

Effects of an Interculturally Enriched CSCL Script on Students' Attitudes and Performance

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Abstract: In an attempt to foster collaboration in general as well as to bridge intercultural differences in culturally heterogeneous groups engaged in CSCL, this study introduces an interculturally enriched collaboration script (IECS). A randomized, two-group pretest-posttest research design was used to compare the effects of the IECS with a general collaboration script (CS) on students' collaborative learning in culturally heterogeneous groups in a CSCL environment. In this study, Master students from a university in the Netherlands (74 subjects, representing 22 countries) worked in dyads on an environmental problem about biodiversity collapse in tropical forest protected areas. The results showed that the IECS positively affected students' attitude towards online collaboration and satisfaction with learning processes and outcomes. Student groups in both conditions achieved comparable task performance and exhibited a comparable level of willingness to collaborate online.

Cultural issues in computer-supported collaborative learning

Individuals from diverse and distinct cultural backgrounds are brought together by the need to collaborate for professional, personal and academic reasons. This comes from the idea that more can be achieved through cultural synergy. Using collaborative technologies in intercultural educational environments creates both potential benefits – by promoting collaborative learning, and sharing culturally divergent knowledge – and challenges, in terms of equitably supporting learners, specifically with different cultural backgrounds. Many culture-related factors have a considerable impact on the group interaction process (Lim & Liu, 2006) and should be taken into consideration when designing and implementing collaborative learning environments (Cox, Lobel, & McLeod, 1991; Weinberger, Clark, Hakkinen, Tamura, and Fischer, 2007).

The present research investigates collaborative learning from a social-constructivist learning perspective. Social constructivist scholars consider the collaborative learning environment as a place where learners may work together and support each other as they use a variety of tools and information resources in their guided pursuit of learning goals and problem-solving activities (Zhu, 2009). A particular emphasis in social constructivism is put on the importance of the background and culture of learner, since the learner's cultural context of cognition influences the way he or she attains knowledge in the learning process.

There is a number of learning aspects that can be studied in this context. Among these are:

Attitude towards online collaboration (students' perspectives on online collaborations which may influence their learning behaviors). While accomplishing a task collaboratively students from various cultures differ in terms of their perspectives on group work, procedural knowledge of how to collaborate and learn together (Weinberger et al., 2007; Cox, et al., 1991). These differences may lead to conflicts because of the mismatch of students' perspectives and approaches to online collaboration (Zhao & McDougall, 2008). Previous research suggests that students' attitude towards the learning environment is one of the determining factors for assessing the quality of educational interventions, as well as predicting both learning processes and outcomes (Zhu, 2009);

Willingness to collaborate online (a psychological mechanism that drives individual's behavior in terms of both acceptance of new learning information and adaptation and use of new communication technologies in the future). Given the increased emphasis on the importance of participation in online collaborative learning environments, it is essential that students are willing to collaborate by these means. It has been suggested that willingness can be seen as a dependent variable (Davis, 1989). In case of intercultural collaboration, culturally diverse students have to overcome the extra layer of complexity owing to culture-related differences;

Satisfaction with online collaborative learning processes and outcomes (students' opinions or feelings as experienced in computer-mediated collaboration). A large and growing body of literature has investigated satisfaction related to the learning process and the other with learning outcomes. Satisfaction can be used as one of the criteria to assess the quality of online training. A number of previous research studies reported positive relationships between learning satisfaction and instructional approaches, social presence, task characteristics, group dynamic (e.g. LaPointe & Gunawardena, 2004); and

Online collaborative task performance (the extent to which the learner achieved certain learning goals which can be reflected in the form of the final group products). The task performance is the extent to which the

learner achieved certain learning goals, which can be reflected in the form of the final group products. 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). Meanwhile, many social and cultural factors impact significantly on the interaction process and are yet to be taken into account when studying CSCL (Weinberger et al., 2007; Cox et al., 1991). However, there is a dearth of research on various learning outcomes between students from different cultures in the CSCL context. In this regard, this study aimed to gain insights into relationship between the dynamics of the group interactions and learning performances in culturally diverse groups in CSCL.

In an attempt to foster collaboration in general as well as to bridge intercultural differences in culturally heterogeneous groups engaged in CSCL, this study introduces a scaffolding technique, in this case the IECS. The basic premise of this script is that collaborating students from different cultural backgrounds may particularly benefit from following a shared external collaboration script that scaffolds their interaction, coordinates their learning activity and incorporates culture-related differences. For this purpose, the researchers developed three external collaboration scripts and implemented them in an authentic learning environment: one conventional CS without intercultural elements, and two collaboration scripts with intercultural enriched ingredients tailored specifically for two groups of culturally distinct backgrounds based on previous research (Rummel & Spada, 2005; Nisbett, 2003; Hofstede, 1991; House, Hanges, Javidan, Dorfman, & Gupta, 2004). The objective was to compare the effects of the IECS with the CS, both scripts were embedded in the CSCL environment, on students' collaborative learning in culturally heterogeneous groups in the CSCL environment. This was done by using a two-group pre-test-post-test research design, and applying quantitative and qualitative measurements.

Phenomenon of cultural and behavioral collaboration scripts

Over the last twenty years, a range of techniques and approaches have been developed that are conducive to successful and productive online group work (Dillenbourg, & Jermann, 2007). However, only few studies provide guidance to facilitate online collaborative interaction among culturally diverse students. These studies focus mostly on intercultural foreign language education through CMC, internet-mediated approaches that are used to raise learners' intercultural awareness, and the use of various e-tools to support brainstorming in order to benefit from cultural diversity in knowledge and perspective (Wang & Fussell, 2010). But, knowledge is still lacking in what instructional support may help culturally diverse collaborative learners obtain the maximum benefit from shared experiences in CSCL.

Specifically in response to this need, this experimental study introduces a scaffolding technique, in this case an external IECS intended to both promote collaboration in general and bridge the cultural gap between collaborative learners with different cultural backgrounds. There is a well-documented body of research focused on the application of collaboration scripts in computer-mediated systems and their effects, which have proved to be particularly influential in supporting collaboration (e.g. Koschmann, 1999; Rummel & Spada, 2005). The basic premise of the collaboration script in this study is that collaborating students may particularly benefit from following a shared external collaboration script that scaffolds their interaction and coordinates their learning activity. Our assumption was that culturally diverse collaborating students with the help of an external IECS can overcome differences between them, minimize the amount of effort required to coordinate their activities and generate collaborations that would lead to more positive experiences and higher performance in such groups.

The design of the general CS in this study is based on an approach developed by Rummel and Spada (2005). By integrating empirical findings from several research studies on communication and computer-mediated collaboration, Rummel and Spada (2005) introduced three levels merging in a good collaboration. These include macro (I) and micro (II) levels, plus domain-specific requirements (III) depending on the learning task. Each of these three levels appoint to certain collaborative behavior in online student interactions (i.e. social, cognitive and coordinating behaviors) and all of them are necessary for successful online group collaboration.

At the core of the CS is a sequence on how to pursue a goal of collaboration process, with the precise prescriptions of learning activities in how students may engage in collaborative discourse. The collaborative work consisted of three phases: initial phase, main phase, and final phase. All three levels necessary for successful online group collaboration (macro, micro, and domain-specific) were incorporated throughout all three phases. In this study, the collaboration process and script instructions were tailored to the collaborative learning activities required to analyze the problem of biodiversity collapse with the application of the Driver–Pressure–State–Impact–Response (DPSIR) model (i.e. DPSIR is a framework that helps to identify and describe processes and interactions in human–environmental systems).

The initial phase covered the technical and social introduction. The main phase included discussion of the background literature, analysis of the problem by constructing the DPSI-part of the DPSIR Diagram, and identifying possible responses to avert biodiversity collapse in tropical forest protected areas. The final phase focused on prioritization of the responses.

The design of the IECS was based on the CS including exactly the same collaboration steps and instructions to them, plus additional cultural enrichment elements developed specifically for each of the two culturally distinct groups of students. These enrichments were derived from cross-cultural psychology findings (Nisbett, 2003; Hofstede, 1991; House et al., 2004). They provide a foundation to both develop an adequate understanding of these cultural differences and to design socio-technical support for collaborative learning that could involve, overcome and bridge the differences between cultures. This support was based on “the assumption that the creation of shared practices on the micro level would allow to bridge cultural gaps on higher level social aggregates” (Hinds, Zhao, Wulf, Thomas, Fussell, & Zhang, 2010, p.609). Thus, we build on be playing on learners’ social/cognitive diversity and knowledge interdependency so as to foster the different mechanisms needed for productive collaboration and maximize the benefits of culturally divergent knowledge.

For instance, different patterns might emerge at the early stage of collaboration in terms of how students get introduced to one another, and in the ways they start to accomplish the learning task. For example, Westerners tend to focus their communication on the task rather than on maintaining relationships at the early stage of working together (Hofstede, 1991; Nisbett, 2003). Some group members from Western countries may unintentionally offend other members from non-Western countries because they are so focused on their tasks that they omit some socialization protocols. A potential solution in this phase (i.e. get to know each other and start building group dynamics) could be to encourage collaborative partners to discover individual and cultural similarities and differences within the group. This can be realized by completing and exchanging students’ personal profiles, which may enable them to introduce themselves to other group members and discuss personal concerns and interests with other members. In this context, we asked students to complete personal profiles, which contained questions, both about content-related experience related to the task and about personal background. The only difference was that students from non-Western countries were instructed to construct a concrete idea of the content-related experience of themselves and their group members, whereas students from Western countries were requested to get to know their group members in terms of their personal backgrounds and try to build a relationship of trust in order to solve the task together. It was predicted that this script element might help to fulfill specific needs of two culturally distinct groups of students at the initial stage of collaboration.

Research questions

This study is aimed at answering the following central research question:

What are the effects of the IECS compared to the CS on students’ collaborative learning in culturally heterogeneous groups in a CSCL environment in higher education?

In order to answer the central research question, this research has been divided into four sub-questions. To what extent does the IECS compared to the general CS affect students’:

RQs1....attitude towards online collaboration?

RQs2....willingness to collaborate online?

RQs3....satisfaction with online collaborative learning processes and outcomes?

RQs4....online collaborative task performance?

Method

Participants

Participants in this study were first year Master program students enrolled in educational program in the field of life and environmental sciences in university in the Netherlands. Our sample of 74 students comprised 18 Dutch and 56 international students; 52.7% of whom are women. Of the international students, 18 come from Europe (outside the Netherlands), 6 from Africa, 25 from Asia, 6 from South America and 1 from North America. The total number of countries represented in our study was twenty two. The age group of the respondents ranged from 19 to 37 years, with a mean age of 24.04 ($SD=3.17$), and 95.9% of respondents were below the age of thirty. 98.3 % of international students had been staying in the Netherlands on average two to three weeks by the time when this study was conducted. Almost all students, regardless of their cultural background, had some short-term previous travel experiences, internships, traveling for work purpose outside of their home countries for both academic and non-academic purposes. Well over half (64.9%) of the participants stated that they had much prior experience working in student group work and only 32.2% had prior experience working in multicultural student group work. 74.3% of the respondents had hardly any or not at all experience working online with students from the other country. All study participants must have proven English language proficiency by passing an oral and written exam while enrolled at the university where the given research was conducted.

Research setting

This study was conducted as a part of the course named Principles of Environmental Sciences (PES). This course is particularly designed for Master program students in Environmental Sciences. The PES course offers students the opportunity of updating and extending their knowledge of the basic concepts of environmental sciences. In a case study, which was used in this research study, students analyzed an environmental problem about biodiversity collapse in tropical forest protected areas. More specifically, Laurance, Carolina Useche et al. (2012) published a scientific paper on the 26th of July in Nature. After publication the article received a lot of media attention globally. The issue addressed in the paper forms the basis of the case study. Students were required to successfully complete this online collaboration assignment in order to pass the PES course. The quality of the students' group work was evaluated by a system of quantitative criteria developed by experts in the area of environmental sciences.

Procedure

All students were asked to collaboratively (in pairs) analyze an environmental problem related to the biodiversity collapse in tropical forest protected areas. All groups used the same online VCRI learning environment (after reading the same pre-study instructions), the same software and the same course manual. The same questionnaires were administered to all study participants. The only difference was that one half of the participants received only CS and the other half received the same collaboration guidance, but with extended intercultural instructions, the so-called the IECS. The participants were randomly assigned to the two conditions (the IECS and the CS), although it was ensured that each pair included one student of non-Western cultural background and one of Western cultural background. The IECS was tailored specifically for students with distinct cultural backgrounds. Collaborating students with the IECS were expected to follow a three-level instruction for all subtasks: (1) a general instruction on WHAT you needed to do; (2) an instruction on HOW you needed to do a certain subtask; (3) an explanation of WHY the subtask instruction is important. Collaborating students with the CS were provided only with the general instruction on WHAT to do. This design allowed us to empirically investigate the effects of the IECS on students' collaborative learning in culturally heterogeneous groups in the CSCL environment.

In total, there were one introductory and two online group work sessions during three consecutive days. Overall time required for completion of the assignment, including filling in pre-posttest questionnaires plus task introduction and debriefing, was about 10 hours. During online group work sessions students were seated at individual computers. The students interacted with the study personnel and with each other in English. Prior to the actual study, the participants were asked to fill in a number of questionnaires focusing on: (a) the demographic information and (b) prior experience with working collaboratively, specifically in intercultural setting, (c) technical (computer) skills, and (d) pre-test of attitude towards online collaborative learning.

During the initial phase, the students were introduced to the VCRI groupware program, to the assignment and to the procedures on collaboration. The participants were specifically asked to follow the guidance instructions. Before continuing with the main phase of collaboration, students were requested individually answer questions about the driving forces, pressures, states, and impacts related to the biodiversity collapse. The main phase of the collaboration consists of two subtasks: (1) analysis of the problem by constructing the DPSIR-part of the DPSIR Diagram, and (2) identification of possible responses to the problem of biodiversity loss. During both subtasks, a three-step pattern (a.b.c) is followed. Step (a) consists of individual work, which allows collaborative partners to bring in their own disciplinary knowledge and ideas. Following this, (b) the individual ideas should be discussed, ensuring the exchange of unshared information. After the discussion, (c) the individual proposals have to be integrated into a group joint solution, and reported usually in the COWRITER window. During the final phase, students were expected to conduct the prioritization of the different responses that they identified. This means that collaborative partners needed to identify which responses they would address or implement first, second, third (etc.), if they would be in the position to make such a decision. Also, students were instructed to provide supporting argumentation for the prioritization. At the conclusion of the final collaboration phase, each participant completed a number of post collaboration questionnaires (students' attitude, willingness and satisfaction towards online collaboration).

Learning platform

A Virtual Collaborative Research Institute (VCRI) groupware program was used in this study as a CSCL learning environment (Figure 1.). The VCRI incorporates a number of features designed to facilitate various collaborative activities online. More specifically, a Chat-tool allows a student to communicate with his/her collaborative partner(s) by exchanging instant messages. A Sources-tool includes all necessary information related to group task itself (e.g. assignment description, a literature source) and instructions to perform the task. Collaboration scripts used in this study was embedded in the Source-tool. All information available in this tool

can be opened and read from the screen. The VCRI program has a Cowriter-tool as a shared word processor, where students can simultaneously work together on their texts. Group members use a Diagrammer-tool to collaboratively make representations of their ideas by constructing various sorts of diagrams or flowcharts. To write down some ideas in a personal space, students can use a Notes-tool.

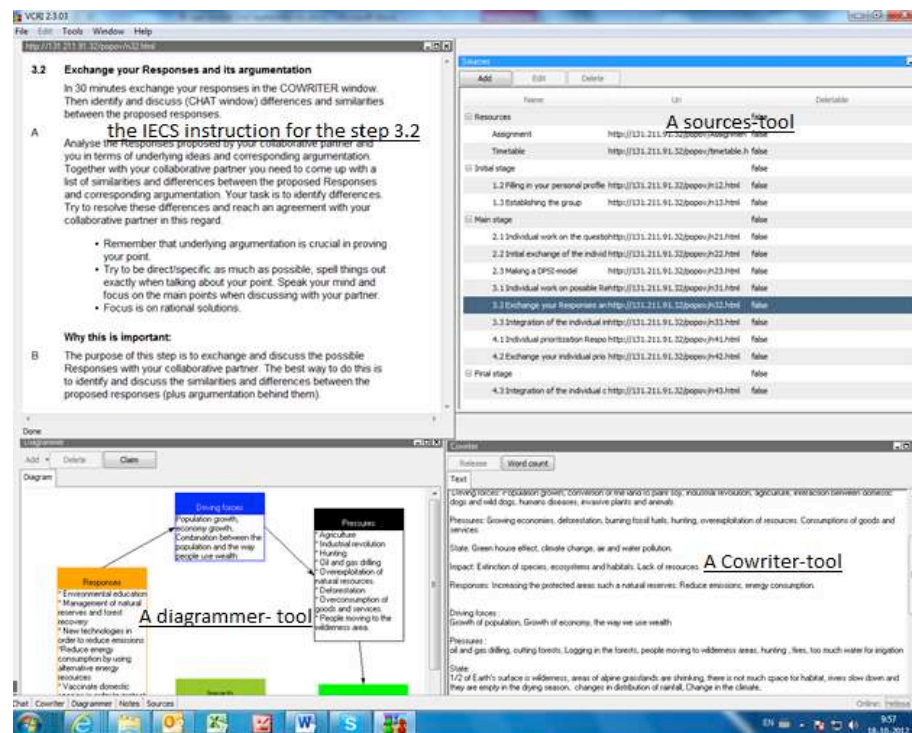


Figure 1. Screenshot of the VCR platform.

Instruments

Table 1 below presents a summary of the various empirical study constructs, their respective measuring instruments and data sources.

Table 1. Variables, instruments, and data sources.

Study construct	Instruments	Data source
Prior to collaboration		
(a) Demographic information, (b) prior experience working collaboratively, specifically in intercultural setting.	Self-made prior to collaboration survey.	Questionnaire
(c) Technical (computer) skills.	Self-made five multiple-choice questions	Questionnaire
(d) Pre-test of attitude toward online collaboration.	Survey developed by Thompson and Ku (2006).	Questionnaire
Post collaboration		
Post-test of students' attitude towards online collaboration.	Post-collaboration survey by Thompson and Ku (2006)	Questionnaire
Students' willingness to collaborate online.	Modified version of the survey developed by Chen, et al., 2006.	Questionnaire
Students' satisfaction with online collaborative learning processes and outcomes	Modified version of the 'perceived usefulness of the online course' developed by Giesbers et al., 2009.	Questionnaire
Students' task performance	Self-made system of quantitative criteria to assess the online group work (i.e. outcomes scores based on the competing the DPSIR assignment).	Log files of the constructed DPSI model and joint solutions (data obtained from Diagrammer and Cowriter tools of VCRI)
Control of the script use by the participants	Click count and survey	Log files; Questionnaire

Data analyses

To show the impact of the IECS on the students attitudes towards online collaboration, a repeated measures ANOVA was conducted with condition (IECS and CS) as the between-subjects variable and students' attitude scores (pre- and post study) as the within subjects (repeated measures) variable.

Separate univariate ANOVAs were used to determine whether there are any differences between experimental condition (collaboration with the IECS) and control condition (collaboration with only CS) for each variable (i.e. willingness to collaborate online, satisfaction with online collaborative learning processes and outcomes, and task performance).

Results

Pre-test control measures in two conditions

None of the participants had prior knowledge or experience working with the DPSIR framework. No significant differences were observed between the students in the IECS and the CS conditions with respect to age, $F(1, 72) = .30, p = .58$, gender $F(1, 72) = .20, p = .65$, the mean scores of technical (computer) skills, $F(1, 72) = .16, p = .33$, and prior group work experiences, $F(1, 72) = 1.25, p = .26$. These results indicated that there were no significant differences between participants in the two conditions.

Attitude towards online collaboration

A repeated-measures analysis of variance enabled us to assess the effectiveness of the introduced IECS by examining differences in changes in students' attitudes across time (pre-post study) between the groups. The results indicated a significant interaction effect between the scripted condition and attitude change before and after the study $F(1, 72)=4.97, p<0.05$, partial $\epsilon^2=.065$. The main effect of the attitude change over time was also significant $F(1, 72)=31.68, p<0.001$, partial $\epsilon^2=.306$. Figure 2 shows a profile plot indicating attitude towards online collaboration before and after the study for both conditions. The students in the IECS condition tend to adopt a more positive attitude toward online collaboration in culturally heterogeneous groups (before the study $M=3.71, SD=.51$, and after the study $M=4.07, SD=.40$) compared to those in the CS condition (before the study $M=3.90, SD=.38$, and after the study $M=4.05, SD=.39$).

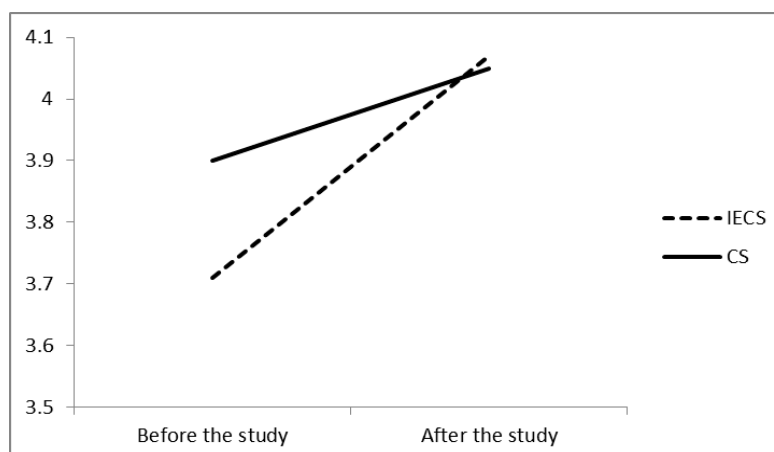


Figure 2. A profile plot indicating attitude towards online collaboration before and after the study in the conditions with the IECS and the CS.

Willingness to collaborate online

Non-significant effect was found on willingness to collaborate online between two conditions ($M=4.02, SD=.59$ for the IECS, and $M=3.77, SD=.75$ for the CS; $F=2.61; p=0.11$). Culturally heterogeneous group members led by the IECS and the CS showed a comparable level of willingness to collaborate online (see Table 2).

Satisfaction with online collaborative learning processes and outcomes

The table 2 shows that the IECS condition ($M=4.19, SD=.48$) has a statistically significant effect on satisfaction compared to the CS condition ($M=3.87, SD=.80$), $F(1,73)=4.41; p<0.05$. Student dyads that were led by the IECS showed higher satisfaction with online collaborative learning processes and outcomes in comparison with those in the CS condition.

Task performance

No significant differences in learning performance were found between the IECS condition ($M=3.17$, $SD=.64$) and the CS condition ($M=3.20$, $SD=.26$), $F=0.02$; $p=0.87$). Student dyads in both condition achieved comparable performance (Table 2).

Table 2. Means and Standard Deviations and Univariate Tests of Significance for willingness, satisfaction and task performance in two conditions the IECS and CS.

Factor	IECS		CS		F	Sig.
	Mean	SD	Mean	SD		
willingness	4.02	.59	3.77	.75	2.61	.11
satisfaction	4.19	.48	3.87	.80	4.41*	.039
task performance	3.17	.64	3.20	.26	.02	.87

* Significant at $p < .05$; ** Significant at $p < .01$.

Concluding remarks

An experimental study with a pre-test/post-test two-group design was conducted to examine the effects of the introduced IECS on the students' collaborative learning in culturally heterogeneous groups in the CSCL environment. When the collected data were analyzed, the following significant findings emerged: (1) the introduced IECS tends to positively affect students' attitude towards online collaboration compared to the condition with CS; (2) students in both conditions exhibited a comparable level of willingness to collaborate online; (3) students in the IECS condition displayed higher levels of online collaboration satisfaction than those students who collaborated in the CS condition; and (4) student groups in both condition achieved comparable performance.

Students in the scripted condition IECS tended to have more positive attitudes toward online collaborative learning in culturally heterogeneous groups in comparison with the students in the CS condition. It seems possible the nature of the instruction offered in the IECS may have contributed to the identified differences. Previous research (e.g. Zhu, 2009; Zhao & McDougall, 2008) suggests that students' collaborative learning dynamic might affect their attitudes towards collaborative learning. By supporting students by means of the IECS instructions from the very beginning of the collaboration (i.e. creating and exchanging personal profiles in order to establish the group) and throughout the whole collaboration process on how to approach a certain subtask, it may be possible that collaborating students did not experience the same challenges or barriers as the students encountered in the condition where only CS was introduced. Thus, this extra facilitation may have led students reporting more positively about their CSCL experiences in such groups.

The second research question addressed the influence of the IECS on students' willingness to collaborate online. In this study, it was assumed that having students follow the script instructions, tailored specifically to two culturally dissimilar group of students, to proceed in a collaborative task, would positively affect their willingness to be engaged in similar collaborative activities in the future. However, the results showed that all student groups regardless of the script condition expressed equally moderate levels of willingness to collaborate online. It could be possibly explained, based on the follow-up survey results, that most students would still prefer a face-to-face format to a computer-mediated communication environment or a combination of both, at least in the early stages of group collaboration.

To investigate the effectiveness of the IECS on learning performance, the scores students received for their joint post-collaboration products were calculated. The results showed that student groups in both scripting conditions achieved similar level of task performance. Apparently, in this study the structure of the task in both conditions did not limit students' creative and critical thinking. The further analysis of the behavioral and part-task data is needed to help us to shed the light on the task performance results.

This socio-technical support was based on combination of previous conceptual contributions about cultural differences and a number of techniques and approaches conducive to successful and productive collaborative problem-solving in the CSCL research field. Taken together, the results of this study suggest that the instructional support of the IECS has proved useful in the context of intercultural online collaborative learning. The theoretical value and practicality of the research discussed in this article rests predominantly on the fact that its methodology is transferable to other educational settings with western-eastern partnerships.

A number of important limitations need to be considered. First, though culture type is proved to be a very important issue, it should not be overestimated as a defining factor and absolute research parameter. Although it is organically accepted that there are individual differences, there have to be and will be certain generalizations, despite which the feasibility and viability of the results is still believed to be in place. Second,

another limitation reflects the brief duration of this study, therefore an important area of research would be to extend the duration of the online collaboration to allow for a longer period of observation and data collection. In view of this, the results showed that satisfaction does not seem to impact task performance, future studies with application of longitudinal design might give new insights into the benefits of having students who are more satisfied with their collaboration.

We hope that the results of this study will lead to a better understanding of collaborative learning in culturally heterogeneous groups in higher education. This line of research will further help educators, researchers and instructional designers to effectively integrate this new approach of instructional technology, which is responsive to culturally diverse learner groups in higher education.

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