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Are They Thinking Differently: A Cross-Cultural Study on the Relationship of Thinking Styles and Emerging Roles in Computer-Supported Collaborative Learning

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ABSTRACT

Numerous studies have recognized collaboration as an effective way of learning. When collaboration involves students from different cultural backgrounds, a question arises: *Will cultural differences influence the manner in which roles are adopted within collaborative learning?* In this study, a correlation analysis was used to explore the relationship between cultural factors and emerging roles among collaborating students from two universities in different countries (China and USA). The cultural factors that might hypothetically affect their collaboration were approximated to thinking styles by using Sternberg's thinking styles inventory. The roles that students adopted according to preferences were coded with an adapted coding scheme. The results indicate a significant relationship between student thinking styles and the adopted roles of students. This finding implies that cultural factors, exhibited as thinking styles, could explain the emerging roles that are adopted in Computer-Supported Collaborative Learning (CSCL). The results could guide teachers in assigning appropriate roles to students with different backgrounds to improve the efficiency of collaboration during cross-cultural CSCL.

Keywords

Cross-culture, Computer-Supported Collaborative Learning, Thinking styles, Emerging roles, Correlation analysis

Introduction

Discussions and debates have focused on the effects of increasing globalization on education (e.g., Zajda, 2015; Marginson, 2011). The statement, "[t]he global dimension is fast-moving and fluid" (Marginson, 2011, p. 11) indicates a work-in-progress that deals with emergent issues constantly playing out. Worldwide participation rates in higher education have clearly risen in the last decade (OECD, 2012), and this increase is widely interpreted as an indicator of socio-economic advance. Moreover, in several cases, many classrooms and courses are experiencing an increasingly internationalized student population. This scenario has raised a number of issues and opportunities, such as political consequences in certain contexts as well as an increasing need for educators to deal with cross-cultural issues in teaching and learning (Nguyen, Elliott, Terlouw, & Pilot, 2009; Vatrapu, 2008) and specifically with learning online (Nafukho, 2014).

Evidence from cultural psychology research has identified individual learning differences, which emerged from cultural factors. Specifically, these differences have been described at the level of the individual in terms of motivation and cognitive process (Millar, Serbun, Vadalia, & Gutchess, 2013; Han, 2010), thinking styles (Lun, Fischer, & Ward, 2010), and learning styles (Joy & Kolb, 2009). These differences manifest as individual behavior, and much of the literature discusses these factors in terms of cultural differences. Likewise, since the emergence of Sternberg's work on thinking styles over two decades ago, much research has been undertaken concerning the relationship between thinking styles and other variables, such as "cultural differences with thinking style" (Han, 2010; Lun, Fischer & Ward, 2010; Millar et al., 2013). In engaging in international collaboration, these issues come to the foreground, as this study reveals.

In reporting a study focused upon cross-cultural factors that might affect role adoption within Computer-Supported Collaborative Learning (CSCL), this study considers a hypothesis that people from different cultures think differently and will therefore behave in different ways by adopting different roles in a cross-cultural CSCL context. We first review related literature on cross-cultural studies on learning, thinking styles, and role-playing in CSCL contexts. We then report on a study designed specifically to investigate whether a correlation could be determined between student cultural contexts and the roles they adopt in CSCL activities. We assume a broad interpretation of CSCL throughout the study, although a number of the activities described could arguably be distinguished as distributed problem-based learning (dPBL). Our rationale for choosing CSCL as the primary

context for this study is that collaboration indicates various roles that need to be performed in addressing prescribed tasks.

Literature review

Cross-cultural studies in learning and CSCL

Culture is a construct commonly used across a range of discourses that include anthropology, sociology, cross-cultural studies, and organizational development. At an abstract level, the components of culture comprise shared norms, values, symbols, and beliefs (Hofstede, 1980; 2011; Triandis, 1995; Zhong, 2010). *Culture* becomes an important construct because human societies and groups conduct their affairs with different conventions and protocols. Hence, this situation provides both opportunities and constraints for mediated interaction.

Learning and teaching are culturally dependent phenomena, and much research on learning consider cultural factors, with extensive evidence showing the differences produced by cultural factors (Millar et al., 2013; Han, 2010; Lun, Fischer, & Ward, 2010). While several studies demonstrate the efficacy of generalization (Van de Vijver & Poortinga, 1982), further analysis that considers a range of contexts reveals significant complexity. For example, while cultural dispositions, such as respect for hierarchy, can be viewed as predicting aspects of organizational harmony over individual needs, other factors, such as overall cultural composition of workplace teams and whether frequent communication promoted early in a team's lifecycle, are as significant in determining performance (Swigger, Alpasan, Brazile, & Monticino, 2004). However, in other studies, Popov, Biemans, Brinkman, Kuznetsov, and Mulder (2013) found that "collaboration in culturally mixed groups is less than optimal and may require extra facilitation" (p. 36).

Zhong (2010) shows that the "cultural influence in CSCL is multi-faceted" (p. 168) and that "cultural [dimension] has been found as an important factor in affecting the collaborative process, directly or indirectly, and the learning outcomes in CSCL" (p. 178). Her thesis explicitly investigates cultural influence in CSCL and explores the expression of cultural values as individual characteristics and the ways that these values could determine technology acceptance and use.

In the case of education, the dimension of *power distance* manifests as a large distance in teacher-centered education and as a smaller distance in more student-centered education (Hofstede, 2011, p. 9). However, this study considers the dimension of *individualism* versus *collectivism* to be more significant. Culture is an important factor in shaping and predicting the action and response of individuals. Because many Asian cultures are often characterized in terms of supporting collectivist goals (Miyahara, Kim, Shin & Yoon, 1998), these cultural dispositions can affect the perception of CSCL tasks (Zhong, 2010).

Thinking styles in cross-cultural studies

Cross-cultural studies reveal that cultural factors affect different behaviors and produce culturally unique thinking styles (Han, 2010; Millar et al., 2013; Varnum, Grossmann, Kitayama, & Nisbett, 2010). These differences in thinking styles are apparent in cognitive process, such as perceptual and attentional processing by a social psychologist (Han, 2010). However, these differences are apparent in terms of cognitive habit according to cultural psychologists, and reveal a more analytic and holistic pattern of thinking and perception (Varnum et al., 2010).

In the seminal work on thinking styles of Sternberg (1990), cultural construct is introduced as "mental self-government" to highlight the relationship between individual abilities and preferences and its effect on teaching and learning (p. 369).

Thinking styles are as important as, and arguably more important than abilities, no matter how broadly abilities are defined. Thus, constructs of social, practical, and emotional intelligence, or of multiple intelligences, expand our notions of what people *can do*, but the construct of style expands our notion of what people *prefer to do* or how they capitalize on the abilities they have. When your profile of thinking styles is a good match to an environment, you thrive. When the match is bad match, one suffers. Different levels of schooling and subject areas reward different styles as well (Sternberg, 1999, p. x).

In using the notion of "government," Sternberg describes its various forms (monarchic, hierarchical, oligarchic, and anarchic) as well as its key functions (executive, legislative, and judicial). Distinguishing preference from ability has provided an important theoretical lens through which subsequent research has followed concerning the biases or preferences in applying thinking styles (Zhang & Sternberg, 2000; Varnum et al., 2010).

Within sociocultural context, thinking styles are subject to cultural differences using broad descriptors, such as analytic versus holistic (Zhu & Han, 2008). Therefore, in this study, approximating cultural factors to thinking styles, while using Sternberg's thinking styles inventory made sense. Applying Sternberg's distinctions of preference versus ability within the context of CSCL requires close examination of roles within CSCL.

Roles in CSCL

The concept of role has been widely used in CSCL and is defined as the stated functions or responsibilities that guide individual behavior and regulate group interaction (Hare, 1994). Generally, two perspectives of roles are found in the practice of CSCL (Strijbos, & Weinberger, 2010). First, scripted roles facilitate the collaborative learning process by prescribing and structuring roles and activities to learners. Second, emerging roles are developed spontaneously by participants during their collaborative learning process.

Structured role design has been shown to be an effective way to engage students in collaborative learning activities in both face-to-face and online contexts (Gu, Shao, Guo, & Lim, 2015; Hoadley, 2010; Hou, 2012; Yeh, 2010; Wishart, Oades, & Morris, 2007). By assigning a student with a particular role in the CSCL process, issues of interdependence, individual accountability, and cognitive engagement in collaborative learning are addressed (De Wever, Van Keer, Schellens, & Valcke, 2010; Strijbos & Weinberger, 2010). However, studies on role structuring rarely consider characteristics of individual student preferences as well as cultural differences between students when assigning them to different roles.

Research on emerging roles has focused on the analysis of *de facto* roles that students produced, self-regulated, and developed (Strijbos & Weinberger, 2010). The analysis of emerging roles is valuable for understanding the CSCL process, including the dynamics of CSCL, individual contribution, and patterns of interactions with each other (Jahnke, 2010; Sarmiento & Shumar, 2010), which are important knowledge for effectively facilitating CSCL.

As mentioned earlier, cross-cultural factors have significantly influenced social engagement in collaboration (Van de Vijver & Poortinga, 1982; Zhong, 2010). To document the cultural dimensions of CSCL by structuring roles appropriately, studies on the possible relationship between cultural differences and their roles in CSCL are needed.

This study explores the relationship between cultural factors and emerging roles among collaborating students from two universities in different countries (China and USA). The cultural factors that might hypothetically affect collaboration were approximated to thinking styles by using Sternberg's (1990; 1999) thinking styles inventory, while the roles that the students adopted were coded with an adapted coding scheme. The research questions adopted as our foci are as follows:

- Are there significant differences among the roles they played in collaboration?
- Are the differences of their roles played in collaboration significantly related to their thinking styles?

The following sections describe the methodology of this study, including the participants, research design, coding scheme adopted, and approach to data collection and analysis.

Methodology

Participants

The participants in this study were 27 Chinese graduate students (7 males and 20 females, aged 23 to 25 years old) majoring in Educational Technology, and 32 American graduate students (12 males and 20 females, mostly in their 30s) majoring in Curriculum during the 2013–2014 Northern hemisphere fall semester. The Chinese were all full-time graduate students with no work experience, while the Americans were pre-service science teachers and all part-time graduate students about to become PhD candidates. Because of their majors, the Chinese students had skills in software development, while American students had skills in instructional design.

This situation provided an optimum combination of different skills that the collaboration expected. All students had some knowledge of and experience with CSCL, which provided good foundation for the success of the project. All Chinese students studied and learned English for more than eight years as a second language and had passed the College English Test 6, which meant that English could be used during the collaboration. Students were divided into 13 groups, with each group comprising two Chinese and two or three Americans.

Research design

The context of the study builds upon a well-established collaborative relationship between two universities, one from US and the other from China. Each academic year, a cohort of graduate students from the universities work together on projects within their respective courses to design and develop educational games for K12 students. The teachers introduced the targeted users, demand and assessment criteria, basic design and technological knowledge, and the timeline of the project. However, the entire project design and development of the games is intrinsic to the project. A key feature is that the course combined elements of collaboration among different roles and instructional design.

At the beginning of the project, students contacted group members through email and added them as contacts on Skype, which was the chosen platform for communications during the following semester. Communication among group members across the countries was conducted in English. However, Chinese was used when the conversation involved only Chinese group members.

The task of each group was to design and develop collaboratively an educational game. Each group was expected to plan their task schedule towards this goal. Students were required to engage in planning by discussing the topic once or twice on each week and the task that must be finished for the following week. Moreover, these meetings assured that future meetings were scheduled. The duration of each meeting was scheduled for one and a half hours, although the actual duration depended on the efficacy of the discussion.

To achieve the learning goal, students collaborated using Skype and provided input into the requirements, design, development, debugging, and evaluation of the game software. Each communication episode was regarded as an instance of CSCL. Each group was required to discuss any issues and come to an agreement in one session, such as the theme of the educational game they would design, what learning strategies they were going to use, or what the game should look like. Each group worked independently on their game design activity, and their output was the game they designed and developed together. During the whole semester, the instructors only provided technical support for this collaborative project. No further intervention was done during the process of the students engaging in CSCL.

Coding emerging roles

In this study, we observed the roles that the students adopted in the collaboration, and coded these observations by using a CSCL role-coding scheme. This coding scheme illustrates six steps that normally involve resolving a conflict, finishing a discussion task, or solving a problem. The role structure we used to approximate the emerging roles of the students is presented in Table 1.

The starters are responsible for setting the timeline of the whole project, kicking off the discussion, putting forward a preliminary analysis of the task, and motivating discussion when necessary. The supporters assist peers by giving positive feedback to their inputs with supportive evidence. The arguers will elaborate upon or add further explanation and analysis to statements made by peers according to logical and critical thinking. The questioners will focus on raising queries to clarify statements or solutions. The challengers provide strong negative feedback and ask critical questions that might reveal assumptions. The timers will coordinate and moderate the speed of discussion, set the tone for discussion, and make a summary at the end of the discussion (Gu et al., 2015).

Students were required to record the Skype video of each CSCL session and save the conversational transcript as text. At the end of the project, all videos and transcripts were sent to the researcher as raw data for coding.

Two research assistants were assigned to handle coding of the emerging roles of the students. Coding was based on Skype videos, interview transcriptions, text messages, or emails as necessary. The code was scaled at 1 to 9

with 1 indicating that the student had never enacted this role and 9 indicating complete engagement with this role. The higher the digit recorded, the higher the level of the role-play experience. Table 2 presents the coding example.

Table 1. CSCL roles

Roles	Function description	Prompts
Starter	To kick off the discussion, put forward a preliminary analysis of the task, add new points for peers to build upon, and give new impulses when discussion slacks off; To make a summary in a certain time, and promote development of the collaboration	To begin with, I think We can first make sure Let's come to the point Let me say more about that From the story, it is clear that Let us solve the problems, now
Supporter	To support ideas of peers by making positive feedback with reasonable evidence	I agree because That's right I can see what you are saying An example is I have read that
Arguer	To make further explanation/reasoning to the statement/idea made by peers, with logical and critical thinking	That is valid if I think both are right because To summarize From the discussion, we can see So, what you mean is It sounds great since
Questioner	To raise questions and not doubt, from statements of peers; To promote discussions as planned	Why is it? What do you mean when you say? Can you say more on that? Is there another way of looking at it? Where did you read/hear that?
Challenger	To challenge statements/ideas and give negative feedback by asking critical questions and probing into their opinions; To lead teams to consider the problem critically and logically	I disagree/am not so sure because Why do you say that? Please give a reason Is there any evidence? But, can we trust that? An argument against that is/ Another view might be I think something different Is it the case that?
Timer	To coordinate and moderate the speed of discussion, set the tone for discussion, respond to individual posts, and prompt individuals or the group to pursue ideas	Would you please? Can we? Sorry Ok. Let's move on Would you please?

Table 2. Role coding examples

	Researcher 1						Researcher 2					
	Sta	Sup	Arg	Que	Cha	Tim	Sta	Sup	Arg	Que	Cha	Tim
Student 1	1	7	6	2	4	1	1	7	5	2	4	1
Student 2	2	1	4	7	4	1	2	2	5	7	4	1
……	…	…	…	…	…	…	…	…	…	…	…	…

Prior to coding the data, the two research assistants received approximately two hours of training in understanding the coding scheme and elaborating on the coding process. After the two-hour training, sample data were used for practice. The final coding results were pooled into MS Excel. Inter-rater reliability (IRR) was calculated by using Cohen's Kappa. Table 3 presents the IRRs.

We can see from Table 3 that six IRRs are all in (0.7, 0.8), which indicates high level of reliability of the two raters. Moreover, the coding results could be used for further correlation analysis.

Table 3. Inter-rater reliability calculation

Role	Starter	Supporter	Arguer	Challenger	Questioner	Timer
IRR	0.842	0.805	0.801	0.760	0.737	0.886

Group interviews were carried out to refine the coding decisions. However, because of difference in region and time, only Chinese group members were interviewed to obtain better understanding of the role-play in CSCL. The researchers first contacted one of the Chinese group members, explained the interview purpose, and promised to respect personal privacy. After negotiating with their own group members for a couple of days, all 13 groups took part in the interview. The interviews were done with each group at the time and place convenient to them. With permission, the interviews were recorded for later analysis and transcription. During the interview, each student was asked to describe in detail the team collaboration and contribution in CSCL. At the end of the interview, the researchers described the six roles in Table 1, and asked the students to evaluate the roles that each student adopted, including American members. This task was done blind to what other the group members thought, and the results of the role evaluation were used as the source of triangulating the coding results.

Thinking skills data

Many scales can be used to measure thinking styles, which could explain the difference in individual academic performance (Grigorenko & Sternberg, 1995). The thinking styles inventory of Sternberg and Wagner (1991) can measure student thinking styles from 13 dimensions, including 104 items, with a seven-point Likert scale (1-*Not at all* and 7-*Extremely well*). This thinking styles inventory has been used in different grades by many researchers and the results showed high reliability and validity. However, the question list is too long, which could agitate participants answering the questionnaire. Such agitation have been considered to affect the reality of the measured results (Lin, Qin, & Chen, 2008). To acquire answers with better accuracy from the participants, Chinese researcher Lin and colleagues (2008) adapted and validated the original version to a shorter one, which has only 64 questions. In this study, we used this short version as the instrument. The measurement was carried out at the beginning of the semester and the results were exported as a spreadsheet. Because the short version has a different number of questions in each dimension, the results were transferred to a hundred-mark system for comparison and calculation. A higher score indicates stronger thinking style on a certain dimension.

Findings and analysis

Results and analysis of thinking styles

After encoding the questionnaire data into a spreadsheet, the average scores of the thinking styles of students from the different countries were calculated from the 13 categories. ANOVA was employed to analyze the differences in thinking style dimensions. The results are shown in Figure 1 and the significant differences are listed in Table 4.

Table 4. ANOVA test of thinking styles

	F	*df*	*Sig.*
Judicial	5.296	1 51 52	0.025
Liberal	17.424	1 51 52	0.000
Hierarchical	18.208	1 51 52	0.000
Oligarchic	7.258	1 51 52	0.010
Anarchic	14.998	1 51 52	0.000

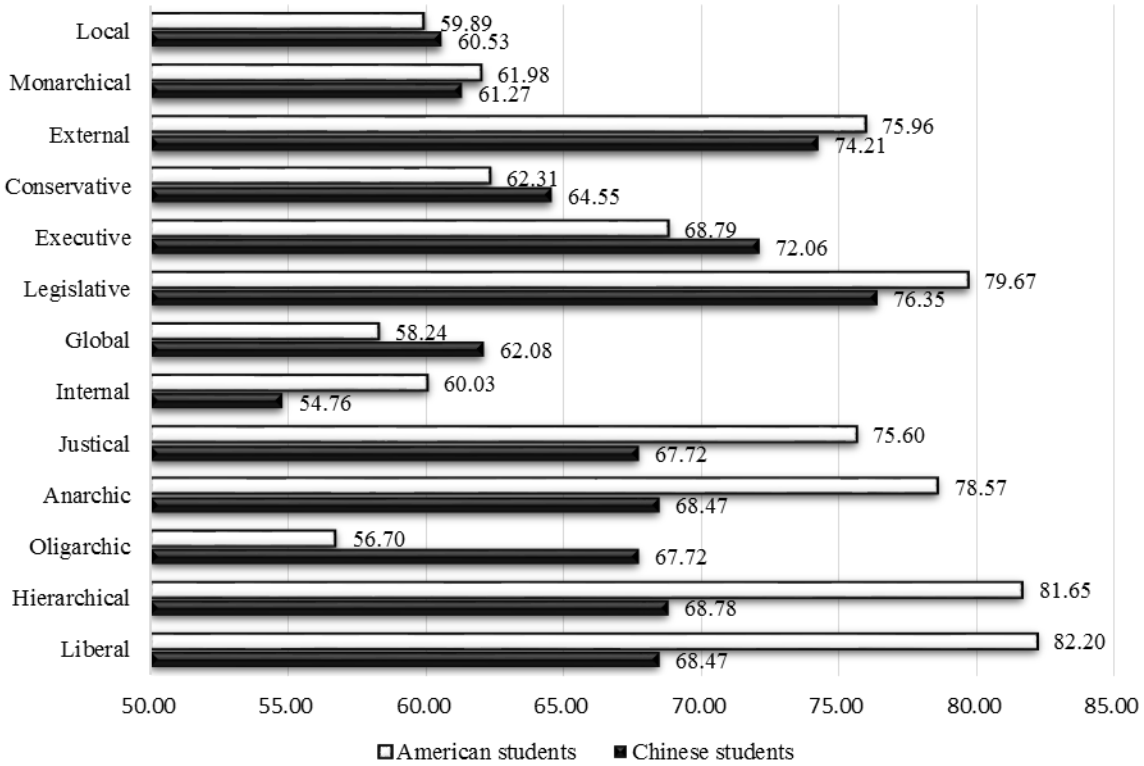

Figure 1. Average scores of thinking styles

Figure 1 shows that visually, Chinese students achieved higher scores in oligarchic, global, executive, conservative, and local styles. By contrast, they had lower scores in liberal, hierarchic, anarchic, judicial, and legislative in comparison with American students. Combined with the ANOVA test results in Table 4, among the 13 thinking styles, significant differences are observed in liberal (p = .000), hierarchical (p = .000), anarchic (p = .000), oligarchic (p = .010), and judicial (p = .025) thinking styles between Chinese and American students. Executive, global, conservative, and oligarchic are not significant, and local and monarchical almost have no disparity. According to Sternberg's theory of mental self-government:

"Individuals with *liberal* style enjoy engaging in tasks that involve novelty and ambiguity" (Zhang & Sternberg, 2000, p. 475);

"The *hierarchic* form allows for multiple goals, each of which may have a different priority" (Sternberg, 1990, p. 369);

"For individuals who have *anarchic* thinking styles, rules, procedures, and guidelines are anathema" (Sternberg, 1990, p. 369);

"The *oligarchic* form allows for multiple goals, all of which are equally important" (Sternberg, 1990, p. 369); and,

"The *judicial* mind is concerned with judging, evaluating, and comparing" (Sternberg, 1990, p. 367).

Therefore, we make the following deductions:

- American students prefer new ideas and new methods or solutions to solve problems that involve novelty and ambiguity. A significant difference (p = .000) can be observed in the liberal thinking style with Americans 82.20: Chinese 68.47.
- American students prefer to distribute attention to several tasks prioritized according to their value to the individual in achieving his or her goals. A significant difference (p = .000) can be observed in the hierarchical thinking style with Americans 81.65: Chinese 68.78.
- American students enjoy working on tasks that allow flexibility as to what, where, when, and how one works, while tending to eschew systems of almost any kind. A significant difference (p = .000) is shown by anarchic thinking style with Americans 78.57: Chinese 68.47.

- Chinese students are more likely to work on multiple activities in the service of multiple objectives, but do not enjoy setting priorities. A significant difference (p = .010) is indicated in oligarchic thinking style with Chinese 56.70: Americans 67.72.
- American students are more willing to focus on evaluating the products of other groups. A significant difference (p = .025) is shown in judicial thinking style with Americans 75.60: Chinese 67.72.

Results and analysis of roles

The average scores of the roles played were calculated according to the coding results. The results are shown in Figure 2, and ANOVA test results of the significant differences are listed in Table 5.

We can see from Figure 2 and Table 5 that Chinese and American students were playing their roles very differently in questioner (p = .000), challenger (p = .002), arguer (p = .016), and starter (p = .041). ANOVA test results suggested that Chinese students were more likely to play roles of arguer, questioner, and challenger, while most American students preferred roles as starter.

Table 5. ANOVA test results of role-play

	F	*df*	*Sig.*
Starter	4.364	1 55 56	.041
Arguer	6.186	1 55 56	.016
Questioner	21.729	1 55 56	.000
Challenger	10.060	1 55 56	.002

During the interview, the researcher asked the students to describe the details of collaborative processes to find out how the members played the roles. The following quotes that echo the ANOVA test results are representative (names mentioned are aliases):

> *"At the beginning of the project, it's the American friends, mainly York, who calls us on the Internet. He sets the online meeting time and sends us emails or messages to know the task process." (American students incline to be starters)*

> *"They are so fluent in English that I can't follow up. I usually tell my Chinese partner my opinions and he would translate for me because his English was better. I mainly focus on the task assigned to me, such as add a scenario in the game, and ask necessary questions." (Chinese students like to be questioners)*

> *"I don't think what they design is an education game, but a courseware. However, our goal is to design and develop an education game. Therefore, we negotiated and I proposed that the content was still there but wrapped in game clothes." (Chinese students were inclined to be challengers and arguers)*

> *"They may not know us well. We are not professional programmers to develop the entire design of the game. Part of the designed game was too hard to develop. I advised to change the design to an easy one and they agreed. Another example was that the background music they use was noisy. I recommended another one and they think it's a great idea." (Chinese students were inclined to be challengers and arguers)*

> *"They don't have much reject voice. They usually say 'It looks great!', 'You have done great job' and so on." (Americans do not like to be challengers and questioners)*

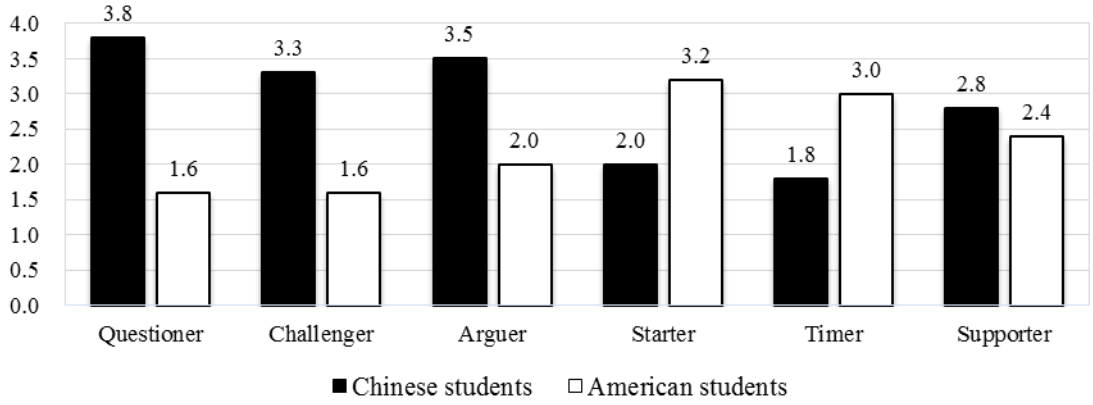

Figure 2. Average scores of role-play

From Figure 2 and the interview, American students are outgoing, enthusiastic, nice to group members, and passive on organizing the collaborative learning. Chinese students, however, tended towards being a little shy. Although communication in English is not a problem in terms of understanding, the Chinese lacked confidence and do not speak much. They would rather focus on their own assignment and express ideas when necessary. Therefore, Chinese students naturally tended toward the roles of arguer, questioner, and challenger.

Correlation analysis of thinking styles and roles

After first identifying the thinking styles and role-playing preferences in cross-cultural settings, we set out to explore how these factors may be correlated. The first step is to match the two data sources according to the name list with identifiers. Given that participants were assigned with an identifier, they could remain anonymous while doing the thinking style measurement. During the interview, the coding process was likewise organized to ensure anonymity. The second step is to delete incomplete or irrelevant data. After completing these first two steps, data from 54 participants were determined valid. The last step was to calculate the correlation of thinking styles and roles. The results are shown in Table 6.

From the evidence, American students gained higher scores in hierarchical thinking styles (shown in Figure 1 and Table 4) and preferred to play the role of starter (shown in Figure 2 and Table 5). These findings are supported by correlation analysis that indicated that hierarchical thinking style has significant positive correlation with the starter ($p < 0.01$; $r = 0.363$). Accordingly, individuals who have obvious preference for hierarchical thinking style could focus on different things with different priorities in terms of goals (Sternberg, 1990), and thus are suitable to play the starter.

Table 6. Correlation coefficients of thinking styles and roles

	Starter	Supporter	Arguer	Questioner	Challenger	Timer
Liberal	0.059	0.106	-0.156	-0.325*	-0.275*	0.247
	0.679	0.455	0.268	0.019	0.048	0.077
Hierarchical	0.363**	-0.149	-0.170	-0.379	-0.230	0.392**
	0.008	0.292	0.228	0.06	0.101	0.004
Monarchical	0.045	0.212	-0.074	-0.113	-0.392**	0.101
	0.750	0.132	0.604	0.425	0.004	0.476
Anarchic	0.012	0.062	-0.249	-0.355**	-0.246	0.077
	0.935	0.660	0.075	0.010	0.078	0.589

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

American students obtained higher scores in anarchic thinking style and were not inclined to play questioner roles. The anarchic thinking style has a significant negative correlation with the questioner ($p < .01$; $r = -0.355$). Individuals who possess strong anarchic thinking style dislike rules, procedures, and guidelines (Sternberg, 1990). However, they enjoy working on tasks that allow flexibility as to what, where, when, and how one works rather than promoting a step-by-step process as planned (Zhang & Sternberg, 2000). The questioner is in charge of raising questions to facilitate discussion as planned. Therefore, the higher the anarchic thinking style, the more unlikely a student will play the role of questioner.

Individuals who have liberal thinking style usually enjoy engaging in tasks that involve novelty and ambiguity (Zhang & Sternberg, 2000). During CSCL, they must propose new ideas, new methods, or solutions. Both negative correlations were found between the liberal thinking style and the role of questioner ($p < .05$; $r = -0.325$), and the liberal thinking style with the role of challenger ($p < .05$; $r = -0.275$). In this study, American students are clearly characterized as having liberal thinking style. Consequently, American students did not adopt the roles of questioners or challengers.

In cross-cultural CSCL, emerging roles vary widely with thinking styles. From this study, we have seen that Chinese students preferred roles, such as executive, global, conservative, and oligarchic, while also playing supporter, arguer, questioner, and challenger. American students meanwhile, tended to legislative, judicial, liberal, hierarchical, and anarchic, and were more likely to play starter and timer. The correlation analysis explored the relationship between emerging roles and thinking styles, that is

- a hierarchical thinking style has significant positive correlation with the starter and with the timer;
- an anarchic thinking style has significant negative correlation with the questioner; and,
- a liberal thinking style has negative correlation with the questioner and with the challenger.

Discussion

Understanding cross-cultural factors in joint activity is necessary in the age of globalization, in which demands are high for complex social engagement in various learning and performance settings. Knowledge of and sensitivity to cultural differences among different parties, especially in terms of learning dispositions, could help instructors facilitate collaborating participants with deliberately designed strategies and resources. These practices could promote better learning outcomes.

In this exploratory study, students from two cultural backgrounds were investigated based on their culturally related characteristics, the emerging roles they assumed in the collaborative learning process, and the relationships between the cultural factors and roles they played. Although not conclusive, these results reveal that cultural differences exist. In particular, the roles that students assume autonomously are culturally distinct and culturally related thinking styles that are significantly related with the adoption of certain collaborative roles.

Confirming the findings of Zhong (2010), the results reveal that cultural differences could be understood in terms of differences in thinking styles, and that these differences could affect the collaborative process. The nature of the interaction of thinking styles and role adoption has revealed differences of cultural features exhibited with different thinking styles. For example, Chinese students are more likely to work on multiple activities in the service of multiple objectives but are less likely to enjoy setting priorities. Meanwhile, American students are far more judicial, liberal, hierarchical, and anarchic. These qualities suggest that American students are far more willing to engage in innovative tasks, evaluate work of others, and are likely supportive.

Consistent with this finding, Chinese students tend toward adopting roles of arguer, questioner and challenger, which are consistent with the thinking style of the oligarchic. By contrast, American students actively assume roles of supporter, starter, and timer, and are characterized as outgoing, enthusiastic, and friendly to group members, which are consistent with judicial, liberal, and hierarchical thinking skills.

The correlation analysis between the roles that students assumed and their preferred thinking styles further confirm that these cultural characteristics and associated roles in collaboration represent significant relationships. In particular, this notion is shown in hierarchical thinking style and roles of starter and timer, the anarchic thinking style and role of questioner, and the liberal thinking style and roles of questioner and challenger.

In similar cross-cultural CSCL contexts, learning efficiency might be improved by assigning scripted roles with the teacher assigning roles that align with cultural dispositions. However, when efficacy is not a primary concern, utilizing cultural differences of students in a CSCL project could be considered from the perspective of alternate learning purposes. For instance, when experience of multi-cultural factors is included explicitly within the learning purposes, teachers may assign roles for students that might contradict their dispositions.

This study was necessarily narrow and exploratory in its scope. Cultural features were approximated with thinking styles. Hence, this study makes no claim that the findings could be generalized. Nonetheless, this limitation has produced useful findings that indicate activities for future research. Because cultural features are complicated with multiple dimensions (Hofstede, 1980; 2011), more in-depth studies are required that might tease out which cultural dimensions might affect collaborative engagement other than thinking styles.

Conclusion

Cultural difference is expressed in many ways. Under the context of CSCL, this study reveals that thinking styles (Hofstede, 1980; 2011) plausibly approximate these differences. However, because of the limitations of the cohort size, further research is required to validate the findings from this study.

The findings suggest that in cross-cultural CSCL (or dPBL) contexts where certain individuals set the rules, make proposals, and deal with unexpected problems, assigning scripted roles according to cultural backgrounds may have value in promoting efficacy of the collaboration and in informing the design of cross-cultural studies.

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