Incorporating Cultural Factors into the Design of Technology to Support Teamwork in Higher Education

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Keywords: Culture, Group Work, Teamwork, Higher Education, Design, HCI, CSCW.

Abstract: Online teamwork is an instructional strategy widely used in education courses to ensure active knowledge construction and deeper learning. There is a challenge for online course designers and technology designers to create group environments that encourage participation, and have the ability to enhance positive attitudes toward group work. It is hypothesised that incorporating cultural factors into the design of teamwork technology has the potential to encourage participation and increase students' positive attitudes towards group work. This paper looks to do exactly that, although the definition of culture in this paper is limited to the individualism–collectivism dimension. The paper summarises our findings from interviews conducted with lecturers and students who have experience with teamwork. It then presents culturally-related design strategies which are identified from cross-cultural psychology literature and our interviews finding. Finally, it demonstrates how culturally-related design strategies are incorporated into the IdeasRoom prototype design.

1 INTRODUCTION

The inclusion of group work into course work by educators within higher education is becoming more frequent, because of the current view that teamwork is an essential skill that students need to develop (Drury et al. 2003). Students gain a number of educational, social and practical benefits by being engaged in group work (Goo, 2011). To promote positive attitudes and encourage students to participate in group work, an effective group work environment needs to be created, which is a challenge for technology designers and online course designers.

Research studies suggest that students work more effectively in group work situations if they perceive teamwork positively, as behaviour is often predicted by attitudes; however, the way that individuals interact with their environment and with others is often governed by shared learned patterns of behaviour and belief, so that culture strongly influences behaviour and attitudes (Mittelmeier et al, 2015; Triandis 1995; Hofstede 1996). Currently, there is insufficient research on how technology could support the effectiveness of teamwork in terms of focusing on how culture could enhance attitudes towards teamwork more positively, or the role of culture in encouraging students to participate in teamwork.

This paper discusses the approach taken to support teamwork for students within the design of technology used that incorporates cultural factors, which is achieved in three stages. Within an academic context, relevant cultural factors associated with the practice of teamwork are explored by conducting interviews, which forms the first stage of this work and is described in more detail in Section 5. Insights from the interviews, as well as findings from cross-cultural psychology literature on the bipolar dimension of individualism-collectivism are evaluated to identify design strategies in Section 6, which forms Stage 2. Section 7 describes Stage 3, which discusses how these design strategies are adopted for the prototype design, named IdeasRoom.

2 MOTIVATION FOR THE RESEARCH

Due to the increasingly multicultural character of students in higher education, it is important for online course designers to understand the role that culture plays in academic teaching.

Several studies in the areas of cross-cultural

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behavioural and cognitive psychology found that one's culture determines how we process information (Kim 2013). In Human Computer Interaction (HCI), there has been only limited research on the effects of cultural differences on information processing and online interactions. Instead, researchers have tended to focus on users' external behaviours, rather than their internal cognition. However, we propose that an understanding of cultural differences will benefit designers in the development of cost-effective systems that serve both 'domestic' students and multicultural groups.

In this research, we propose a novel approach that is culturally personalised in a group-based system in higher education. The motivation for this approach is to establish a culturally related group-based tool to aid collaborative work carried out by multicultural student groups. This led to the development of a prototype system called "IdeasRoom", to investigate this proposal and demonstrate a culturally personalised approach to collaboration. This paper details the first phase of research by exploring the differences between how individualists and collectivists process information through group work.

3 CULTURAL DIMENSIONS

In this study, we focus on two common societal dimensions of culture: individualism and collectivism. We define these as follows:

- Societies described as individualist tend to be mainly associated with their close families and often live independently, so that they are expected to look after themselves; therefore, there are loose ties between individuals. People living in individualist societies tend to be motivated by loss of self-respect and guilt, and are often perceived to be goal-oriented and self-motivated, so that group interests are less important than individual interests (Hofstede, 2010; Hofstede, 1996). People living in individualist societies tend to demonstrate a personal identity rather than an identity of specific groups, so that they often seek benefit from their duties and activities, and have a more consistent behaviour and attitude approach to life than those from collectivist societies (Triandis, 1995).

- These findings are contrasted with societies described as collectivist, where people tend to form groups that are cohesive and strong throughout life, so that the welfare of individuals becomes the concern of the group associated with them, and anxiety can result when individuals are separated from their group. Unquestioning loyalty is shown to individuals in collectivist societies, as the groups they are associated with, and often known as 'in-groups', give them protection when needed. Generally, people in collectivist societies attempt to maintain tradition, adopt virtues and skills that are needed to demonstrate that they are good members of their group, and attempt to maintain social harmony, so individual interests are less important than group interests. Therefore, people living in collectivist societies tend to be motivated by loss of face and shame (Hofstede, 2010; Hofstede, 1996). The identities of individuals in collectivist societies are usually associated strongly with the values of their group, so that they generally support what is acceptable in their group (Triandis, 1995).

The main focus of individualism and collectivism is how individuals are integrated within groups. Therefore, this research focuses on peer group interaction with individuals from different cultures, within a group-learning environment.

Although this categorisation of societies is widely supported in the literature review, the definition of cultural identity involves greater complexity than factors discussed above, as individuals in all societies are likely to demonstrate various cultural identities at different times and in different circumstances. We present only one perspective on how to examine culture and there are others that we could draw upon. However, to form a concept of different groups in terms of their behaviour patterns and general belief, the individualism-collectivism dimension proposed in previous research studies provides a very useful and important initial categorisation on which to ground future work.

4 TEAMWORK IN EDUCATION

According to Smith and Bath (2006), the most effective approach to ensure students acquire knowledge and enhance their communication skills at educational institutions is teamwork, as this provides significant advantages to supervisors and teachers to reduce the quantity of their marking, give students opportunities to work collaboratively, enhance the challenge and complexity of tasks given to students to improve their experience of working, and to engage students more effectively (Gibbs, 2009). When compared with face-to-face collaboration for group work projects, the performance of students collaborating online can be significantly better, because the interactions with other members of the

group are more meaningful and frequent for students collaborating online, when compared with students involved in learning activities on a face-to-face basis (Tutty and Klein, 2008).

Online learning tasks for teamwork is perceived more negatively by Smith et al. (2011), who report that resolving logistical problems is easier for students seated physically together in one room, when compared to students learning in online classes. Personal factors can influence the perception of teamwork by students, so that how they perform within group activities is affected by this perception. Perceptions of group work by students might also be affected by their communication and personality traits (Myers et al., 2009), but this is challenged by findings from other research, which suggests that the previous experience of students working in groups could change their perception of teamwork through online channels. In a study by Powell, Piccoli and Ives (2004), the findings report that when students had wider experience of working with other students online and were involved in more online courses, their perceptions of teamwork through online channels were increased positively. This was related to the students spending more time online, and using this time to adapt to (and benefit from) the technology and online teamwork activities.

Research studies evaluating behaviour and teamwork preferences for employees and students suggest that the cultural dimensions of individualism and collectivism developed by Hofstede are an important factor in terms of profiling such groups and a useful way of assessing group behaviours (Bishop et al., 1999). When students work collaboratively in groups, their working processes are likely to be different, due to differing approaches that are likely to be taken by students from primarily individualist versus primarily collectivist cultures (Galanes et al., 2004).

5 CULTURE IN DESIGN

The link between individuals' interactions with technology, and their culture, has become a focus for an evolving field of research. HCI approaches can utilise Hofstede's cultural dimensions, borrowed from the field of sociology, to investigate how aspects of culture influence our interactions with technology (Hofstede, 1996). Evers (2001) investigated interface metaphors from a perception of cross-cultural understanding, and Vohringer-Kuhnt (2001) investigated perceptions of usability by people and the influence of culture, where both studies relied on

cultural dimensions in HCI investigations. However, there is an insufficient focus in the literature on how teamwork could be supported by examining the relationship between technology and culture.

Designers of technology tend to adopt cultural aspects of day-to-day life when adapting design preferences for technology products, as this is an important factor for consideration, and the strategies adopted by designers are embedded and used in their products. Design decisions are often based on the value judgement of the designers in terms of motivating factors used, their belief in what any target audience could be influenced by, and what influences them personally (Khaled, 2008). This suggests that technology designers are likely to embed their own cultural preferences into their technology products, but do not sufficiently consider the consumer or audience that could use these products who might not associate with these values and ideals. According to Hall (1989), hidden issues in society are often exposed when individuals become aware of control systems that are in place, and this is exposed more frequently during programmes involving a mix of cultures, and who reports from an anthropological perspective. Hall explains that an individual's personality has cultural programmes that are internalised, so that people's behaviour, attitudes and personalities are based on these (Hall, 1989). However, these findings could be transposed to investigations of technology users, as some could feel dissatisfied by their typical interaction patterns, their behaviour, their knowledge base or mismatched assumptions about their identity. Therefore, behavioural and attitude changes are unlikely if users are made to feel uncomfortable, and technology designers need to consider these potential consequences.

When using technological tools to trigger encouragement, it is important to recognise and identify that different users will have different cultural dimensions, and that their perceptions are likely to differ. Therefore, the potential effectiveness of such tools could be increased if designs match the cultural assumptions of users, as they should be more comfortable using the technology, concerns would be reduced, and users can focus their attention on the content better, which would help overcome the issues mentioned previously by Hall (1989).

6 EXPLORING CULTURAL FACTORS IN TEAMWORK

Semi-structured interviews were adopted in this study in order to explore how students incorporated culture

as a factor in their current practice of teamwork activities.

Two groups of participants were recruited for this study. The first group involved twelve computer science postgraduate students from a UK university, who had prior experience of working in groups. The gender balance of this sample was six females and six males. Student interviews included topics that asked about tools usually used for the completion of group tasks and projects, together with tools used for communicating with others, evaluating and assessing the group projects. Advantages and disadvantages, and problems and issues faced by students working in groups are also included.

The second group involved five lecturers from the same university, who teach computer science for university students at its UK campus and also in its overseas campuses in China and Malaysia. All lecturers had prior experience planning and teaching group activities. The focus of lecturers' interviews included asking about their experience with teamwork activities, how students' project teams were formed (whether student, tutor, or randomly organised), how roles were allocated (no roles, tutor allocated roles, student chosen roles or all tasks divided evenly) and whether the groups designated a leader or not. The lecturers were also asked about tools or technology used to support student teamwork, and the strategies used for group work assessment and students' feedback regarding the assessment.

The interviews took place in the School of Computer Science at the university's UK campus, where respondents were individually interviewed in a quiet area. The interview process, the purposes and aims of the interview were explained to the participants; the interview time ranged from 30 to 45 minutes. Respondents were asked for their permission to record the interview, and to sign a consent form demonstrating their willingness to participate before the interviews. The researcher explained that respondents could stop the interview and withdraw at any time; the interviews were recorded with an audio recording device for subsequent analysis.

6.1 Analysis

Following the interviews, the audio recordings were transcribed, resulting in fifty-one thousand words. Then, the transcripts were qualitatively analysed. A thematic analysis was adopted in order to identify underlying patterns and themes of behaviour or living from text data, to reveal common threads that emerged from all the responses, as recommended by Aronson (1994).

An initial phase of analysis was conducted before thematic coding was applied. This phase consisted of gathering cross-cultural psychology literature on the behavioural and motivational differences between individualists and collectivists. Key motivations from the literature are summarised in Table 1 and were then considered as a scientific basis for the thematic analysis and codes are described in the next section. Then, thematic analysis was used to analyse the transcripts in two phases. In the first phase, two indicators were used (individualistic focused theme vs. collectivistic focused theme). In the second phase, four indicators were used, that emerged from the data and coded appropriately. These two phases is described in more detail below. The assignment of statements to categories was done by the main researcher in consultation with two other lead researchers, to avoid subjectivity and bias.

Table 1: Individualist and collectivist motivations.

Motivation	Individualist	Collectivist
Superordinate goal	Individual goal	Sharing goal
Identity	Self-identity	Group identity
Trust	Cognition based	Affect based
Accountability	Individual based	Group based
Communication	Partial channel	Full channel
Reward distribution	Equity based	Equality based
Relationship	Competition	Harmony
Rules	few rules	many rules

6.1.1 Thematic Analysis: Phase 1

Two overarching thematic codes were developed to use in this phase. The two codes were identified based on cultural anthropologists' classification on how individuals are integrated within groups (Hofstede, 1996; Triandis, 1995) as described in the definition of individualism and collectivism in the introduction. The codes are reflected the following classifications:

- **IND** – Individualism
- **COL** – Collectivism

Many sociologists such as Hofstede and Triandis have worked on classifying individualism and collectivism on two levels – namely, the nationality and individual level. Hofstede's research applies the classification of individualism and collectivism to the nationality level, while Triandis's research applies it at the individual level. Hofstede's work has often been criticized because of his classification which reduces culture to nationality. It also ignores the ongoing changes that a person or a group who shared cultural values undergo (McSweeney 2002). In our

analysis, we relied on the individual level of classification of individualism and collectivism and excluded participants' nationalities.

By the end of this phase, two lists are generated: the IND list which includes all quotes that refer to individualistic perspectives and the COL list which includes all quotes that refer to collectivist perspectives.

6.1.2 Thematic Analysis: Phase 2

A set of thematic codes was developed to use in determining the key differences in cooperation between individualism and collectivism quotes from the two lists in the thematic analysis phase 1. The codes were developed by the research team based on both a grounded analysis of the text and also taking into account the critical aspects of teaching from the lecturers' accounts. The codes reflect the following key aspects, which highlight notable differences between students and are explained in more detail below:

- **R** – In-Group Relationships
- **I** – Identity (of the student)
- **N** – Assessment Norms
- **G** - Superordinate Goals

In-Group Relationships (R) refer to how the relationship among group members is different between individualistic and collectivist perspectives.

Identity (I) refers to how the views about self is different between individualistic and collectivist perspectives.

Assessment Norms (N) refers to how the individual perceives the distribution of rewards or marks among group members and how this may be different between individualistic and collectivist perspectives.

Superordinate Goals (G) refer to how the goal of the cooperation will be achieved which is different between individualistic and collectivist perspectives.

Quotes from the two lists in Phase 1 were then recoded to identify themes that indicated R, I, N and G. By the end of this phase, eight lists of quotes are generated and referred to by the codes given in Table 2.

Table 2: Codes Generated in Thematic Analysis Phase 2.

Code	R	I	N	G
IND	IND- R	IND - I	IND - N	IND - G
COL	COL- R	COL- I	COL- N	COL- G

6.2 Results

This section explains the results from the thematic analysis of Phase 1 and Phase 2.

6.2.1 Thematic Analysis Results: Phase 1

As explained above, the recordings of the interviews were transcribed and the transcriptions were then thematically coded looking for quotes relating to individualistic perspectives and collectivist perspectives. Table 3 below shows the quotes frequency that emerged for each code (IND and COL) in this phase. Broadly speaking, there were some key differences found between students and these are explored in the analyses below.

Collectivism was described by both groups of participants, i.e. both students and lecturers; for example, the collectivist behaviour that described students in China and how the interdependency of the Chinese students influences the strategy of forming students in groups by lecturers. A typical response given by one lecturer was "*Once we have formed CS [Computer Science] students together, we form groups in the way that they live. It is more convenient. So they absolutely do not need mobiles to communicate. They come to the lecture together, they walk together, and eat together.*"

Also, a high collectivism perception is demonstrated in describing students in Malaysia, as they are seen as more family oriented. A typical response given by one lecturer was "*In Malaysia, students see their teachers like their parents. Maybe the culture of the east. The culture is like this, this is the lecturer and everything is OK, so they do not argue. Their culture is to do what is the teacher asks.*"

This collectivism is demonstrated by students as well; for example, one student expresses the priority and the importance of values like harmony and working together in teams. A typical response was "*It just came to my mind is that it is group work after all and firstly we should have some harmony. We need all working together.*"

On the other hand, individualism was also demonstrated; for example, the need for the evaluation of individual contributions was highlighted. A typical response by one student was "*I think it's difficult to mark a group without peer evaluation, because if you don't have peer assessments, you can't tell he [a particular student] hasn't done any work and the group gets all the same mark.* "

Individualism is demonstrated by lecturers; for example, describing the feature of the student self-moderators in online groups is the reason for the success of experience with forums that are not provided by the university. A typical response given by one lecturer was "*Using forums through Moodle, I can't make any students moderators, so they can't*

appoint their own self-moderators in groups, which I think is why I have never seen any forum setup using the university learning system, which has a same kind of interaction as any other kind of forum that you can see existing online."

Table 3: Themes Frequency that Emerged in Phase 1. (Numbers refer to number of quotes from interview participants).

Participant	IND Theme	COL Theme
Student_1 *	8	7
Student_2 **	4	10
Student_3 **	0	20
Student_4 **	8	11
Student_5 *	20	2
Student_6 *	16	3
Student_7 **	2	17
Student_8 **	1	7
Student_9 *	19	4
Student_10 **	5	17
Student_11 **	2	19
Student_12 *	20	12
Lecturer_1 **	0	3
Lecturer_2 **	0	2
Lecturer_3 **	0	3
Lecturer_4 **	0	2
Lecturer_5 *	4	0
Total IND/COL	**109**	**139**
Total	**248**	

(* indicates that IND themes more than COL themes)

(** indicates that COL themes more than IND themes)

6.2.2 Thematic Analysis Results: Phase 2

In this phase 248 quotes were listed in Phase 1 and recoded in this phase looking for quotes relating to indicators relating to in-group relationships, identity, assessment norms and superordinate goals. Table 4 below shows the quotes frequency that emerged for the eight codes that were developed for this phase.

Table 4: themes frequency emerged in phase 2 (Numbers refer to number of quotes from interview participants).

Code	R	I	N	G
IND	12	36	35	42
COL	51	49	15	50

Table 5 shows examples of quotes reflecting the codes used in this phase. The quotes in Table 5 show how individualists and collectivists differ in the in-group relationship (R), the quote (COL-R) shows more harmony and collaboration behaviour while the (IND-R) shows more competitive behaviour among group members. Regarding the identity (I), the comparison behaviour in cooperation explained by the quotes (COL-I) and (IND-I) shows the differences between individualism and collectivism in the identity. The (COL-I) quote demonstrates high

collectivism, as the respondent perceives the self as the group and compare the group that belong to with other groups. In contrast, (IND-I) quote demonstrates high individualism, as the respondent perceive the self as individual and compare own efforts with other individuals.

In assessment norms (N), the (COL-N) quote relates to when students are working in the same group, but who are dissatisfied when they receive unequal marks. The (IND-N) relates to students who are dissatisfied when members of the same groups are awarded equal marks despite making unequal effort, which was perceived to be a factor that influenced the contribution of individuals involved in group work. Regarding the Superordinate Goals (G), the quote demonstrates the motivation to achieve the goal of cooperation in collectivism (COL-G), and shows the person has a group goal interest. The quote demonstrates the motivation to achieve the goal in individualism (IND-G), and shows the person has more personal goals and interests.

Table 5: Examples of Quotes Reflecting the Codes in Phase 2.

Code	Quote
IND-R	"When they come to receive marks back to the group coursework, students will compare each other mark and if they believe that their friend get the mark for something they did not get a mark for. They are coming ask for that extra mark so they can have higher grades than friend. They are very **competitive between each other within the group** about the mark they receive." (lecturer_5)
IND-I	"Sometimes people don't care what others contribute so with each person, it differs, but with me if I see someone else do more work, then it motivates me to do more" (Student_6)
IND-N	"It's not fair on the rest of the group who have done the work whereas someone hasn't and he's got high marks from doing nothing. Our marks **should not be equal**" (Student_9)
IND-G	"if there was some way to measure how <u>much I contribute</u> to the overall work than I will do my best" (Student_10)
COL-R	"Sometime my friends think that I work hard looking for extra marks but it is not. I see it is teamwork and we need **work together and support each other**" (Student_7)
COL-I	"Sometimes I will compare our group effort to others because sometimes I see other group is more like our group." (Student_12)
COL-N	"We worked in a group of two and we did all the preparation together. It's just that my friend said the first half and I said the second half; I got a bad mark even though we did the work together, and we both felt it was unfair. It is a group work and we suppose to get an **equal** marks" (Student_8)
COL-G	"I mean I will **try my best** to win the competition **for my group**." (Student_11)

6.2.3 Summary of Results

The analysis shows how two groups of participants (lecturers and students) reported their views of individualism and collectivism on teamwork. This study is in keeping with previous studies such as, Cox et al., (1991); Galanes et al., (2004); Mittelmeier et al, (2015) which suggested that individualism and collectivism traits can predict and influence student group work behaviours. The findings also show that, while some students' have a more dominating individualistic tendency, others have more collectivistic tendencies. For instance, five students report that they have more individualistic perspective towards teamwork. On the other hand, seven students show that they have more collectivistic perspectives towards teamwork (see Table2). With regard to lecturers, four of them have a collectivist perspective in teamwork while one lecturer has a more individualistic perspective.

In the second stage of the interview analysis, we focused on four key strategies; namely, 'R' – In-Group Relationships, 'I' – Identity of the student, 'N' – Assessment Norms and G - Superordinate Goals. The results show that these four keys were found in both individualist and collectivist perspectives. However, the percentage was more significant in 'R' – In-Group Relationships in the collectivist perspectives rather than individualist. On the other hand, 'N' – Assessment Norms was more significant in individualist rather than the collectivist perspectives. Figure 1 demonstrates the percentages of the occurrence of the four key strategies in both individualist and collectivist perspectives.
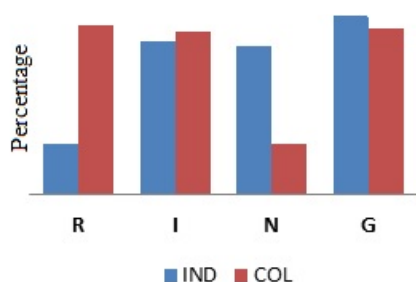

Figure 1: The percentage of the four key strategies' quotes in the individualist and collectivist perspectives.

7 A SET OF CULTURE-RELATED DESIGN STRATEGIES

To design group-based technologies that are meaningful and effective for their target audiences, designers should reference – or at least allow for - the audiences' cultures in their approaches. This section summarises the findings of the interviews carried out with lecturers and university students who have experienced group work, to establish how students incorporate culture as a factor from their current practice. This section also presents a set of culturally relevant group-based technology design strategies based on insights from the interviews, as well as findings from cross-cultural psychology literature on behavioural tendencies of individualists and collectivists.

These strategies have resulted from our work with the participants mentioned above, and form suggested approaches when considering the design of technological tools to support and encourage effective online team working, particularly when working with culturally diverse group members.

A set of four main culturally relevant design strategies is presented and each strategy involves two sub strategies. One is aimed at use in tools developed for collectivist users and the other is aimed at use in tools for individualist users. Each strategy is presented with the following information: *Description*, which attempts to explain the strategy presented, *Antecedents*, which highlight the factors based on the review of the literature that lead to the strategy, *Real World Parallels*, which demonstrate the strategy in real world situations, and *The Two Sub-Strategies* produced from each main strategy. The two sub strategies are presented with a description and target audience, which suggests whether the audience would likely to be collectivist or individualist. This way of describing the strategies is intended to help designers include appropriate strategies in systems that are relevant for target audiences where cultural backgrounds could be a significant factor. It is anticipated that designers could find the discussions, descriptions and antecedents helpful in understanding the strategies, why they were developed and how they could be applied.

7.1 Strategy 1: In-Group Relationships

Description: The difference between collectivist users and individualist users forms the basis of this overall strategy to define relationships between members of a group.

Antecedents: In studies of education theory, findings suggest that individuals from individualist cultures often display less cooperative behaviour in groups than those from collectivist cultures, which supports the views discussed above (Cox et al., 1991). Collectivists often highly value group solidarity and

interpersonal harmony, prefer cooperation to competition, value group success rather than individual success, and tend to avoid individual recognition. This contrasts with individualists who often demonstrate additional effort to attain individual goals, and are generally motivated by individual recognition and competition (Triandis, 1994; Cox et al., 1991; Leibbrandt et al., 2013).

Real World Parallels: the study investigated communication in the USA (individualist culture) and in Syria (collectivist culture), and reported that Syrian respondents preferred strategies that were ritualistic, indirect and cooperative, but American respondents preferred strategies that were hostile, direct and competitive (Merkin & Ramadan, 2010).

The Sub-Strategies: this strategy contributes to the competitive strategy and the harmony strategy.

- *The Competitive Strategy:* A sense of competition between members of a group could be promoted with the competitive strategy. *Target Audience*: Individuals in individualist cultures.
- *The Harmony Strategy:* When the level of cooperation between group members is increased, a sense of harmony relationship is promoted by the harmony strategy. *Target Audience:* Individuals in collectivist cultures

7.2 Strategy 2: Identity

Description: The differences between collectivist users and individualist users in the views about the self are described by the strategy.

Antecedents: How individual people understand themselves in relating to other people explains the concept of the self, and Erez and Earley (1993) suggest that people represent their social roles, social identity and personality as the self. People in individualist cultures often perceive themselves as separate from the social context, and independently follow their own projects and interests. People in collectivist cultures often perceive themselves as connected to social contexts with relationships with other people that are interdependent (Markus and Kitayama, 1991). Therefore, people living in individualist cultures often perceive themselves as unique (Shulruf et al., 2007; Triandis, 1994), but people living in collectivist cultures tend to feel they fit into or belong to society, and do not feel isolated (Triandis 1994; Triandis 2001).

Real World Parallels: An example of parents in an individualist culture, such as the USA, would

encourage their children when reluctant to eat the meal prepared for them by telling them that children in other countries have very little food, and that they should be pleased that they are fortunate. An example of parents in a collectivist culture, such as Japan, would encourage their children when reluctant to eat the meal prepared for them by telling them that the farmer that had grown the rice had wasted his time, so he would feel bad if the children did not eat the rice, so they are encouraged to think more about the producer of the food rather than themselves. The example of the Japanese family suggests the importance of interdependence with others and fitting in and being concerned about others. The example of the USA family suggests the importance of promoting the self, noticing the differences with others and focusing on the self (Markus and Kitayama, 1991).

The Sub-Strategies: this strategy contributes to Individual-identity strategy and Group-identity strategy.

- *Individual-identity Strategy:* This strategy aims to promote uniqueness, independence, and an independent view of self in cooperation. *Target Audience:* Individuals in individualist cultures.
- *Group-identity Strategy:* This strategy aims to promote belonging, fitting in and an interdependent view of self in cooperation. *Target Audience*: Individuals in collectivist cultures.

7.3 Strategy 3: Assessment Norm

Description: The differences between collectivist users and individualist users form the basis for the strategy in terms of the perceptions of compensation or rewards for an individual within a group.

Antecedents: The review of literature into reward allocation preferences indicates cross cultural differences, so that individuals from an individualist culture tend to prefer equity based allocation of rewards, but individuals from a collectivist culture tend to prefer equality based allocation of rewards (Triandis, 2001; Fadil et al., 2009). Therefore, values of collectivist cultures emphasise affiliation and cooperation, but values of individualist cultures emphasise achievement and competition, so that individualist values are more compatible with equity norms and identify individual performance for career progression and reward systems, as well as pay for performance systems (Gelfand et al., 2007).

Real World Parallels: In a study that compared distribution of rewards in a group and decision rules, Japanese respondents described as collectivist and

Australian respondents described as individualist, were involved in a game of decisions for classroom administration. Australian respondents had a tendency to follow self-interest rules in this game, and Japanese respondents had a tendency to follow equal-say rules (Mann et al., 1985).

The Sub-Strategies: this strategy contributes to Equity strategy and Equality strategy:

- *The Equity Strategy:* The equity strategy proposes that persons who allocate rewards or compensation within a group distribute them in proportion to each member's contributions. *Target Audience*: Individuals in individualist cultures.
- *The Equality Strategy:* The equality strategy proposes that persons who allocate rewards or compensation within a group distribute them for a group of users for the actions of an individual user. *Target Audience*: Individuals in collectivist cultures.

7.4 Strategy 4: Superordinate Goals

Description: The differences between collectivist users and individualist users in goals, interests and motivations described by the strategy.

Antecedents: In societies defined as having an individualist culture, group interests are less important than individual interests, so that individuals in this type of culture are often motivated by potential loss of self-respect and feelings of personal guilt, so that they tend to be goal orientated and self-motivated. This contrasts with societies defined as having a collectivist culture, as individuals tend to maintain traditions by being good members of groups by adapting their virtues and skills, and in a collectivist culture typical motivators are loss of face and shame (Hofstede, 2001; Triandis, 2001; Triandis, 1994; Plueddemann, 2012).

Individuals often emphasise personal autonomy, freedom of choice and personal responsibility as values of personal independence in individualist cultures, and often show a preference for the independence of groups and self-directed behaviour, as these individuals attempt to maintain personal opinions and attitudes that are distinctive (Triandis 1994; Shulruf et al. 2007). In contrast, a sense of working within a group, interdependence and duty to a group are attitudes represented in a collectivist culture, as values in these societies stress that personal goals in groups are less important than maintaining the goals of the group. Therefore, individuals living in a collectivist society are interdependent with their in-group, and there is a collective responsibility for accountability and sharing responsibility (Triandis 2001; Triandis 1994).

Real World Parallels: In Japan, managers of organisations often use participative programmes, employee suggestions and team decision-making or delegate responsibilities to team members and practice team working as a business strategy. Therefore, Japanese managers tend to adopt restrictive methods by expecting employees to obey and honour all management decisions, but also adopt relaxed methods by looking for consensus when issues arise, even minor issues, and ask for suggestions and ideas from employees (Sagie & Aycan, 2003). Japanese organisations often introduce activities, such as team names, team banners, team dormitories and collective meals, to enhance productivity, as these types of activities help to integrate workers within their team and encourage effective teams. This contrasts with patterns of group working in Western countries, such as the USA, the UK, Sweden, Canada and Australia, where work teams are often self-managing, semi-autonomous or autonomous, so that team working operates as a form of self-management, and is widely applied in these countries (Sagie & Aycan 2003). According to Hofstede (2001), there is a perception that in the USA and the UK, higher quality decisions are made by individuals, when compared to decisions made by groups.

The Sub-Strategies: this strategy contributes independence goal strategy and interdependence goal strategy.

- *The Independence Goal Strategy:* This strategy aims to promote self-goal, self-interest, personal responsibility and a sense of independence in cooperation. *Target Audience*: Individuals in individualist cultures.
- *The Interdependence Gaol Strategy:* This strategy aims to promote group-goal, group-interest, collective responsibility and a sense of interdependence in cooperation. *Target Audience:* Individuals in collectivist cultures.

8 PROTOTYPE DESIGN

A key motivation for this research was to establish whether a culturally related group-based tool would be more effective and more welcomed by a target audience, than a tool that was assumed to be neutral. This led to developing a prototype for testing whether the system design strategies detailed in Section 5

provided useful design directions. The design of the prototype for teamwork was titled IdeasRoom.

8.1 The IdeasRoom Prototype

One of the most important strategies in developing creative thinking is brainstorming, which is a skill required by computer science students, since designing and innovation is at the centre of computer science (Shih, Venolia and Olson, 2011). IdeasRoom, a medium-fidelity prototype, was used in this study to simulate a web-based tool designed to support students with group activity, which is designed to encourage electronic group brainstorming for students to generate ideas within their groups. Prototype designs were carried out using Balsamiq, providing a useful initial simulation. It was selected because it resembles a medium-fidelity prototype. Its use encourages users to view it as work in progress rather than a completed product, thus encouraging users to provide more feedback than they might for a more 'finished' product. In addition, its comprehensive layout offers high visual elements, resulting in users feeling that they are using the real environment. The evaluation focuses upon the behaviour and needs of users, instead of the visual elements. IdeasRoom is based on a discussion forum format. There are five main options in IdeasRoom, namely 'add idea', 'idea comment', 'ideas list', 'visibility score of participation' and a 'leader board'.

8.2 Incorporating RING Strategies into IdeasRoom

IdeasRoom was intended to be an experimental tool by designing one version that would appeal more to individualist users (which we refer to as the IND version) and another that would appeal more to collectivist users (which we refer to as the COL version). While cultural identity is complex, the cultural assumptions of the IND version of IdeasRoom are based on typical attitudes of individualists, while those of the COL version are based on typical attitudes of collectivists. Our intention was to make the IND and COL versions of IdeasRoom able to equally promote group brainstorming activity for different types of audience. At this stage of the design, a student's allocation to a particular group is not yet carried out because of this function has yet to be implemented. In the next stage of the IdeasRoom design, adaption rules will be developed to allocate students to specific groups. These rules will be based on a match or mismatch of each student's pre-assessed cultural type (individual

or collectivist).

8.2.1 IdeasRoom IND Version

In the IND version, R.I.N.G. sub-strategies for individualism culture are incorporated: competition strategy, individual-identity strategy, equity strategy and independent goal strategy.

To increase the feel of the competition, the leader-board in the IND version was adapted. Members' ranking in the leader-board is applied and ranked by higher member contribution. Contribution is defined by the total number of ideas and idea comments generated by the member. It ranks the names of group members and their contributions, which should promote in-group competition strategy.

To promote Individual-identity strategy, self-information is provided in many forms. Users are identified by their name and personal greeting message. Also, user pictures are used for personal identity and to promote a feel of the uniqueness. In the leader-board, the representation of information as members instead of the group together with visibility of user participation should increase the view of independence.

The equity strategy is applied in representing participation in the group as a member score. Participation in the prototype by generating ideas will increase the score of the member. Finally, the independent goal strategy is also promoted. The design increases the sense of the personal goal. Participation is the main goal in IdeasRoom and in the IND version, individual participation is promoted. The design motivates users to work for their independent goals, such as changing their position in the leader-board by increasing their participation, and to work to increase their own score of participation.

8.2.2 IdeasRoom COL Version

In the COL version, R.I.N.G. sub-strategies for collectivism culture are incorporated: harmony strategy, group-identity strategy, equality strategy and interdependent goal strategy.

To increase the feel of collaboration and harmony, the leader-board in the COL version is adapted. The leader-board was adapted based on between-group competition technique, which is suggested as a technique that encourages in-group collaboration (Cárdenas & Mantilla, 2015; Hausken, 2000). Group ranking in the leader-board is applied and ranked by higher group contribution. Contribution is defined by the total number of ideas and idea comments generated by all members in the group. It ranks the

names of groups and the group contributions, which should promote in-group harmony strategy.

To promote Group-identity strategy, group information is provided in many forms. Users are identified by the group name and the greeting message is personalised with the group name. Also, a group picture is used as an identity, which promotes a feeling of belonging to the group. In the leader-board, the representation of information as groups instead of members, together with visibility of shared participation, should increase the view of interdependence.

The equality strategy is applied in representing participation in the group as a collective score. Any member of the group can participate in the prototype by generating ideas that should increase the score. Finally, the interdependent goal strategy is also promoted. The design increases the sense of the shared goal. The design motivates users to work for the interdependent goal, such as to change the group position in the leader-board, each member in the group could work to increase group participation and it is necessary to work together to increase the collective score.

9 CONCLUSIONS

This paper summarises the process of incorporating cultural factors in the design of technology that supports teamwork. Interviews with lecturers and students who had experience with teamwork were conducted that aimed to explore cultural factors in group work activities. The analysis of the interviews used thematic analysis that was accomplished in two phases. The main focus in the first phase is individualism theme and collectivism theme, while the main focus in the second phase is the differences between individualism and collectivism in teamwork. This identified four key differences: In-Group Relationships (R), Identity (I), Assessment Norms (N) and Superordinate Goals (G).

R.I.N.G. design strategies were identified from the cross-cultural psychology literature relating to the bipolar dimension of individualism–collectivism, and used with the responses from the interviews. The design of the two versions of the prototype of the system is called IdeasRoom. The IND version should appeal more to individualist users and the COL version should appeal more to collectivist users. The discussion explained how the design was informed by the R.I.N.G. design strategies in both versions.

Currently, the prototype is undergoing iterative testing and development as a web-based system for students, and there is a focus on the design and usability issues that have emerged from the user tests of the initial prototypes of IdeasRoom. An analysis of the evaluation findings highlighted issues within the IdeasRoom design that needed to be reconsidered and adapted, which shaped how the final phase of IdeasRoom development should be approached. Once this is fully implemented, the system will be evaluated by examining the effectiveness of the system in terms of encouraging participation and its ability to enhance students' attitudes towards group work.

ACKNOWLEDGEMENTS

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