the students were non-native English speakers.

While the difficulty of giving and receiving feedback was an issue common for most students, almost two-thirds of the students from individualist cultures – regardless of the dyad type – reported that differences in opinions between collaborative partners was something that could eventually improve the quality of work, and that easily compromising or agreeing too quickly might reduce the value of the discussion. In contrast, just over half of the students from collectivist cultures across all dyad types reported that strongly opposing opinions or disagreements were counterproductive in collaboration. They saw the major source of disagreements as distinct disciplinary backgrounds and difficulties in convincing or making the collaborative partner understand their point of view:

Debbie (female, collectivist, culturally dissimilar dyad): But if we see things differently. If we both don't agree on an issue. Then it would mean that you to drag, drag, drag, drag. You might not arrive at a consensus. Only if he is asking it in a very polite way and then, so yeah, so no one is offending anybody.

Almost one-third of the students from collectivist cultures across dyad types reported that they tried to get their messages across with more care by choosing polite words and phrases so the collaborative partner would feel at ease, not threatened, and comfortable:

Joe (male, collectivist, culturally similar dyad): By asking direct questions – you might hurt feelings of another person. I think language use was very, very difficult. And you know, this texting, chatting... You know chatting can really mess up people's ways of writing. I felt like she was getting more aggressive when she was responding.

Students with an individualist cultural orientation found it challenging to express themselves in the CSCL system, they believed that to be understood one needs to be direct and as specific as possible. The following was a typical expression of this:

Jarl (male, individualist, culturally similar dyad): You have to be able to control the English language and also you really have to put all the information in all these letters so that you type on your screen. What you're trying to say, you really have to be specific and direct.

Since the two types of complementary expertise were necessary for accomplishing the learning task, most students noticed that a lack of trust in a partner's expertise could be one of the serious barriers to collaboration:

Pittie (female, individualist, culturally similar dyad): I have to know that the person who is saying something to me has the knowledge and expert experience and that I can rely on the information he is giving there.

About one-third of students from collectivist cultures from both culturally similar and dissimilar dyads expressed their concerns about learning from a peer. They had some doubts about the trustworthiness of their partners' contributions:

Omar (male, collectivist, culturally similar dyad): My partner may be wrong, like for example a teacher and a student there is also communication and a teacher is in quite higher level than a student. But the way teacher communicates with the student, I think it's their ability, it's their experience, it is not compared to novices like us.

Students explicitly talked about their cultural backgrounds (e.g., my culture versus my partner's culture). They often were concerned about a collaborative partner's cultural background (which they could identify based on his/her full name available in the CSCL

program). According to more than half of the students from culturally dissimilar groups, culture and the use of the English language as the lingua franca may have influenced the communication dynamic of a dyad.

Maddy (male, collectivist, culturally dissimilar dyad): I'm from South America and he was Dutch. So we look at things completely different. So sometimes when I was writing something, I know that he translated it into Dutch in his head and then it came out very wrong then. But I couldn't do anything about that.

While a substantial number of students admitted that dealing with the language and culture issues in a computer-mediated system was very challenging, students from culturally dissimilar dyads were more likely to associate different ways of interaction and dealing with group problems as culture-driven aspects.

Magal (male, collectivist, culturally dissimilar dyad): He was straightforward and... Yeah. I knew he was not from Africa. If I were him... I wouldn't want to say it in a way that made the person feel uncomfortable. For me I'm like going like around, but he's quite straightforward. So it's just like a bit shocking. Okay, how come he asked me that direct question?

Sara (female, individualist, culturally dissimilar dyad): If I were communicating with another Dutch person in Dutch, then it would have gone ten times faster.

5. Discussion

This study aimed to examine differences between students working in a CSCL environment with a partner who was culturally similar or dissimilar (using Hofstede's I–C cultural dimension), looking specifically at differences in their perceptions of collaborative learning, reported experiences, and learning outcomes in the CSCL environment. Qualitative analysis of in-depth interviews in combination with the quantitative questionnaire data helped reveal underlying links between socio-cultural factors and learning processes in the CSCL environment. The results showed that irrespective of dyad composition, students with a collectivist cultural orientation had significantly lower learning outcomes than students with an individualistic orientation. Also, irrespective of dyad composition, students with a collectivist cultural orientation had a significantly higher score for their perceptions of collaborative learning than students with an individualistic orientation. Women working in a similar individualistic dyad had a lower score for their perception of collaborative learning than women working in a collectivist dyad and men working in a similar individualistic dyad. All of the main research findings will now be discussed in turn.

5.1. Differences in students' perceptions of collaborative learning

Findings related to the first research question suggest that collectivists perceived their online collaborative learning experience more positively than did the individualists. This finding is consistent with prior research studies (Chan & Watkins, 1994; Phuong-Mai, Terlouw, & Pilot, 2006; Zhong et al., 2008) in terms of the effects of I–C cultural dimension on students' perceptions in online collaborative learning. Students with a collectivistic cultural orientation seem to prefer working in groups and feel they perform better in groups, and they tend to share more knowledge and exhibit less conflict-oriented behavior (Phuong-Mai et al., 2006). The student interviews backed up these explanations. It is more likely in culturally dissimilar dyads, culture-related differences may eventually create uncertainty in predicting others' feedback and an uneasy atmosphere for socializing and building working relationships

between partners, which in turn, may prevent them from active participation and lead to a less-positive perceptions of collaborative learning.

Another important finding was that women working in a similar individualistic dyad (II) had a lower score for their perception of collaborative learning than women working in a collectivistic dyad (CC) and men working in a similar individualistic dyad (II). Although there is a large and growing body of literature investigating gender-related differences in language use and communication behavior, more research needs to be undertaken before the association between individual characteristics such as gender and culture is clearly understood in the context of CSCL.

5.2. Differences in the learning outcomes

The results of this study show that students with an individualist cultural background achieved better learning outcomes than students with a collectivist background regardless of group composition. According to Phuong-Mai et al. (2006) and Weinberger et al. (2007) collaborative online learning tasks that focus on conflict-oriented behavior between equal students may not be appropriate for collectivistic cultures. As the learning task in this study required a high level of collaboration between two people with different fields of expertise, it was likely to induce a clash of opinions or viewpoints. Individuals from individualistic cultures value uniqueness and creativity and see group work as a place of confrontation and the exchange of diverse ideas in a search for solutions. By contrast, collectivists are more likely to avoid confrontations and to prefer working with someone who shares similar interests or opinions. This finding is supported by the interview data. Specifically, students from collectivistic cultures reported that they could have been more effective and had fewer misunderstandings if they had more in common with their partners. This sentiment is captured by one of the students who said, "Look, of course, people have different opinions. If I can choose, I choose for someone who has the same attitude to, you know, something like each other." By contrast, individualists said that by bringing together two complementary disciplines they were able to gain new insights by looking at the problem from different perspectives: "I think the most positive part was that we both had different backgrounds and you're not as much overlapped with knowledge and the discussion is broad. I think that's the most positive".

5.3. Differences in the students' reported learning experiences

Addressing the third research question on differences in the students' reported learning experiences in the CSCL environment, interview analyses provided a further understanding of the issues that could not be captured solely through the questionnaire. All of the main research findings based on the interview data will now be discussed in turn.

5.3.1. Lack of nonverbal, visual, and social context cues in the CSCL environment

One of the most interesting findings was that all members of both culturally similar and dissimilar dyads complained about the absence of nonverbal, visual, and social context cues in the CSCL environment. There were, however, major differences between students from collectivist and individualist cultural backgrounds in the issues they mentioned regarding the lack of these various cues, and the impact of these issues. A substantial number of students from collectivist cultures noted that the lack of tone of voice and facial expressions in text-based communication made it harder for them to interpret the partner's intent. Without knowing the partner's intent, they found it very problematic to make

Table 9

Estimates for random intercept model for the effects of different cultural orientation dyad compositions and student gender concerning students' learning outcome and perception of CSCL.

	Learning outcome		Perception of CSCL	
	β	SE	β	SE
γ_{00} = Intercept	2.65	0.12	27.53	0.62
β_1 = similar vs. dissimilar cultural orientation dyad	0.12	0.12	0.73	0.62
β_2 = Student gender	-0.05	0.07	0.68	0.63
β_3 = Cultural orientation dyad ^a student gender	-0.01	0.07	-1.85**	0.63
Variance				
Group level	0.34		28.42	
Individual level	0.46		-0.37	
Deviance	239.87		461.49	
Decrease in deviance	-7.91		13.67**	

^a $p < .05$.

** $p < .01$.

inferences and respond back in an appropriate way. By contrast, most of the students from individualist cultures talked about how text-based communication created an uncertainty about whether what they posted was understood correctly. For this reason, they often had to ask clarifying questions and repeat the main point in other words, to make sure that they were understood correctly. This finding corroborates studies by Salas et al. (2004), and Gudykunst et al. (1996), which suggested that individualistic cultures prioritize clarity in conversation, tend to use low-context, direct and explicit messages, and focus on the task-related information, while collectivists are more likely to use high-context, indirect and implicit messages, and to emphasize contextual information to interpret others' communication. In face-to-face communication, there are multiple channels for communication, such as direct feedback, nonverbal cues, and other audio/ visual senses, that are important for communication. In a computer-mediated situation, culturally diverse students reacted differently to the absence of these cues. Particularly, individualists were primarily concerned with feedback from their partner to make sure that the sent message was construed as intended, while collectivists lacked contextual information to interpret their partner's message.

5.3.2. Advantages of text-based communication format

Our data also showed that despite the fact that all students concurred that text messages are limited in expression and prone to misunderstandings, they believed that written communication makes thinking visible and provides time to reflect on what was already posted by both parties. Students from collectivist cultures characterized the computer medium as a safe environment where one can freely express opinions without directly confronting another person involved in a dialogue. Individualists preferred online communication because it gives an opportunity, especially in the initial stage, to convey one's ideas without being interrupted or judged prematurely.

5.3.3. Peer perception and perceived equal participation in a dyad

Our analyses also showed that perception of the CSCL experience was dependent on the working relationships and group dynamics between collaborators. Perceptions of the learning experience can vary widely among culturally distinct individuals exposed to the same collaborative situation. For instance, one person might perceive a straightforward collaborative partner as aggressive and rude, while another would perceive the same partner as efficient and honest. The results of this study indicate that students from collectivist cultures are likely to attribute overall perceived satisfaction with the study to positive or negative impressions about their collaborative partners, whereas most students from individualistic cultures based satisfaction with their collaborative work on the perceived equal participation and degree of involvement of both partners. These findings suggest that

individuals from collectivistic cultures tend to be more concerned with social relationships in a group process than the task, and by contrast, individualists emphasize the importance of working on a task over relationship building. Also, equal participation and productivity are expected to be of more importance for individualists compared to collectivists. Furthermore, collectivists are more likely to overrate their collaborative peers "due to situational attributions explaining any perceived unpleasant performance" (Vatrapu & Suthers, 2007, p. 269; see also Gomez, Kirkman, & Shapiro, 2000), while individualists are often dissatisfied with collaborative tasks requiring a great deal of effort and interdependency among group members (Lam, 1997).

5.3.4. Students' beliefs about important elements and strategies for successful collaborative learning

All of the students in this study found it challenging to collaborate with an unfamiliar group member and to use text-based communication as the only means to interact with each other. However, we observed various strategies that students suggested to overcome these challenges in the culturally diverse dyads. More specifically, in order to reach out and communicate successfully under these conditions (i.e., limitations of the medium and lack of familiarity between group members), individualists emphasized the importance of being direct and specific and of communicating exactly what is meant in an explicit manner. In addition, individualists believed that a better group performance could be achieved by directly exploring their partners' experience and task-related knowledge. In contrast, collectivists believed that maintaining a positive relationship between group members is essential and on-line messages should be written with care to ensure that nobody is inadvertently offended. Moreover, in addition to acquiring knowledge about their partners' backgrounds relevant to the task, collectivists would also like to know something about their partners' personal backgrounds (e.g., hobbies, interests, character, etc.) to develop a better impression of them, which may help the collectivists' adapt their communication to their partners' individual traits. These factors may explain the anxiety and uncertainty developed between partners who worked in culturally dissimilar dyads. Particularly, students from individualist cultures might have unintentionally hurt the feelings of their collaborative partners because they rushed into taking actions to solve the task and did not take time to learn more about their partners. On the other hand, collectivists were concerned with maintaining the group relationships and trying to avoid conflict situations.

6. Possible limitations of the present study, strengths, and suggestions for future research

One of the limitations of this study is that it applied a single I-C cultural dimension to determine cultural composition of the CSCL

leaner dyads. Although a student coming from a collectivistic country is more likely to hold collectivistic values and norms, he/she may exhibit certain individualistic behavioral patterns due to his/her prior learning or travel experiences. Further, it might be possible that only the more individualist persons from these countries choose to study abroad in the Netherlands. Thus, the differences between the two cultural groups might not be as big as suggested by Hofstede's dimensions. Generalizations about collectivist populations based on a sample consisting of international students should be interpreted with caution, as the findings might not be completely transferable to their counterparts residing in their "native" cultures. Also, it can be argued that the similarity between international students based on Hofstede's I-C dimension (for example between some Asian and South American students) could be relatively small compared to large differences among their cultures on other dimensions. Therefore, in future studies the findings should be verified with a larger sample as well as investigated with application of other cultural dimensions (e.g., analytic/holistic reasoning, see [Choi & Nisbett, 2000](#); high-low context, see [Hall, 1990](#)). Accounting for all cultural factors is very desirable, but it was not feasible within the scope of this study.

To ensure reliability, the number of countries represented in two cultural groups (individualists and collectivists) could be increased. This is especially important with respect to students from individualistic cultures, since the majority of the students in this study representing individualistic culture were from the Netherlands (position 80 on the IDV index), whereas participants representing collectivistic culture were from a wide range of countries (positions on the IDV index varied from 12 to 51). In view of these differences in the cultural orientations dominating and strongly represented by one group could have affected the nature of online collaborative interactions between individualists and collectivists. The influence of Individualists (represented by Dutch students) was larger compared to collectivists. Therefore, further empirical investigations are needed to replicate the findings in a more culturally diverse body of students.

The attrition rate for the sample not included for the final analyses in this study was high. The number of participants in the phase of data collection after the actual study decreased to two-thirds ($n = 78$) of its starting size ($n = 120$) for the questionnaire data and one half ($n = 58$) for the interview data due to inability of the study personnel to interview all students and failure to make contact with some sample units. Therefore, the loss of part of the sample may impact the validity of study.

When studying cultural group composition, three factors are important: (1) the background of the actor (i.e., is the student from a collectivistic or an individualistic culture?), (2) the background of the partner (i.e., what is the effect of collaborating with someone from a collectivistic background compared to an individualistic background?), and (3) the actor * partner interaction effect (i.e., what is the unique effect of a particular combination of actor and partner background?). The Actor-Partner Interdependence Model (APIM) is generally well-suited to analyzing the effects of individual background variables in relation to group composition in dyadic situations. However, in this study, due to the large number of dyads with data unavailable for one partner (20% of the total dyads), estimating the APIM presented problems. Due to the limitations of the available data, we opted not to estimate the APIM as it would not be very informative in this study. Where feasible, future research should examine the effect of cultural background on online collaboration by applying the APIM.

The current investigation was limited by the time period allocated to collaborate and perform the task. Students were recruited to work in an assigned dyad for a single session (about four hours) and the actual collaborative activity was about 90 min long; future studies with application of longitudinal design and an

implementation of an authentic learning environment might give new insights into influences of social-cultural factors on the learning processes and the learning outcomes of culturally diverse groups in CSCL. The effects of cultural diversity can presumably change over time – as students become familiar with each other and familiar with collaborative activities.

7. Conclusions and implications

The introduction of computer-supported collaborative learning, specifically in an intercultural learning environment, creates both challenges and potential benefits for students. Likely challenges arise in terms of coordinating different perceptions, reasoning, and communication styles of students from different cultures, while key benefits involve sharing culturally diverse knowledge and preparing students for working effectively in culturally heterogeneous dyads. In this context, it is important for educators to have access to learning environments that accentuate the positive aspects of such collaborative learning and reduce the potentially negative aspects. This study has provided valuable insight into our understanding of differences in the ways culturally similar and dissimilar student dyads proceed in collaborative discourse in the CSCL environment.

Educators and instructional designers can utilize these findings to inform the design and implementation of learning environments that will be responsive to the intercultural context of collaborative learning. Paying attention to cultural differences can help educators further improve learning experiences in multicultural settings. Particularly, the results of this study indicate that Hofstede's I-C cultural dimension may give some indications of what student reactions can be expected given their cultural backgrounds. A student's perception of a certain collaborative situation or partner can be a good predictor of his/her level of engagement in collaborative activities and use of a technology. In this regard, collaborative systems should tailor interventions to facilitate students' interaction processes in order to achieve the potential rewards of collaborative learning. Such facilitations can be realized by the students themselves, the educators/educational designer, or even with the application of machine-learning techniques, which can automatically identify and prevent problems that might occur in a conversation between students with different cultural backgrounds. For example, the design of collaborative systems should offer an opportunity for students to choose the level of synchronicity for the communication medium. Having online students regulate themselves in the extent of anonymity in collaboration might also facilitate student participation in the online environment. Fostering activities for social interaction (e.g., informal meeting or exchange of personal profiles) in the early stage of online collaboration may improve active collaboration of the students, especially those from collectivist cultures. Adding nonverbal content in the CSCL system (e.g., a real time video connection) may improve the effectiveness of information exchange in culturally diverse groups. Increasing the collaborators' awareness of the existing differences in communication styles between them can be done either by using special features of CSCL tools (e.g., adaptive scripting developed by [Gweon, Rosé, Zaiss, & Carey, 2006](#)) or by providing prior examples or case transcripts indicating specific cultural differences ([Kim & Bonk, 2002](#)). The present study also provides some insights into designing external collaboration scripts for the CSCL environments, paying specific attention to students' cultural background ([Popov, Bie-mans, Kuznetsov & Mulder, accepted for publication](#)). These scripts can be viewed in terms of instructional design as a specified sequence of events that students are asked to follow during a training session ([Kollar, Fischer, & Hesse, 2006](#)). Thus, such collaboration scripts can help collaborating students overcome differences and

minimize the amount of effort required to coordinate their learning activity (Popov, Biemans, Brinkman, Kuznetsov, & Mulder, 2013). Taken as a whole, the findings of this study will enable researchers and educators to construct collaborative learning environments where cultural differences will, at the very least, be accommodated and perhaps even leveraged effectively to promote learning.

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