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## Online collaborative learning: Cultural differences in student satisfaction and performance

### Abstract

*Recent studies focusing on Western students indicate that online collaboration enhances student learning achievement. Yet few empirical studies have analyzed student satisfaction and performance through online collaboration from a cross-cultural perspective. This study aims to examine student satisfaction and performance in online collaborative learning involving students in two different cultural contexts. A parallel e-learning environment with online collaborative group work was implemented for a group of Chinese first-year students from a national comprehensive university in Beijing, China and a group of Flemish first-year students from a regional comprehensive university in Flanders, Belgium. Differences and similarities with regard to student (dis-)satisfaction and their performance are analyzed and discussed from a cross-cultural perspective.*

### Keywords

*Computer supported collaborative learning; Cultural context; Asynchronous group discussion; Satisfaction; Academic performance*

## Kulturelle Unterschiede in der Zufriedenheit mit und den Lernerträgen aus online-gestütztem kollaborativem Lernen bei Studierenden

### Zusammenfassung

*Aktuelle Studien mit einem Fokus auf Studierende in der westlichen Welt deuten darauf hin, dass online-gestütztes kollaboratives Lernen Lernerfolge steigert. Jedoch liegen bislang nur wenige Studien vor, die die Zufriedenheit und die Leistungen von Studierenden im Rahmen von Online-Kollaborationen aus interkultureller Perspektive untersuchen. Mit der vorliegenden Studie soll dies nun unter Beteiligung von Studierenden aus zwei unterschiedlichen kulturellen Kontexten untersucht werden. Eine parallele E-Learning-Umgebung mit online-gestützter kollaborativer Arbeit in Lerngruppen wurde für eine Gruppe chinesischer Studienanfänger einer staatlichen Volluniversität in Peking und eine Gruppe flämischer Studienanfänger einer*

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*regionalen Volluniversität im belgischen Flandern eingerichtet. Unterschiede und Gemeinsamkeiten hinsichtlich der (Un-)Zufriedenheit und Leistungen der Studierenden werden untersucht und aus interkultureller Perspektive diskutiert.*

## **Schlagworte**

*Computer-gestütztes kollaboratives Lernen; Kultureller Kontext; Asynchrone Gruppendiskussion; Zufriedenheit; Akademische Leistung*

## **1. Introduction**

In the literature, a growing amount of research focuses on learning in group settings and more specifically on learning in *computer supported collaborative learning* (CSCL) settings. Group discussion is one of the key activities of collaborative learning during which students develop effective cognitive learning strategies through social interactions. These learning strategies encourage the adoption of a deep learning approach and have been shown to be effective in enhancing student achievements (Garrison & Cleveland-Innes, 2005). Previous studies confirm that student involvement is more intense and equally distributed among group members in CSCL environments as compared to face-to-face sessions (Angeli, Valanides, & Bonk, 2003). Recent studies indicate that online collaboration such as asynchronous discussions enhances student learning achievement (Young, 2008).

Culture plays an important role in cognitive development of learners through social interaction and discourse. From the socio-cultural view of learning, all knowledge is socially mediated (Rovai, 2002). Accordingly, cultural dimensions of learning need to be adequately addressed in designing and delivering instruction (Thomas, Mitchell, & Joseph, 2002). Cultural attributes can affect online presence and learner perceptions. It is important to consider the cultural backgrounds of learners if we are to understand how they respond to computer-based learning (McLoughlin & Oliver, 2000). Some previous studies have indicated cultural gaps between 'Confucian-heritage' and 'Western' learners in online collaborative learning environments, however, mostly in Western educational settings. Historically, the Chinese culture and the Western culture are typically distinguished as collectivist and individualist culture (Baron, 1998; Hofstede, 1986). In collectivistic cultures, people tend to avoid conflict and use more intermediaries. Effort, persistence and obligations are considered as the determinants of what a person achieves. People are encouraged to conform to the societal demands (Pratt, 1991; Triandis, McCusker, & Hui, 1990). The salient characteristics of learning in the Confucian-Heritage Cultures include social-achievement orientation, diligence and attributing success to effort (Bond, 1996; Ho, 1986; Watkins & Biggs, 1996). In individualistic cultures, individual differences are respected, people are encouraged to stand out, be unique and express themselves, and to develop the tendency to question and evaluate. However, culture is a dynamic process. It has been stressed that most cultures combine elements of both collectivistic and individualistic orientations.

Oyserman, Kimmmeier, and Coon (2002) suggest that it is better to undertake a comprehensive reassessment of individualism and collectivism within a culture rather than make priori assumptions based on generalizations and previous studies.

Although previous studies have been conducted to examine student characteristics in the Eastern and Western contexts, there are limited empirical studies focusing on student attitudes, behaviors and performance in e-learning environments in the Chinese and Western educational settings. This study responds to this gap and investigates student satisfaction and performance through online collaboration in two different cultural settings. The aim of this study is to examine student satisfaction with collaborative e-learning, and their online performance and academic achievement across different cultural contexts. This study also aims to understand whether the instructional approach that is widely adopted in Western settings (group work, student learning autonomy, and few guidance of teacher) would be suitable for Chinese students.

### **1.1 Computer supported collaborative learning**

CSCL is based on the pedagogical assertion that students learn – construct knowledge – through group interaction (Puntambekar, 2006). Collaborative learning involves the joint construction of meaning through interaction with others (Law & Wong, 2003). CSCL promotes meta-cognitive processes, reflective interaction, and problem solving (Jonassen & Kwon, 2001). Students are more interested and critical thinking and inquiry are promoted (Duffy, Dueber, & Hawley, 1998). Previous research on student learning supports the view that discussion is important (Mayes, 2001). Educational research has shown that more effective learning takes place if learners are actively involved, rather than passive listeners. Learning can be viewed as a social phenomenon where people develop, negotiate and share understanding (Nurmela, Palonen, Lehtinen, & Hakkarainen, 2003). Working together to accomplish a task is seen as a characteristic of a powerful learning environment, which facilitates active construction of knowledge (Van Merriënboer & Paas, 2003). Previous research has reported that students in collaborative learning conditions had more constructive learning processes (Hiltz, 1995). In the collaborative learning processes, students can share information, practice critical reflection, negotiate meaning, test synthesis and build consensus. According to Walker (2005), collaborative written assignments, such as developing team reports on specific topics, group answers to discussion questions, debates and critiques of arguments can enhance knowledge construction.

### **1.2 Cultural context and preferences of collaborative learning**

Culture shapes people's values, perceptions and behavior (Berry, Poortinga, Segall, & Dasen, 2002). It serves as a perceptual framework that guides the interpreta-

tion of interactions and the construction of meanings (Cortazzi, 1990). Previous research points out that individualist and collectivist cultures not only influence people's different senses of self, but also their cognitive processes (Triandis, McCusker, & Hui 1990). In individualistic cultures, people tend to be more direct to speak out, question or be confrontational; whereas in collectivistic cultures, people tend to avoid conflict and use more intermediaries. The former indicates a higher respect for individuality and the latter a higher respect for authority. The Flemish culture is situated in a Western setting, which is more individualistic, while previous studies identified that the Chinese culture, as part of the Confucian-heritage cultures is traditionally a representative of a collectivistic culture (Baron, 1998; Hofstede, 1986). Besides the 'collectivism vs. individualism' dimension, 'power distance' (high vs. low) is another important cultural dimension, which specifies the degree to which less powerful people in a society accept inequality in power. Previous research indicates that in high power distance cultures, students tend to be more passive and may be reluctant to participate in communicative activities as they are not used to speaking in front of their superiors (Ryan, 2000). Former studies put forth that Chinese culture is higher on power distance compared to many Western countries (Hofstede & Bond, 1984). However, a study of the current cultural and educational contexts including the power distance between teachers and students can be very helpful for understanding the current situation, power distance and student preferences for collaborative learning in the concerned contexts. Cultural adaptations in the use of educational technology and e-learning are also very relevant (Lin & Hatano, 2002).

### **1.3 Student satisfaction with collaborative e-learning**

The degree of student satisfaction is an important factor in evaluating the effectiveness of e-learning. Previous studies report that students who participated in online collaborative tasks expressed higher levels of satisfaction with their learning process compared to students who did not participate in online collaborative learning (Jung, Choi, Lim, & Leem, 2002). Recent evaluations of Western teaching practices within Asia cast doubt on whether findings can be transported from one community to the other without an understanding of what important contextual variables are, and how they interact with key educational interventions (Chang & Tsai, 2005). Kim and Bonk (2002) contend that more comparative research is needed within different cultures, situations and content areas, especially learners' interaction online and studies related to the impacts of cultural differences of student online collaboration.

Ramsay (2005) studied the influence of learner distinctions in cultural background on learners' experience of asynchronous computer-mediated discussions. His results indicate that both Confucian-heritage and Western learners perceived the computer-mediated communication approach as flexible, interesting, of value and providing pedagogical benefit, but Western students were more actively in-

involved in online discussions compared to Confucian-heritage students. Similar results were found that *Confucian-heritage Culture* (CHC) students are low participants when it comes to group discussion among peers and teachers (Volet, 1999). These findings indicate that CHC students show a tendency to be introverted and passive, and less active in online collaboration. Feast and Churchman (1997) observed that students from CHC rely on teachers to guide study strategies. Research by Baron (1998) indicates that online interactions among CHC students are largely confined to an instructivist approach on the part of the teacher. However, there is still a lack of empirical studies involving students in mainland China to support these arguments.

#### **1.4 Student online performance and academic achievement**

CSCL is often presented as a promising learning method. However, it is also facing some new challenges, as student preferences for collaborative learning may not be homogenous (Laurillard, 2002). Learners' perceptions about collaborative learning should be considered as they influence student attitudes, behavior and ways of knowledge construction in the learning processes (Fraser, 1998).

Student learning experience, the learning context and the learning outcomes are not to be seen as separate variables and processes (Prosser & Trigwell, 1999). Empirical studies (e.g. Wang, 2004) reveal a positive correlation between students' visible learning behaviors, such as participating in online activities, and their learning outcomes. However, there were very limited empirical studies examining student experiences, attitudes towards these innovative learning environments, and the learning process and outcomes of students in distinct cultural and educational settings.

#### **1.5 Research questions**

This study focuses on examining the following research questions: 1) Are there differences regarding student perceptions of power-distance, collaboration and competition in different cultural contexts? 2) Are there differences in student satisfaction with the online collaborative learning in different cultural contexts? 3) Do Chinese and Flemish students perform and achieve differently in online collaborative learning? Based on the theoretical and empirical background, it is expected that there will be differences with regard to satisfaction and the interaction processes between students from different cultural contexts.

## 2. Method

### 2.1 Research setting

The present study was set up as part of a cross-cultural research collaboration between a regional comprehensive university in Flanders and a national comprehensive university in Beijing, China. Students enrolled at the comprehensive Flemish university mostly come from all places in Flanders, and students enrolled at the Chinese national comprehensive university come from almost all provinces in China. Therefore, the students from these two universities can be representative of the university student population of its respective culture. A freshman course was implemented in parallel to first-year Chinese and Flemish students majoring in Educational Studies. Next to face-to-face lectures, an e-learning environment was set up. Besides the course information and online documents and resources, students were asked to participate in asynchronous group discussions on assigned tasks. The e-learning was supported by the Minerva (Dokeos) learning platform. The Minerva system is based on an open-source Dokeos system which has been developed by a university consortium. The system supports multiple languages, including English, Dutch and Chinese languages. The same e-learning system, learning content, and discussion tasks were presented to the Chinese and Flemish students involved in this study. An example of a discussion topic would be “view four educational websites and discuss what characteristics are in line with constructivist principle and come to a consensus in your answer within your group.”

### 2.2 Participants

All first-year students taking the course “Instructional Sciences” in both settings participated in the study. The Chinese students ( $n = 159$ ) were from different provinces in China. The average age of the Chinese group was 19.5 years; among these students, 70% were female, and 30% male students. The Flemish students ( $n = 205$ ) were from various provinces in Flanders, Belgium. Their average age was 19.9 years; among these students, 86% were female and 14% male students. In both contexts, the majority of students were female, and this reflects the real situation of student composition in Educational Studies in many other universities.

### 2.3 Procedure

All students in both settings were randomly assigned to a group consisting of six to eight students. The same lecturer gave the lectures in both contexts during the research period. After each lecture, online discussion tasks were presented to the groups of students. Students were required to contribute to the online tasks, at

least twice contributions each week. The supervisors for the groups only had to moderate, encourage, and give necessary directions or remarks to each group. Student online contributions were assessed on the basis of qualitative and quantitative criteria that were communicated to the students during the training session. In the Chinese setting, 35 students were randomly selected as a control group. They completed the same assignments related to each theme individually instead of through the online discussion groups. The control group was set up in the Chinese setting in order to examine the possible effects of online collaborative learning; however, it was not possible to set up such a group in the Flemish context due to practical reasons. All completed assignments, both by groups and individual students, were evaluated. At the end of the course, a final written test was presented to all students.

## **2.4 Instruments**

At the beginning of the research, student demographic information, computer use and competence level was gathered. All participants filled out a Cultural Environment Survey. The Cultural Environment Survey is a 15-item questionnaire adapted from Wang (2004) as well as Jegede and Okebukola (1990) that was used to analyze cultural factors in an online learning environment. The inventory reflects three dimensions: power-distance, collaboration, and competition. The reliability of the three scales was satisfactory with Cronbach's  $\alpha$  between .75 and .86.

After the e-learning experience, student preferences of collaborative learning and satisfaction with online collaborative learning were assessed with a questionnaire of 35 questions. This questionnaire consists of 5 questions about student perceptions of collaborative learning, 15 questions assessing the satisfaction of collaborative learning and 15 questions for students to choose and rank the aspects that they like or dislike most. Student satisfaction reflects five dimensions: e-learning function, collaborative learning, peer contribution, interaction and group results. The psychometric quality of this measurement was also confirmed (Cronbach's  $\alpha > .70$ ).

## **2.5 Statistical analysis**

T-tests were used to analyze the differences between the Chinese and Flemish students regarding their perceptions of collaborative learning as well as their satisfaction and dissatisfaction with the online collaborative learning. MANOVA tests were conducted taking student gender, culture and student computer competence as independent variables and student perceptions and satisfaction as dependent variables. Furthermore, the achievements of Chinese and Flemish students in online group settings were compared to a Chinese control group who completed their assignments individually. The online contributions were evaluated by four teaching



assistants (two for the Flemish students and two for the Chinese students) after a training by the researcher. The same evaluation criteria were set up and used by the four teaching assistants for the evaluation. The evaluation criteria were based on qualitative and quantitative requirements that were already communicated to all students. The requirements include: each student has to participate at least twice a week in the group discussions; the contribution needs to be meaningful, e.g. by putting forward an own opinion, providing evidence to an opinion, reacting to others' opinions, or referring to arguments of other authors with references. The total score is 5 points, with the qualitative evaluation accounts for 1 score point and the quantitative evaluation accounts for 4 score points. A guideline on "how to participate in online discussions effectively" was provided online for all students.

### 3. Results

#### 3.1 Student computer competence

The students in both contexts were asked to report about their access to computer and Internet (0 = no easy access 6 = very easy access) and their actual use and computer competence. The Flemish students ( $M = 5.33$ ) had an easier access compared to the Chinese students ( $M = 4.09$ ,  $p < .001$ ). 90% of the Flemish students had computer and Internet access at home; and the rest had free computer and Internet access from university PC rooms. Only 25% of the Chinese students had their own computer in their campus dormitories, and the rest had access from university PC rooms at a low fee. The Flemish and Chinese students differed significantly in computer competence at the beginning of this research. Compared to the Chinese students, the Flemish students had easier access to computer and Internet, and they spent on an average more time online and used more frequently emails than the Chinese students. The post-test showed that the Flemish group on average posted more messages in the asynchronous group discussions than the Chinese group ( $p < .01$ ).

#### 3.2 Student perceptions of cultural environment in terms of power distance, collaboration and competition

Based on the survey, Chinese and Flemish student perceptions on power distance, collaboration and competition were analyzed. The results are presented in Table 1. The results show that Chinese students perceived a greater *power distance* between teachers and students compared to Flemish students ( $p < .01$ ). The results indicate that *collaboration* appears to be similarly important in both educational settings ( $p > .05$ ). However, compared to the Flemish students, Chinese students seem to put more emphasis on *competition* among students ( $p < .001$ ).



**Table 1:** Cultural environment survey: Flemish and Chinese students

	Chinese ( $n = 159$ )	Flemish ( $n = 205$ )	
	$M(\sigma)$	$M(\sigma)$	$p$
Power distance teacher-student	3.41 (.70)	3.23 (.74)	.032
Collaboration	4.36 (.51)	4.27 (.57)	.13
Competition	3.82 (1.01)	2.27 (1.05)	< .000

### 3.3 Student satisfaction and dissatisfaction with online collaborative learning

The results indicate that there were significant differences between Chinese and Flemish students regarding their satisfaction and dissatisfaction with online collaborative learning. A summary of the significant differences between the two groups is presented in Table 2. Compared to the Flemish students, the Chinese students reported a higher level of satisfaction with the e-learning functions, online collaboration, and peer contribution ( $p < .05$ ). The results show that the Chinese group was more satisfied with the equal contribution of group members compared to the Flemish group ( $p < .01$ ). The Chinese group liked to a greater extent working together with others on the assignments than the Flemish group ( $p < .01$ ). Chinese students also reported to a larger extent that the online collaborative learning is “new and exciting” compared to the Flemish group. The Flemish students were more satisfied with the final results of the online group work compared to the Chinese group ( $p < .001$ ); and they spent more time on average on the online group collaborative learning, 4.87 hours per week versus 2.20 hours per week for the Chinese students. As to the dissatisfaction of students, the Chinese group reported more often a lack of interaction between students and teacher in asynchronous group discussions compared to the Flemish group. The Flemish group reported to a larger extent that it was time-consuming compared to the Chinese group ( $p < .001$ ). The Chinese students were less happy with the task division in online group work compared to the Flemish students.

Similarities in student responses were also found. Both Chinese and Flemish students found it an advantage to be able to work at their own pace and time, and liked online collaborative learning as each group member can contribute his/her part in the group assignments. Both groups reported that online collaborative learning helped them to gain more knowledge than if they would have studied alone. They also stated that they had learned a lot considering the time they invested into the online collaborative learning assignments. The Chinese and Flemish students were similarly satisfied with the peer interaction and with the technical help they received from the course coordinators. Both groups of students faced similar technical problems, such as losing a contribution after submission, downloading or uploading documents.

**Table 2:** Student satisfaction and dissatisfaction with online collaborative learning (scale from 0–6, 0 = absolutely not true, 6 = very true)

	<i>M</i>		<i>p</i>
	Chinese	Flemish	
<i>Satisfaction with online collaborative learning</i>			
Satisfaction with the e-learning environment	4.01	3.45	.012
Satisfaction with collaborative learning	4.14	3.44	.001
Satisfaction with peer contribution	3.43	2.83	.003
Satisfaction with peer interaction	3.60	3.56	.83
Satisfaction with group results	3.85	4.66	.000
<i>Dissatisfaction with online collaborative learning</i>			
Time-consuming	3.24	4.50	.000
Dissatisfaction with task division	2.76	2.25	.010
Lack of interaction with teacher	4.09	3.43	.001

The ranking of what students liked and disliked most with regard to online collaborative learning is summarized in Table 3. The Flemish students most of all liked working in their own pace and time, while the Chinese students most of all liked the fact that they could work together with others on the assignments. What the Flemish students disliked most was that it was time-consuming, whereas the first problem the Chinese group reported was the lack of interaction between students and teacher.

**Table 3:** The ranking of what Chinese and Flemish students were most satisfied and most dissatisfied with online collaborative learning

	Chinese group		Flemish group	
	%	Ranking	%	Ranking
<i>What do you like the most of the e-learning environment?</i>				
Flexibility	48.8	2	56.3	1
Collaborative learning	49.7	1	42.6	2
Peer contribution	21.1	3	40.1	3
<i>What do you dislike the most of the e-learning environment?</i>				
Time consuming	26.7	3	64.1	1
Technical problems	45.6	2	49.3	2
Lack of interaction with teacher	64.4	1	42.6	3

In order to understand whether collaborative learning enhanced student academic performance, we also compared the results of the assignments accomplished by the Chinese students who worked collaboratively online and the students who accomplished the same assignments individually. The results show that the students in the group condition ( $M = 5.4$  out of 10) had a higher mean score compared to the students in the individual condition ( $M = 4.8$  out of 10,  $p < .05$ , Cohen's  $d = .40$ ). The Flemish students, all in the group condition, had a slightly higher mean score ( $M = 5.9$  out of 10) compared to the Chinese students in group condition ( $p < .05$ , Cohen's  $d = .31$ ). But the effect sizes were small based on the criteria suggested by Cohen (1988). The assessment criteria were the same for both settings although we need to bear in mind that the assessment was made by different teaching assistants. There were no significant differences in the final test scores between the Chinese students who were in group or individual condition for the assignment tasks ( $p > .05$ ).

In addition, MANOVA tests were conducted taking student gender, culture and student computer competence as independent variables and student perceptions and satisfaction as dependent variables. The results show that male students were more satisfied with the e-learning environment compared to female students ( $p < .05$ ). Student computer experience was also a significant factor that affects student satisfaction with the e-learning environment ( $p < .05$ ). The results indicated that there were no interaction effects among gender, culture and student computer competence. The MANOVA tests confirmed that culture had the most significant effects on student satisfaction with e-learning and their achievement. The details are reported in Table 4.

**Table 4:** Multivariate analysis of variance by gender, culture and computer experience

Independent variable	Dependant variable	<i>F</i>	Sig.	Partial Eta Square
Gender	Satisfaction with e-learning environment	4.01	.040*	.006
Culture	Satisfaction with the e-learning environment	5.05	.022*	.009
	Satisfaction with collaborative learning	4.79	.023*	.011
	Satisfaction with peer contribution	5.44	.012*	.013
	Satisfaction with group results	5.26	.022*	.010
	Dissatisfaction (lack of interaction with teacher)	9.12	.003**	.026
	Dissatisfaction (time-consuming)	5.46	.008**	.012
	Dissatisfaction with task division	6.40	.010*	.014
	Score (online discussion performance)	3.55	.015*	.010
	Score (final test performance)	6.40	.004**	.013
Computer experience	Satisfaction with e-learning environment	4.52	.032*	.007

\* $p < .05$ . \*\* $p < .01$ .

## 4. Discussion

This study focuses on three key issues in relation to student perceptions of the cultural environment, preferences for online collaborative learning, satisfaction with the online learning environment, and their online performance and academic achievement.

The findings suggest that student preferences for online collaborative learning may be related to cultural differences. The results regarding student-teacher power distance seem to reveal that there is a larger power distance in the Chinese context compared to the Flemish context. Additionally, our results suggest that there is a higher sense of competition among Chinese students compared to Flemish students. The combined effects of power-distance and competitive nature of education in the Chinese system seem to have an effect on teaching and learning in China as the teacher-centered instructional methods are still quite common although constructivism and student collaborative learning has been encouraged in several campaigns of educational reform.

Surveying students' satisfaction with collaborative e-learning is a critical issue in promoting the innovative use of modern educational technology, especially in different cultural contexts. Our results indicate that there were significant differences between Chinese and Flemish students regarding their satisfaction with online collaborative learning. In average, the Flemish students spent more time in online collaboration and were more satisfied with the results of group work compared to the Chinese students. The Chinese students enjoyed online collaborative learning to a greater extent and were happier with the contributions of group members compared to the Flemish students. Both groups of students were satisfied with the functions of the e-learning environment, appreciated the opportunities to work collaboratively and agreed that collaborative learning promotes deeper understanding of the learning content. The results are consistent with previous studies that students in general are satisfied with online collaborative learning (Dewiyanti, Brand-Gruwel, Jochems, & Broers, 2007). The Flemish students ranked flexibility in time and space as the main advantage of e-learning, and the Chinese students found that working collaboratively online was a big advantage. Both groups of students were positive about working on a group product.

As to student dissatisfaction, the findings of this study showed that the lack of interaction with teachers in the e-learning environment was the biggest problem for the Chinese students. Although the teacher guidance was at about the same level for the Flemish students, the latter found it less of a problem. This might be due to the different expectations of teacher's involvement of the two distinct groups. Teachers or tutors play a very important role in Chinese educational contexts. Observations of the current e-learning programs in China indicate that e-learning tends to be heavily instructor-centered, for example by using video lectures online. Other studies also comment that Chinese e-learners found it problematic when teacher or tutor presence is low (Friesner & Hart, 2004). This could

also be because of the low ambiguity tolerance of Chinese students who expect the presence of expert and certain knowledge (Zhu, Valcke, & Schellens, 2008a), which leads for a stronger need for feedback and teacher help in the learning environment (Anderson, 2000). The 'new and exciting' online collaborative learning approach did not result in more intensive involvement of the Chinese participants; they were less active than Flemish students in terms of the time spent online and the messages posted. This might be because the Chinese students were less familiar with this type of learning approach compared to the Flemish students. It might also be related to the fact that Chinese students had not as easy access to computer and Internet and were less familiar with computer use compared to Flemish students (Zhu, Valcke, & Schellens, 2008b). Flemish students rated 'time-consuming' as the primary problem, but most probably due to their extensive participation, they were quite satisfied with their final results of group work. Another negative effect was the technology dimension, which was reported as the second problem by both groups of students. This is not surprising for new learners in e-learning, but attention should be paid in future to provide more appropriate training and technical support to students (Fallshaw & McNaught, 2005). Our results were consistent with results from a previous study by Smith, Coldwell, Smith, and Murphy (2005) which showed that Chinese students were significantly less comfortable with discussions in e-learning compared to Western students. They also found that Chinese students posted less messages associated with content contributions to the online discussions. These results point out that there are distinct features in online collaborative learning experience, participation and satisfaction of students from different cultural backgrounds.

Previous research put forth that student attitudes towards collaborative learning might inhibit or promote their participation in the collaborative learning process (Kagan, 1994). Our results show that student perceptions of collaborative learning were positively associated with their online performance in group work. Our results reveal that the Chinese students in the group condition excelled the students in the individual condition in the results for their assignment. This was probably because the groups could integrate different points of view by working collaboratively and their perspectives became more comprehensive than those of the students who worked individually. The Flemish students performed better for the group assignments compared to the Chinese students. This might be related to the more intensive involvement of the Flemish students. In addition, easier computer and Internet access might also be an explanatory factor.

Student perceived satisfaction and the students' performance in online collaborative learning are important factors to determine whether an innovative learning approach can be applied continuously. Our study confirms that culture is an important factor that affects student satisfaction and academic achievement in an innovative e-learning environment.

## 5. Limitations and conclusions

It has to be noted that the results should be considered in a cautious way as the study is applied in specific settings. Generation of the results could only be made in a cautious way in similar settings. It also has to be pointed out that although we have identified a series of differences and similarities between the two cultural groups, individual differences should not be neglected. Furthermore, the differences in the results of the two settings can be explained not only in relation to cultural differences, but could also be partly explained in relation to the new instructional experience for Chinese students.

There is also a limitation as to the number of participants involved, especially samples involved in the group and individual conditions, as only 35 students were randomly assigned to the latter condition. It was not possible to generate these two conditions in the Flemish setting due to various practical, ethical and administrative reasons. Secondly, the student computer competence level might have influenced student satisfaction with and perceptions of e-learning. Thirdly, only individual satisfaction and performance were used for data analysis in this study. Future studies could attempt analyses at group level and cultural level. Furthermore, although we tried to control several educational setting variables, we realize that there are other variables such as social and economic environment, educational systems, or campus environment, which might have influenced student satisfaction, participation and performance in the collaborative e-learning settings. We realize that the research only concerns one Chinese cultural context and one Western context. In future research, more participants in relevant cultural contexts can be involved for a wider scale research. It is suggested that a multilevel approach could be one of the approaches to cope with the methodological challenges of cross-cultural research (Fontaine, 2008). Such an endeavor in future studies would be very valuable. Furthermore, besides learner's attitudes, instructors' attitudes towards innovative teaching and the use of learning technology should be examined in future studies.

In conclusion, the study indicates that student perceived satisfaction and their performance in online collaborative learning are important factors to determine whether an innovative learning approach can be applied in a sustainable way. Our study confirms that there are significant cultural differences in student satisfaction and academic performance in an innovative e-learning environment. The study provides a clear understanding that culture is an important variable to be considered with regard to instructional design in different cultural contexts. Student preferences for collaborative learning and satisfaction with the e-learning environment are also important variables influencing student learning, especially in a student-centered e-learning environment. Understanding these variables would be helpful for instructors to design meaningful educational activities to enhance student performance and make learning more effective, appealing and satisfactory for students.

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