Culture-aware collaborative learning

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Abstract

Purpose – In a collaborative learning environment there will be many learners with diverse cultures. These learners should be supported to communicate and collaborate among themselves. The variety of the communication and collaboration tools and modes available to each learner would depend on his/her personal cultural background. The purpose of this paper is to suggest the adaptation of the collaborative learning environment to the learner's cultural profile. So, first it aims to present learner's models with respect to his/her cultural characteristics. It also aims to present the various communication and collaboration tools and modes that would be available to the learners. Then, each learner has at his/her disposal the appropriate communication and collaboration tools and modes according to his/her cultural characteristics.

Design/methodology/approach – The cultural models of Trompenaars and Hampden-Turner, as well Hofsted are modified relaxing the dualism of their dimensions. The modified models are used in a collaborative learning environment. The various attributes and types of communication and collaboration among learners and teachers in a collaborative learning environment are also identified.

Findings – This paper presents learner's cultural models across several cultural dimensions. Each cultural dimension weights differently. Also, a learner may not belong strictly to a cultural extreme of a dimension, but he/she may have characteristics from both cultural extremes of each dimension. Based on a learner's cultural profile, different communication and collaboration tools would be available to the learner.

Research limitations/implications – Based on the learner's profile, either the adaptation engine, or the teacher, or the learner him/herself may select the appropriate communication and collaboration tools and modes for the particular learner. Designers, developers and evaluators of collaborative learning systems may benefit from these learners' cultural models and the communication and collaboration attributes. For example, they may create collaborative learning systems with flexible communication and collaboration attributes that provide to each learner personalized communication and collaboration tools according to his cultural profile.

Practical implications – This paper proposes the adaptation of the collaborative learning environment to the cultural characteristics of the learner. Future research may assign the specific communication and collaboration tools to each particular learner's cultural profile.

Originality/value – This paper proposes the adaptation of the communication and collaboration tools and modes that are used by a learner in a collaborative learning environment to the learner's cultural characteristics. First, the paper presents new cultural models of a learner. Then, it presents the communication and collaboration attributes and types that would be used by the learners in a collaborative learning environment. A learner would have at disposal the appropriate personalized communication and collaboration tools.

Keywords Communication, Culture, E-learning

Paper type Conceptual paper

Introduction

Collaborative learning is an educational method where a group of learners collaborate to learn and improve themselves. They work together toward a common goal, exchange and share ideas, information, knowledge, resources, tools, products, work, and results. They join their efforts and abilities to perform and accomplish the task.

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For example, they may team up to do the following: investigate and explore an issue or an idea; analyze and solve a problem; design a product; integrate and combine several parts into a whole; sort and order a list of items; develop, construct and built a device; create and produce an essay; organize and manage an experiment; evaluate and criticize a theory, a case or a product.

Collaborative learning draws away from the teacher-centred education, where the teacher is the authority and broadcasts the knowledge to the learners. It emphasizes the interaction among all participants in the learning experience. Teachers and learners actively participate in the learning. The teachers design the learning activities and guide the group. They may support the learners as a group and/or individually. For example, they may help "weak" learners.

Previous research on collaborative learning established its benefits (Vasiliou and Economides, 2007). It develops and enhances critical-thinking skills (Totten *et al.*, 1991; Gokhale, 1995), enables students achieve higher level of thoughts and retain information longer than students who work quietly as individuals (Johnson and Johnson, 1986). It also improves student learning and satisfaction (Alavi, 1994; Hiltz and Wellman, 1997). Furthermore, it is necessary for cultural development (Bruner, 1996; Tomasello, 1999). It may facilitate the active participation of students who have a lot of difficulties in traditional school learning (Hakkarainen *et al.*, 1999).

Currently, there is a huge interest in developing computer-supported collaborative learning systems (Economides, 2005; Vasiliou and Economides, 2007). In such systems, learners will openly communicate and collaborate with other learners, teachers, tutors, etc. However, contemporary systems do not completely support the diverse learner types as well as their different collaboration modes. Research is needed to identify the appropriate requirements for the efficient design of such systems. Learners have diverse background, experiences, values, perspectives, learning styles, etc. Therefore, they need different communication and collaboration tools and methods to effectively accomplish their tasks. The presentation of the information as well as the interactions should be possible in various forms and media (e.g. text, audio, and visual). For example, signs and symbols (e.g. facial expressions), photos, video, etc. would be available to extrovert learners.

However, the cultural differences of the individual learners affect their collaboration and thus their learning. The culture of a country or an organization can be viewed as a set of shared values, rules, beliefs, attitudes, behaviors. It is the common way of looking at things. Culture is composed of "beliefs, norms, assumptions, knowledge, values, or sets of practice that are shared and form a system" (Rapport and Overing, 2000). So, the different learners' cultural backgrounds affect their participation, their motivation, their satisfaction and their performance during collaborative learning activities. Learners with diverse cultural background may have divergent modes of communicating, interacting, and working. They may have different views of the world, different values, behaviors, and attitudes. They may also develop different feelings and thoughts during the collaborative learning activities. Therefore, the system should take into consideration cultural aspects of the learners in order to support every individual learner as well their efficient interaction and goal accomplishment.

In order to design an effective computer supported collaborative learning system, it is important to consider quality criteria. Economides (2005) proposed the following dimensions of quality criteria: educational, economical, and technical. Since there are cultural differences among learners, it is important to design and develop systems that

take into consideration these differences. Raybourn (2001) described a system that encourages people to interact in real time where there are mutual concerns or interests. He incorporated cultural cues into a text-based collaborative virtual environment in order to encourage collaboration and awareness of intercultural communication, including the negotiation of power and exploration of identity. For effective multi-cultural collaborative learning, it is important that participants become aware of other cultures (Agerup and Büsser, 2004; LeBaron *et al.*, 2000) as well similarities and differences among cultures. Furthermore, a culture-aware computer-based system would support learners facilitating communication and collaborative learning. Michailidou and Economides (2007) mentioned that communication distortion may appear because of dissimilar communication modes among people from dissimilar cultural background. A collaborative learning system would try to foster participants' participation, interaction, and engagement with collaborative tasks. It would also try to motivate participants in sharing information, cultural issues, ideas, digital products, etc.

In the next three sections, the connection between culture and education is investigated. The following section presents the cultural models. The penultimate section presents the communication and collaboration attributes. Finally, the last section concludes.

Need for culture-aware learning systems

Since the early design phase of a learning system, the cultural diversity of the participants should be taken into consideration. Instructors and designers of learning systems should be aware of the variety of participants' cultural backgrounds. It is important to ensure that students from diverse cultures would have equal opportunities to learning. However, current instructional design lacks culturally inclusive learning (McLoughlin, 2001a). Currently, Web-based instruction is not culturally neutral, but instead is based on the particular epistemologies, learning theories and goal orientations of the designers themselves (McLoughlin and Oliver, 2000). Furthermore, there may be a gap between the learners' profile and the educational material (Hardaker *et al.*, 2007).

Information and communication technology (ICT) would help in bringing people together to communicate, share, collaborate and learn. Also, ICT would bring cultures closer to each other. Furthermore, it was observed that cross-cultural communication via a computer may be a positive tool within an interactive learning environment (Atsumi *et al.*, 1989). The use of the computer changed the participants' views of contributions from others so that they were more likely to be considered. It seems that computer mediated communication would reduce any cultural biases. Similarly, Warschauer (1996) found that the difference in participation across cultures was lower in online discussions. In face-to-face discussions, Filipino students tended to dominate discussions while the other students, especially the Japanese, spoke much less. However, Japanese students showed more active participation in online discussions than in face-to-face discussions. However, cultural attitudes toward technology may influence the use of ICT.

Multi-cultural perspectives would be incorporated in computer-based learning systems. In this way, an individual learner would select learning materials or tools best suited to his culture. In addition, such systems would help the collaboration among culturally diverse learners. Multicultural participants would provide unique insights (Hardaker and Sabki, 2007) and versatile views on educational subjects. Cultural pluralism can create positive learning outcomes such as improved working relationships,

better interaction skills, and growth in cognitive reasoning (Johnson and Johnson, 1989). Participants in heterogeneous groups of different cultural backgrounds can offer a wider variety of skills, information, knowledge, and experiences that could potentially improve the quality of collaborative learning (Rich, 1997). In e-learning communities, participants would learn from each other, and collaboration would lead to synthesis of knowledge from different perspectives (McLoughlin, 2001b).

On the other hand, cultural diversity in learning can lead to negative relationships characterized by hostility, rejection, stereotyping, and prejudice. Individualistic learners support individual identity and think that they should be self-sufficient (Hofstede, 1980). The task for them is more important than the relationship (Trumbull *et al.*, 2000). Also, individualistic learners will rely on the words that were said to interpret the meaning (Hall, 1976). Individuals that prefer to work autonomously perform poorly and are dissatisfied in collaborative work settings (Vroom, 1959; Birch and Veroff, 1966). Possible pressure on a more introvert student or on one who have difficulties in interacting in groups may cause him to withdraw from the CL activities or even to decrease his level of self-esteem and capacity for further learning Laister and Koubek, 2001; Laister and Kober, 2002). There are also dangers of opportunism and groupthink stemming from the proved human tendency to conform with authoritative leaders or to group pressure (Janis, 1982).

Many researchers stressed the need that culture should be taken into consideration in computer-based learning systems. Henderson (1996) suggested that education should allow variability and flexibility. Participants would learn through interaction with the instructor and with each other. Learning materials would reflect multiple cultural values and perspectives, including multiple ways of learning and teaching. LeBaron *et al.* (2000) as well Jager and Collis (2000) suggested that Web-based courses should accommodate learners with different cultural backgrounds.

McLoughlin (1999) and McLoughlin and Oliver (2000) described an online tool for Indigenous Australian learners and pointed out that instructional design should not exclude minority cultures. They argued for cultural localization, which means incorporating the local values, styles of learning and cognitive preferences of the target population. Learners should be able to access multiple channels of communication with tutors and with other learners. McLoughlin (2000) stated that learners should be free to select personally and culturally relevant paths toward the achievement of learning objectives. Also, learning would be enhanced by letting students share culturally rich learning materials with their instructor and peers. McLoughlin (2001a,b) demanded for culturally inclusive pedagogy and cultural portability of course, ware to ensure access by culturally diverse learners.

Michailidou and Economides (2002) alerted that the design and development of collaborative educational virtual environments on the basis on different cultures and languages may be crucial for on line teaching. Michailidou and Economides (2003) developed and evaluated Elearn, a collaborative virtual learning environment for teaching electronic commerce. They suggested that such a system should be designed taking into consideration four dimensions:

(1) Pedagogical and psychological.

(2) Technical and functional.

(3) Organizational and economical.

(4) Social and cultural.

Specifically, cultural criteria included the following:

- team communication is supported taking under consideration possible differences in religion or in cultural development; and
- the individuality of each student with regards to his cultural and social development is taken under consideration.

Georgiadou and Economides (2003) proposed an evaluation instrument for hypermedia courseware which considers not only technical issues but also social acceptability issues. They pointed out the need for balanced representation of cultural, ethnic, and racial groups in course design. Triantafillou *et al.* (2006) mentioned that language, and culture should be taken into account when designing adaptive educational interfaces to optimise learner's potential to benefit from the system's design in terms of knowledge acquisition. Michailidou and Economides (2007) argued that computer supported collaborative learning environments and instructors should take into consideration cultural factors that influence learners' learning. Pittman (2007) called for converging instructional technology and intercultural pedagogy in teacher education. Young (2008) stressed the need for design specifications to enable the integration of culture in the design of ICT.

Cultural differences in learning

Many previous studies acknowledged the existence of cultural differences among people. For example, Chu and Reeves (2000) found differences between American and Chinese students regarding their personal Web pages. Specifically, in education, cultural differences would affect learners' learning motivation (Chye *et al.*, 1997; Lim, 2004; Niles, 1995; Ramburuth and McCormick, 2001; Salili, 1996; Zhu *et al.*, 2008), attitude towards learning and e-learning (Anakwe *et al.*, 1999; Freedman and Liu, 1996; Hannon and D'Netto, 2007), learning styles (Kim and Bonk, 2002; Ramburuth and McCormick, 2001; Teng, 2007), computer usage in education (Freedman and Liu, 1996; Hannon and D'Netto, 2007; Volman *et al.*, 2005), learning behavior and strategies (Agerup and Büsser, 2004; Chye *et al.*, 1997; Freedman and Liu, 1996; Hwang *et al.*, 2003; Sanchez and Gunawardena, 1998; Valiente, 2008), and learning achievements (Chye *et al.*, 1997; Pearse and Lin, 2007) among others. However, one should be cautious in interpreting these results. In most projects, the English language was used for communication among participants. At the same time, English was not the mother tongue of all participants. These studies are analyzed in the next subsections.

Cultural background may affect motivation

Niles (1995) found that the need for "competition" and getting to the top seems to be an important dimension of motivation for Australian students. On the other hand, social approval motivation would be the force in pushing towards higher levels of achievement for Asian students. Salili (1996) revealed that Chinese high school students had significant higher "need for achievement" scores than their British counterparts. Chye *et al.* (1997) found differences in the self-regulated learning behavior of culturally dissimilar students. In addition, students who reported a higher perception of self-efficacy also reported a greater use of learning strategies and higher academic achievement.

Ramburuth and McCormick (2001) found that Asian international students demonstrated significantly higher use of deep motivation, surface strategies,

and achieving strategies, whilst Australian students demonstrated higher use of deep strategies and surface motivation. Lim (2004) found that online learners in Korea and the US perceived online learning motivation differently. American students indicated significantly higher motivation scores for the four motivation types (course relevancy, course interest, reinforcement, and self-efficacy) than Korean students. Korean students scored significantly higher only for learner control. American students felt more accomplishment when completing online lessons, preferred voicing personal opinions during class, enjoyed learning and enrolled in classes to obtain a sense of belonging. Finally, Zhu *et al.* (2008) found that Chinese students reflected to a greater extent conceptions of learning that stress understanding, personal change, and development of social competence as compared to Flemish students.

Cultural background may affect attitude towards learning and e-learning

Anakwe *et al.* (1999) examined the impact of cultural differences on potential users' receptivity towards distance learning. Findings revealed that an individual's culture affects his overall attitude towards distance learning. Specifically, individualists' motives and communication patterns fit to distance learning as a medium of instruction or communication; while collectivists' motives and communication patterns turn away from distance learning. Hannon and D'Netto (2007) found that learners from different cultures respond differently to the organizational imperatives and arrangements which are built into online learning technologies.

Cultural background may affect learning styles

Ramburuth and McCormick (2001) found that Australian and Asian international students differed significantly in their "Learning Style Preferences" in group, auditory, tactile and kinesthetic modes of learning. Kim and Bonk (2002) revealed that Finnish students were more reflective and, at times, theoretically driven, while US students were more action-oriented and pragmatic in seeking results or giving solutions.

Agerup and Büsser (2004) observed that US students focused on specific deadlines and project requirements, while Japanese students were more closely related to PhD researchers, content research, and writing papers in a hierarchical relation to a professor. The Japanese students characterized the US team as fast, stressful, and unstructured. The US students said that the Japanese were conservative and unemotional. Teng (2007) found that US students were more expressive than Taiwanese students. They significantly spent more time at work and showed greater urgency in completing the group work. They were also more conscious about their responsibilities.

Cultural background may affect computer usage in education

Freedman and Liu (1996) found that Asian American students preferred using e-mail over other computer uses. Volman *et al.* (2005) observed that pupils from an ethnic-minority background appear to consider themselves to be less skilled ICT users than pupils from the majority population in the Netherlands. They used computers out of school less than pupils from the majority population for all kinds of writing activities (papers, preparing talks, letters, reports, and e-mails). They also used the computer at school less for gathering information and preparing talks and papers and more for drill and practice. Hannon and D'Netto (2007) found that learners from

different cultures differed both in their ability to work with and in their satisfaction from online learning technologies.

Cultural background may affect learning behavior and strategies

Freedman and Liu (1996) studied American middle school students who corresponded electronically with culturally dissimilar students. They found that students of different ethnic backgrounds may have different learning processes when working with computers. Asian American students tended to ask fewer questions and were less likely to use trial-and-error or experimental methods than the non-Asian American students. Chye *et al.* (1997) found significant differences between Australian and Singaporean students on three learning strategies: organization, management of time and study environment, and effort regulation. Sanchez and Gunawardena (1998) found that Hispanic adult learners showed a strong preference for feedback, concrete over abstract learning, active experimentation, and judgment over perception.

Hwang *et al.* (2003) found that the impact of feedback forms on learning processes is highly dependent on cultural context. In-class questions in Hong Kong led to desired grade-performance knowledge, whereas this was not so in the United States. Asking questions outside of class in the United States was positively related to grades. Valiente (2008) mentioned that some non-Western cultures are traditionally reliant on visual contextual means, involving graphic, sensorial and rhetoric characters and associations. Particularly in the Confucian tradition, rehearsing and repeating is a necessary basic step in the process of thinking.

Cultural background may affect academic achievements

Chye *et al.* (1997) found that students who reported a higher perception of self-efficacy also reported a greater use of learning strategies and higher academic achievement. Hannon and D'Netto (2007) found that local students whose first language was English had significantly more positive perceptions and higher mean scores when compared with international students whose first language was not English. Pearse and Lin (2007) argued that both social and cultural factors (parental educational attainment, parental educational expectation, parental involvement, and parenting style) play important roles in academic achievement and attainment. They found a clear evidence of academic achievement of Chinese Americans at least on par with, and in some cases surpassing, achievement among White Americans.

Cultural differences in communication and collaborative learning

In the educational activities, everyone brings his culture, values, beliefs, misconceptions, attitudes, behaviors, etc. For example, a learner may be individualistic or collectivist, active or passive, cooperative or competitive, open or reserved, flexible or uncompromising. Specifically, collectivistic learners are more group oriented, and support the group identity over the individual identity (Chang and Lim, 2002). They consider relationships to be more essential than the task to be completed (Trumbull *et al.*, 2000). Furthermore, they rely not just on words but also on the nonverbal language, like gestures, timing, and facial expressions (Francesco and Gold, 1998).

The learner's cultural background may influence his communication and collaboration skills and patterns. For example, collectivist cultures may actually use collaborative software more effectively than individualistic cultures (Chung and Adams, 1997).

Cultural values of individual learners in a heterogeneous group would impact upon the learning process and outcome of the entire group of learners (Chang and Lim, 2002). Heterogeneous groups, whose members are of different cultural backgrounds, provide a variety of skills, information and experiences that could improve the quality of collaborative learning (Rich, 1997). However, learning in groups may have completely different meanings and expectations in various cultures (Valiente, 2008). In individualistic societies, group work is a place of confrontation and search for solutions. In collectivist societies, an individual may fail to differentiate between what is expected to be his work and what should be the result of group activities. The process of grouping and re-grouping students would be more difficult in collectivist than in individualistic cultures.

Cultural differences would affect the interaction and communication (Chase *et al.*, 2008; Chen *et al.*, 2006; Freedman and Liu, 1996; Sarker, 2005; Teng, 2007), participation (Chen *et al.*, 2006; Iivonen *et al.*, 1998; Kim and Bonk, 2002; Sanchez and Gunawardena, 1998), knowledge transfer, sharing and collaborative learning (Agerup and Büsser, 2004; Chang and Lim, 2002; Hannon and D'Netto, 2007; Kim and Bonk, 2002; Park, 2002; Phuong-Mai *et al.*, 2005; Ramburuth amd McCormick, 2001; Sanchez and Gunawardena, 1998; Sarker, 2005; Teng, 2007). As, it was alerted in the previous section, English was used in most projects which was not the mother tongue of all participants. These studies are analyzed in the next subsections.

Cultural background may affect communication

Freedman and Liu (1996) reported that students of different ethnic backgrounds may have different cross-cultural communication patterns. The Asian American students tended to ask fewer questions than the non-Asian American students. Chase *et al.* (2008) stated that cultural gaps can exist between individuals in the cyberspace, as well as between individuals and the dominant cyber-culture, increasing the chances of miscommunication. Communication styles, viewing/listening practices and attitudes towards person to person communication using new communications technologies vary greatly between cultures. Sarker (2005) found that the US students were complaining about the limited and somewhat ineffective communication received from the Thai team members. Thai students seemed to avoid extensive communication about new and difficult concepts with their remote participants. Chen *et al.* (2006) revealed culture-based differences in interaction patterns during online discussions. Taiwanese students posted long introductory messages, and included emoticons on their messages. On the other hand, American students posted brief introductions, and sent many summarizing and confirming messages. In a cross-border project between Taiwan and the US, Teng (2007) found that the US students enjoyed interacting with their group members more, and were more comfortable with online communication. It was easier for the U.S. students to initiate a conversation with others and express themselves openly. They were more expressive which was reflected in their higher level of enjoyment in posting, reading, and responding to online messages. Taiwanese students were more reserved when communicating with others. Also, they were more hesitant in seeking help, especially from the instructors.

Cultural background may affect participation

Sanchez and Gunawardena (1998) observed that Hispanic adult learners showed a strong preference for participation over avoidance. In an online course, Iivonen *et al.* (1998) revealed that American students posted more messages to the electronic

discussion group than the Finns. In a project between intercultural teams in Hong Kong and Netherlands, Vogel *et al.* (2000) found that Dutch students actively participated during the project with a small decline during the middle time. On the other hand, Hong Kong students heavily participated when deadlines were approaching. In two interconnected conferences formed in Finland and the US, Kim and Bonk (2002) found that the three participating cultural groups (Finns, Americans, and Koreans) exhibited different levels of participation. There were more cross-cultural postings in the Finnish conference by US students than visitors within the US conference. The Finnish students inserted more culturally sensitive comments or explanations of unique terminology or situations in order for readers from another country or culture to understand the term or idea better.

Chen *et al.* (2006) found that Taiwanese students were passive toward interacting with group members. On the other hand, American students appeared actively engaged and energetic, and sent many summarizing and confirming messages.

Cultural background may affect knowledge transfer, sharing and collaborative learning

Sanchez and Gunawardena (1998) found that Hispanic adult learners showed a strong preference for collaborative over competitive activities. Computer conferencing would be appropriate since it supports group activities (discussion on a topic, problem solving, role playing, etc.). Vogel *et al.* (2000) found that working together in collaborative teams with students from another study background and country offer much educational value and is highly appreciated. However, Hong Kong students experienced a global team feeling and trust towards their classmates while Dutch students did not. Gunawardena *et al.* (2001) observed that there were differences in perception of online group process and development between participants in Mexico and the US. There were significant differences in perception for the Norming and Performing stages of group development. The groups also differed in their perception of collectivism, low power distance, femininity, and high context communication. Ramburuth and McCormick (2001) found that Australian and Asian international students differed significantly in group learning, supporting the notion of Asian students being more "collaborative".

Chang and Lim (2002) found that culturally heterogeneous (mixed individualistic and collectivist) groups had reasoning level higher than homogeneous collectivistic groups but lower than individualistic groups. Good group cooperation (a feature of collectivistic-collectivistic communication) benefits the social and response processes of asynchronous learning. Individual activity and achievement (features of individualistic-individualistic communication) benefit the reasoning process. Park (2002) investigated the learning styles of English learners (Armenian, Hmong, Korean, Mexican, and Vietnamese) in California secondary schools. He found significant ethnic group differences. Hmong, Mexican, and Vietnamese students preferred group learning while Armenian and Korean students did not. Kim and Bonk (2002) found that Korean students were more social and contextually driven online while Finnish students were more group-focused. The US and Finnish students spent much time sharing knowledge and resources. Korean students showed a higher level of social interaction behaviors than Finnish or American students, whose social interaction behaviors were almost absent. Phuong-Mai *et al.* (2005) pointed out that the collectivist mentality of Confucian heritage culture strongly supports cooperation, guarantees group success and enables

learners' best performance in groups. However, not all forms of cooperative learning will surely succeed within a Confucian heritage culture environment.

In a study to examine the knowledge transfer and collaboration in distributed teams, Sarker (2005) observed that members of individualistic cultures (US students) transferred/shared more knowledge than those in collectivist cultures (Thai students). The communication style preferred by cultures (high-context vs low-context) may have significant impact on who is viewed as a knowledge transferor within a collaborative group. Thai students seemed to avoid extensive communication about new and difficult concepts with their remote participants. The US students were complaining about the limited and somewhat ineffective communication received from the Thai team members.

Teng (2007) found that the US students had developed a better sense of community and closer relationships with their classmates. It was easier for them to make group decisions. They demonstrated more enjoyment in working in groups and showed greater satisfaction with their group performances. They agreed more that they had participated in the group projects to the best of their abilities. Also, they felt that they were more supported by their group members, and had known their group members better through this project. On the other hand, Taiwanese students preferred building relationships than working in teams. It was observed a divide in the sense of importance of task completion between the two countries.

Multicultural collaborative learning does not always lead to successful outcomes. In a case study on collaborative learning in distributed US and Japanese teams. Agerup and Büsser (2004) mentioned that based on cultural differences the graduate students' initiative to collaborate gradually failed. Instead of a mutual engagement that led to knowledge creation, only the lower level of a web-based coordination was reached. Also, Hannon and D'Netto (2007) found a lack of peer engagement in online communication among multicultural students.

Collaboration may affect learner's culture

Several researchers mentioned that collaboration may affect each participant's cultural characteristics (Chang and Lim, 2002; Cifuentes and Murphy, 2000; Ferdig *et al.*, 2007; Holloway and Valentine, 2000; Lim and Zhong, 2005; Michailidou and Economides, 2007). Computer-based collaborative work can transform classroom cultures, the roles of teachers and the expectations of learners (DeVoogd, 1998). Online communication can help breakdown stereotypes, bias, and misunderstandings that children hold towards people in other countries (Holloway and Valentine, 2000). By using asynchronous learning networks, learners from an individualistic cultural context might emphasize more on group achievement or relationship than before, and learners from a collectivistic context might become more independent and insistent on their own opinion during the reasoning process (Chang and Lim, 2002). Together, participants would co-create a "new culture" that is neither one nor the other, but a combination of the two, or three, and so on (Lim and Zhong, 2005). So, cultural co-creation may occur in computer supported collaborative learning that support diversified cultures (Michailidou and Economides, 2007).

In a collaborative learning project between two schools, Cifuentes and Murphy (2000) found that the participants' multicultural understanding increased. The teachers developed empowering multicultural relationships and the students developed

multicultural understanding and positive self-concept. The students matured, acquired cultural sensitivity, and grew by expressing their own voices and listening to the diverse voices of others. They learned to acknowledge similarities with one another and accepted each other's differences. In a collaborative project between European and US Universities (Ferdig *et al.*, 2007), students become both sensitive to a wide variety of academic environments and cultures, and open-minded to the variety of approaches and cultures.

So, the learners' social growth and maturity would be affected by their close association with other learners and teachers. Collaborative learning would enhance the participants' social and communication skills, and develop relationships among themselves. The participants get used in sharing their skills, ideas, work, values, feelings, and goals. They depend on others and feel to belong in a community. In order to proceed with a task, they should negotiate and partially accept others' ideas, opinions, behaviors, etc. Furthermore, they get used in power management relationships and develop leadership, managerial, negotiation, and conflict resolution skills.

An effective computer-based collaborative learning system should support personalized communication and collaboration tools for every learner according to his cultural type. The next section provides learner's cultural models.

Learner's cultural profile

In this section, two learner's cultural profiles are presented. These profiles are based on Trompenaars and Hampden-Turner (1997) and Hofstede (1980) models. The learner himself may declare his cultural type, or choose one from a list of profiles, or answer a questionnaire that will help to discover his type.

Trompenaars and Hampden-Turner (1997) identified seven culture value dimensions: Universalism versus Particularism, Communitarianism versus Individualism, Neutral versus Emotional, Defuse versus Specific cultures, Achievement versus Ascription, Human-Time relationship and Human-Nature relationship.

Let the importance of Universalistic-Particularistic (U-P) dimension be up percent, of the Individualistic-Communitarian (I-C) dimension be ic percent, of the Specific-Diffusive (S-D) dimension be sd percent, of the Affective-Neutral (A-N) dimension be an percent, of the Achievement-Ascription (A-A) dimension be aa percent, of the Sequential-Synchronic (S-S) time dimension be ss percent, of the Past-Present-Future (P-P-F) dimension be ppf percent, and the Internalistic-Externalistic (I-E) dimension be ie percent. Then, we summarize all the above into the following vector:

Learner's Cultural Profile: = [U-P up percent, I-C ic percent, S-D sd percent, A-N an percent, A-A aa percent, S-S ss percent, P-P-F ppf percent, and I-E ie percent].

For every dimension, we consider that a learner may have characteristics from both cultural extremes (e.g. Individualistic-Communitarian) and does not strictly and absolutely belong to only one cultural extreme.

Let a particular learner be Universalistic at un percent and Particularistic at si percent. So, at un percent, he believes that general, universal, and shared rules, codes, laws, values, and standards take precedence over particular needs and claims of friends and relations; the rules apply equally to all members; the universal truth and the law are more important than the relationships. On the other hand, at si percent,

he believes in the uniqueness of every person or situation; he finds meaning in intimate relationships and human friendship; he accepts exceptions and special circumstances; he tries to judge every particular case uniquely. Then, we can write: U-P: = [Universalistic un percent, Particularistic pa percent].

Let a particular learner be Individualistic at id percent and Communitarian at co percent. So, at id percent, he places the individual before the community; he considers that the individual's happiness, fulfillment, welfare, freedom, and development are the most important; every individual plans, decides, develops, manages, controls, and evaluates matters largely on his own; the community should serve the interest and rights of individual members. On the other hand, at co percent, he places the family, the neighborhood or the community before the individual; he considers that the member is responsible to take care of his fellows, to serve the community even at his own cost. Then, we can write: I-C: = [Individualistic id percent, Communitarian co percent].

Let a particular learner be Specific at sp percent and Diffusive at di percent. So, at sp percent, he starts with the specifics, the parts, the components, the elements; he decomposes and analyzes matters separately to find the detail; he considers that the whole is the sum of its parts; his life is divided into many components that "you can only enter one at a time"; interactions between people are highly purposeful and well-defined; his public sphere is much larger than his private sphere; others are easily accepted into his public sphere, but it is very difficult to get into his private sphere; each specific area in which two people encounter each other is considered separate from other specific areas.

On the other hand, at di percent, he starts with the whole and sees each element in perspective of the total; he considers that the whole is more than just the sum of its elements; he integrates and synthesizes things to build the big picture; all elements are related to each other; these relationships are more important than each separate element; he has a large private sphere and a small public one; newcomers are not easily accepted into either, but once they have been accepted, they are admitted into all layers of his life; a friend is a friend in all specific areas; the various roles someone might play in his life are not separated. Then, we can write: S-D: = [Specific sp percent, Diffusive di percent].

Let a particular learner be Affective at af percent and Neutral at ne percent. So, at af percent, he easily displays his emotions and feelings; he manifests loudly his feelings; he may unnoticed and miss the less explicit affective signals of a neutral culture. On the other hand, at ne percent, he does not show his feelings overtly; he controls and limits the expression of his feelings; he hides feelings and keeps inside her. Then, we can write: A-N: = [Affective af percent, Neutral ne percent].

Let a particular learner be Achievement at ac percent and Ascription at as percent. So, at ac percent, he derives his status from what he has accomplished and achieved; he has to retain his achieved status, and prove him over and over again; he is continually gaining and loosing his status through his performance every day. On the other hand, at as percent, he posses his status from birth, age, gender or wealth; his ascribed status is accorded to him on the basis of his being; the order and the status assignment are decided a priori; they depend on who he is. Then, we can write: A-A: = [Achievement ac percent, Ascription as percent].

Let a particular learner be Sequential time at se percent and Synchronic time at sy percent. So, at se percent, he tends to do one thing at a time; he views time as a

narrow line of distinct, consecutive frames; he views time as divisible in separated time frames one after another; he strongly prefers planning and scheduling; he stays strictly to the scheduling and takes seriously time commitments. On the other hand, at sy percent, he does several things at a time; he views time as a wide ribbon, allowing many things to take place simultaneously; time is flexible and intangible; he manages events in parallel and easily changes plans; he especially values the satisfactory completion of interactions with others. Then, we can write: S-S: = [Sequential time se percent, Synchronic time sy percent].

Let a particular learner be Past-oriented at ps percent, Present-oriented at pr percent and Future-oriented at fu percent. So, at ps percent, he gives value to the past; he sees the future as a repetition of past experiences; he considers history and experiences of major importance; he respects the ancestors. On the other hand, at pr percent, he gives value to the current situation; he struggles and puts all of his efforts to the current situation; the present directs his life. Finally, at fu percent, he gives value to the future prospects; he considers planning of major importance; the future expectancies direct his life. Then, we can write: P-P-F: = [Past-oriented ps percent, Present-oriented pr percent, Future-oriented fu percent].

Let a particular learner be Internalistic at in percent and Externalistic at ex percent. So, at in percent, he has a mechanistic view of nature; he tries to control, dominate and exploit the natural resources; he lives his life he wants to live and takes advantage of the opportunities. On the other hand, at ex percent, he has a more holistic view of nature; he thinks that he is part of the nature; he tries to live in harmony with the environment and go along with its forces. Then, we can write: I-E: = [Internalistic in percent, Externalistic ex percent].

Substituting the above vectors into the Learner's Culture, we have the cultural profile of the learner (Figure 1).

Next, we give a simplified example for a particular learner. Let that for a particular learner the importance of the Universalistic-Particularistic (U-P) dimension is 60 percent and the importance of the Individualistic-Communitarian (I-C) dimension is 40 percent. Also, for the U-P dimension, let that he is Universalistic at 30 percent and Particularistic at 70 percent. Finally, for the I-C dimension, let that he is Individualistic at 45 percent and Communitarian at 55 percent. In short, this learner develops close relationships with people, helps them and excuses their mistakes.

A similar learner's cultural profile would be derived based on Hofstede's model (1980, 1991). Hofstede demonstrated that cultures vary along five dimensions: Power distance, Collectivism-Individualism, Femininity-Masculinity, Uncertainty Avoidance, and Long term-Short term orientation:

(1) *Power distance.* It is defined as "the extent to which the less powerful members of institutions and organizations within a country expect and accept that power is distributed unequally". It is often reflected in the respect that is expected to be shown by the learner towards his teacher, or the control of communication and collaboration.

(2) *Individualism versus collectivism.* They are related to the integration of individuals into the group. "Individualism pertains to societies in which the ties between individuals are loose: everyone is expected to look after him and his immediate family. Collectivism as its opposite pertains to societies in which people from birth onwards are integrated into strong, cohesive in-groups, which

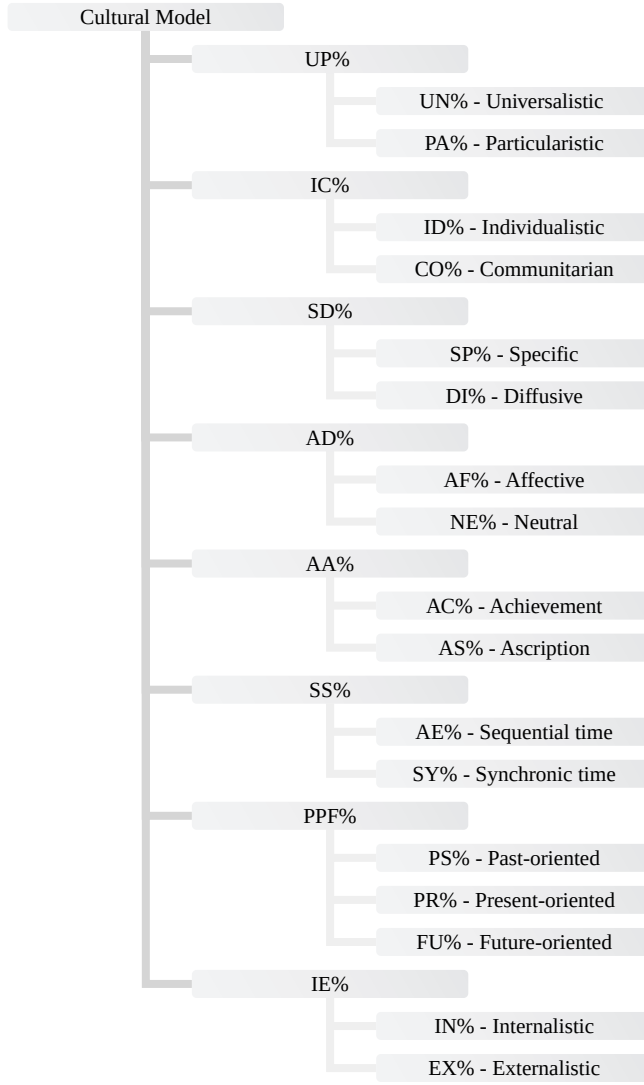

Figure 1.
Cultural profile based on Trompenaars and Hampden-Turner model

throughout people's lifetime continue to protect them in exchange for unquestioning loyalty."

(3) *Masculinity versus femininity.* They are related to the emotional roles between men and women. "Masculinity pertains to societies in which social gender roles are clearly distinct (i.e. men are supposed to be assertive, tough, and focused on material success whereas women are supposed to be more modest, tender, and concerned with the quality of life); femininity pertains to societies in which social gender roles overlap (i.e. both men and women are supposed be modest, tender, and concerned with the quality of life)."

(4) *Uncertainty avoidance.* It is related to the level of stress in a society in the face of an unknown future. "It is the extent to which the members of a culture feel threatened by uncertain or unknown situations."

(5) *Long- versus short-term orientation.* They are related to the choice of focus for people's efforts: the future or the present. Long-term orientation as characterised by persistence, ordering relationships by status and observing this order, thrift, and having a sense of shame, whereas short-term orientation is characterised by personal steadiness and stability, protecting your "face", respect for tradition and reciprocation of greetings, favors, and gifts.

After defining the corresponding variables and percentages, the derived learner's culture profile is shown in Figure 2.

Communication and collaboration (C&C) attributes

In this section, we investigate the various tools, relations, and types of communication and collaboration (C&C) that would be available to a group member. A group may consist of learners, teachers, tutors, trainers, coaches, examiners, parents, etc. For simplicity, we shall refer to a learner. A learner, or the adaptation engine, or the teacher may select the tools, relations and modes of C&C that are appropriate for the particular learner.

In Table I, we present the various C&C attributes. Based on the particular learner's cultural type, the appropriate C&C tools would become available to this learner.

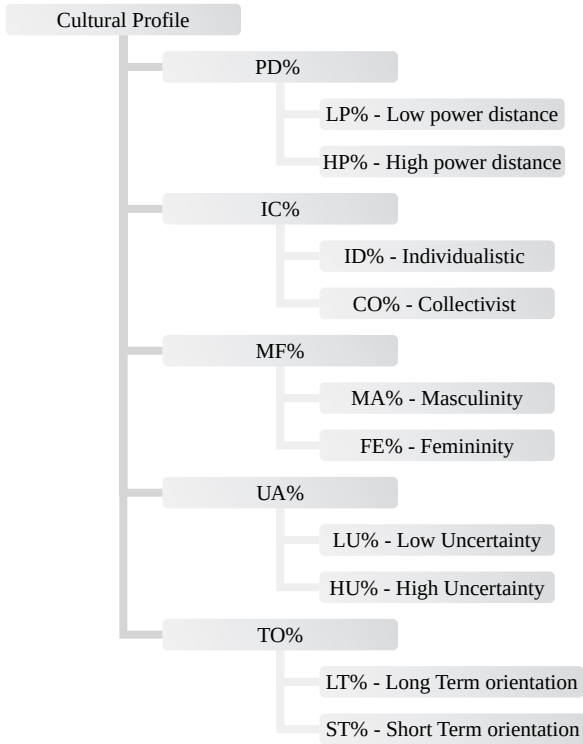

Figure 2.
Cultural profile based on Hofstede's model

Table I.
The Communication and Collaboration (C&C) attributes

Attributes	Types	Examples
Amount	Simple and short	Learners are permitted to only Exchange short sms
	Plentiful and abundant	A learner may send a video up to 3 min long The learners use all kinds of C&C during a project
Duration	Short	C&C is permitted for the first 10 min of an activity
	Long	
Frequency	Frequent	Learners may C&C whenever they like
	Rare	C&C is permitted every half hour or at the end of each activity
Limits	Fixed	A learner can speak only three times
	Unlimited	A learner may send messages as many times as he likes
Synchro-nization	Synchronous	Chat, videoconferencing, RSS, web cast, podcasts, multi-party games, simulations, etc. Email, file exchange, e-lists, forums, newsgroups, bulletin boards, message boards, blogs, wikis, FAQs, etc.
	Asynchronous	
Deadlines	Fixed and scheduled	Scheduled educational activities
	Flexible	Scheduled exams Deadlines to answer a test Calendar Learners talk in sequence In order to proceed to the next activity, the learners should negotiate a conflict Strict time periods to perform a theatrical act Learners discuss news whenever they have free time
Priority and urgency	High and primary	The coordinator may interrupt learners discussing an issue because an important matter appears
	Low and secondary	

(*continued*)

Table I.

Attributes	Types	Examples
Language	Spoken-written	The learners C&C using English
	Notional, gestures, stand, and eye movement	Every learner speaks his mother tongue, and the system translates it to the listener's mother tongue
	Emotional	A learner uses the notional language
		A learner understands his friend's mood by the way he moves and stands
		The teacher understands the learner's face expressions and eye movement
		The learner's emotions are detected
Media variety	Single	Only audio C&C is permitted
	Multiple	Text messaging, audio and videoconferencing is permitted
Media type	Data and text	Only text messaging is permitted
	Audio and verbal	Drawings and paintings may be exchanged
	Static views, pictures, and images	Immersion is used in an educational surgery
	Video, gestures, face and eye expressions, 3D animation	Verbal, visual and virtual touching C&C are available
	Immersion and virtual reality	
Number of senders and receivers	One-to-one	The teacher broadcasts instructions to all learners
	One-to-many	A learner multicasts his ideas to his close friends
	One-to-all	The learners send their homework to the teacher
	Many-to-one	The members of a group exchange their opinions
	Many-to-many	Each leader of the various learners groups sends to all learners his group results
	Many-to-all	
Direction	Unidirectional	A learner makes a presentation or performance (e.g. piano playing)
	Bidirectional and conversational, interactive	Two learners have a debate
		The teacher asks questions and the learners answer

(*continued*)

Table I.

Attributes	Types	Examples
Restrictions and constraints	Few	Two specific learners are not able to C&C
	Many	A particular learner does not have access to some resources
		All learners cannot see the test answers
Initiator	Sender, supplier, and provider	The teacher initiates a discussion
	Receiver, requester, and demander	The teacher provides the educational material and resources to initiate a project
		A learner asks for help or advice
		The teacher requests answers to his questions
Control	Autonomous	Each learner autonomously C&C with others and manages the educational activity
	Hierarchical	One coordinator plans and controls the educational activity steps
Communication phase	Question and request	A learner asks a question
	Answer	A learner answers to that question
	Order, instruction, and command	Then, another learner comments on that answer
	Comment, statement, and opinion	The teacher directs the students to perform a theatrical show
Proximity and distance (in: meters, feelings, relationships, ideas, culture, age, sex, etc.)	Close and near	A group of friends form a band and play music
	Far	A group of learners walking outdoors has to investigate a lake. The learners who are neighbors are destined to the same side of the lake. Then, the subgroups exchange their observations
Privacy and ownership (copyright)	Private	No-one else can hear the communication between two learners
	Public	The result of a collaborative activity becomes publicly available
Contention and agreement	Cooperative	Two learners ally to solve a problem
	Competitive	A debate about the election of a group leader
		Learners evaluate various systems in order to select the best system

(*continued*)

Attributes	Types	Examples
Typology, form, and code	Formal and structured	A meeting adheres to a formal protocol
	Informal and loose	Each learner first registers and then speaks when his turn comes
		Learners follow a specific etiquette
		Learners speak freely without any order
Reinforcement	Positive, reward, and praise	The teacher congratulates a learner
	Negative, punishment, and blame	A learner accuses another member of his group for the group's failure
Manner, way, and handling	Friendly, warm, and lovely	The teacher warmly helps the learners to choose their own strategies
	Aggressive and pushy	The teacher dictates the learners to follow specific steps
Focus	Focused and specific	A debate is focused on a specific target subject
	Scattered, loose, and general	The learners have to solve a specific problem
		A discussion is scattered over many issues
Number of groups	Small	All learners together discuss the main event of the day
	Large	There are multiple groups, and learners in each group discuss a particular event of the day (e.g. politics, athletics, arts, economics, and businesses)
Number of members per group	Small	Two learners argue about an idea
	Large	Many learners argue and vote in an election
Group homogeneity	Absolute	The group members have the same socio-culture
	Diverse	Each group member is completely different than the others

Table I.

In the previous sections, we described the cultural characteristics of a learner. Not all learners have identical cultural characteristics. For personalized learning, the C&C types should be adapted to the particular cultural characteristics of every learner. For example, learners in a Universalistic society may be accustomed to formal relationships with the teacher. So, the C&C among these learners and the teacher may be formal. They may also prefer strict scheduling of the activities. In addition, they may prefer clear roles and relationships among the group members.

The adaptation engine of the CL system, or the teacher would select the appropriate C&C tools and modes for every learner and every educational activity. In another open learning scenario, the learners would collaboratively decide on the C&C tools and modes that they will use. Or, every learner may select the appropriate C&C tools for himself. It is a subject of future research to identify which C&C tools and modes are appropriate for a particular cultural profile.

Conclusions

Developing a computer-based collaborative learning system is not an easy task. The system should offer to the learners communication and collaboration tools tailored to their social and cultural characteristics. For example, if the learner has not good relationship with time and deadlines, the system should be tolerant to deadlines. If a learner is shy, quiet and reserved, then the system may push him to participate. If a learner has strong relationships with only few other learners, then the CL system may try to introduce him to some others and encourage his acceptance.

The main contributions of this paper are to propose the following:

- adapt the collaborative learning to learners' cultural profiles;
- cultural models; and
- communication and collaboration attributes that would be tailored to the individual learner's cultural profile.

So, first this paper presents learner's cultural models. Next, it presents the attributes of C&C tools. The learner, or the teacher, or the system would select the appropriate C&C tools for each particular learner. For example, if the learner is very talkative and outspoken, the system may restrict him from monopolizing his group communications. If some learners respect the seniority, then the system may define a senior learner as their leader. If some learners are discriminating others, then the system may mix them with diverse learners and encourage their cooperation.

Designers, developers and evaluators of collaborative learning systems may benefit from this learner's cultural models and the C&C attributes. For example, designers and developers may create systems with flexible C&C attributes that provide to each learner personalized C&C tools according to his cultural profile. Future research may aim at identifying the appropriate C&C tools for each cultural profile. Implementation of such systems would be the next step. Furthermore, future research would investigate what learners' skills, abilities and achievements are affected when they participate in culturally heterogeneous teams.

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