PREPARING COMPUTING STUDENTS FOR CULTURAL DIVERSE E-MEDIATED IT-PROJECTS

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ABSTRACT

We present an account of an undergraduate team based assignment designed to facilitate, exhibit and record team working skills in an e-mediated environment. By linking the student feedback received to Hofstede's classic model of cultural dimensions we aim to show the assignment's suitability in revealing the student's multi-cultural context. In addition to anecdotal evidence we also present a quantitative analysis that shows that the desired learning outcomes have been met. In a further discussion we show how the qualitative data collected can be used to quantitatively determine a cultural fingerprint of the groups that is useful to predict the team's suitability for a given task in a real-world project.

KEYWORDS

Culture, E-Mediation, Virtual Teams, Curriculum Design, Cultural Fingerprint

INTRODUCTION

In a global e-society more and more software development projects are performed in a team that is distributed across countries and different cultures. Global Virtual Teams are typically formed by members from culturally different countries, who differ in the views of their relation to authority, time, conflict resolution and their perception of communication technologies, along with other differences in language, tradition, cultural values and work ethics (Ramachandran, 2004). Vinaja (2003) investigates the multi-cultural challenges faced by multi-cultural virtual teams. A good analysis of key challenges using sample cases is given covering all four areas of *communication*, *culture*, *technology* and *project management*. Many potential problems experienced by multi-cultural virtual teams are identified, such as time delays in replies, lack of synergy among cross-cultural team members, communication breakdowns, unresolved conflicts among members, and so on.

Van Ryssen and Godar (2000) found that cultural differences create problems for UG (undergraduate) students in the areas of socialization, communication and coordination. Maznevshi and Chudoba (2001) argue that regular "Face-to-Face" meetings provide necessary coordination when cultural differences cause some difficulties in coordination. Besides cultural differences, other obstacles to coordination include power, "doing it their own way" and communication predictability (Johansson et al, 1999). Although cultural differences intensify communication and coordination problems, richer communication facilitates socialization and virtual teams using more communication methods and under more effective leadership are more satisfied and more successful (Kayworth & Leidner, 2000-2003; Landrum & Paris, 2000).

However a study from Scott et al. (1999) in which international business students used the Internet to interact at distances of many thousands of miles, in order to conduct an Internet-based collaborative project sees the problem not so much in the physical distance but on the difference of culture. This is confirmed by Robey et al. (2000) who found that differences in culture could negatively impact a virtual team.

In this context we developed a student assignment that prepares the students for these cultural challenges that they may face in their future workplace. The essential idea is of course not a new one: A study by

Landrum and Paris (2000) for example, in which 53 students took part in virtual team projects concludes, with qualitative (anecdotal) evidence, that leadership from instructors leads to the success of such projects. However this labor-intensive approach is not feasible for large courses with more than 150 students (as in our own situation). Hence we developed an approach that in fact takes advantage of the high number of students while significantly reducing the amount of required staff attendance. In short, the students are randomly divided in small groups (via discussion boards on a VLE) who are given an ostensibly simple task: They have to form a team (for details see the following section). Due to the large number of students and the randomness of the distribution the students in each groups are mostly previously unknown to each other. With the feedback received from the students, as we go on to show in the remainder of the paper, we are not only able to provide anecdotal evidence but also quantitative results that prove the success of the assignment in respect to the desired learning outcomes. This is achieved via a carefully designed final questionnaire that is based on Hofstede's (1991) model of cultural dimensions.

Furthermore by being able to describe the cultural orientation of the individual students, we can systematically assess their contribution to group outcomes. This allows the characterization of the cultural dimension of the team and will be highly useful in determining the cultural "fingerprint" (Smith et al., 2004) of the group that can be used to deduce the suitability of the team for a dedicated task or to identify possible problems the team may encounter in the future.

THE E-MEDIATED ASSIGNMENT

The context of the assignment is a third year BSc module in "IT Project Management". Approximately 150 students were enrolled in the module. The students come from a wide variety of ethnic backgrounds (however we focus here on cultural diversity and not on ethnic diversity or self-definitions concerning their notions of cultural identity although these concepts are somehow related). From the student's point of view the aim of the task is: *"Understanding of soft skills and the problems in team building activities. Evaluation and use of interpersonal skills."* At the beginning of November 2004 the students were given the following scenario:

"You have been employed by "The Big Software Company" for their next software project that is about to begin just before Christmas. You are assigned to a team that consists of 8-10 people[1]. The team members come from various cultural backgrounds, so the team shows a high diversity. "The Big Software Company" therefore has decided that you should use the time from now on until December 16th exclusively for performing team-building activities. The goal is to have a team of high coherence at December 16th."

This was accompanied by a more detailed description of the tasks as follows:

1. *Each group has to organize at least two "social" events that serve to improve the team coherence.*
2. *Each Thursday a report has to be produced containing a short overview and summary of the activities of the team in the previous seven days. [...]*

These intermediate reports could either be individual reports or joint reports. The starting point of the assignment was a discussion group in a Virtual Learning Environment (VLE). Each student has been assigned to a discussion group; there was an overall of 20 groups. Students are allowed to write or read in their own discussion group only. The assignment text ends with a reminder that it is the student's responsibility to be proactive:

" Note that this is an individual assignment. This is not a group assignment. The grade is based on:
- *Participation in the discussion group.*
- *Activity shown in organizing team building activities.*

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[1] The actual group sizes were usually 6-8 students as the division into groups has been based on a data that (unintentionally) included students not doing the course.

- *Approaches to conflict management.*
- *Quality of contributions.*
- *Weekly summaries"*

The intermediate reports did encourage the student to do some basic reflection. The main reflection however that encompasses an academic evaluation was the final report that encouraged the students to thoroughly rethink their actions within the group. The following instructions were given approximately one week before the end of the assignment:

[T]he last report must be an individual report. In any case, it must contain answers to the following questions (you can use these questions as headlines for sections):

1. *When and what were the (at least) two social events?*
2. *Do you think that these events have been suitable for team building?*
3. *Is the team strong enough to do a software project (as in the case study)? If not, why not?*
4. *Assume that the budget of the software company allows only a team of five people, which four other people of your group would you choose?*
5. *Assume that the software project is to be done by only two people. Which other member of your group would you prefer to work with? Why?*
6. *Were there any team members whose contributions to the team's coherence is positively outstanding?*
7. *Do you think that some group members have not been properly integrated?*
8. *Do you think that some group members did not want to be properly integrated?*
9. *Did you feel excluded from group activities?*
10. *This assignment, as you know, is about working relationships and not making friends. Anyway – did you make new friends in doing this assignment?*
11. *What do you think was your most useful contribution to the group?*
12. *If you had to start the assignment again – would you do it differently? Did you learn something from it?*
13. *What was the biggest problem in your group and what did you do in helping to solve that problem? Was the problem solved?*

In order to emphasize on the importance of this last report, a paragraph about the marking scheme was added that include the sentence:

Reflection means that you have a clear understanding of the group's coherence and how it could be improved. The questions above should help you in doing this reflection.

Before we discuss how this assignment leads to the envisaged learning outcomes we introduce the theoretical underpinning of our approach.

WHAT IS CULTURE: ISSUES AND FRAMEWORKS

In this section we discuss the theoretical underpinning of cultural issues in the context of the student activity outlined earlier. Here we closely follow Smith et al. (2004), where similar research on cultural dimensions has been used for web localisation design. A number of researchers have previously attempted to define the various dimensions of culture through empirical research. Hall (1976) for example distinguished cultures on the basis of a way of communicating along a dimension from "high-context" to "low-context". A high-context communication is one in which little has to be said or written because most of the information is either in the physical environment or within the person, while very little is in the coded, explicit part of the message. Trompenaars (1993) researched value dimensions and his work was spread over a ten year period with 15,000 managers from 20 countries representing 47 national cultures. In relation to learning styles, as pointed out by Engelbrecht and Natzel (1997), field-dependency is an additional cultural valuable factor that

varies across cultures. Field-independent individuals tend to be more analytical, impose their own structuring more on a situation, and be relatively less passive and global in their behavior (Ford et al., 1994).

In an educational context, i.e. student's understanding of working in a culturally diverse team we feel that Hofstede's (1991) dimensions of culture are the most appropriate as they directly relate to well-known problems that teams in software development typically encounter. Hofstede conceptualized culture as "programming of the mind", in the sense that certain reactions were more likely in certain cultures. Hofstede carried out a study of 116,000 IBM employees distributed through 72 countries using 20 languages in 1968 and 1972. The study was based on a rigorous research design and systematic data collection. He proposed that all cultures could be defined through three dimensions:

- power distance (PD), the degree of emotional dependence between boss and subordinate,
- collectivism/individualism (IC) integration into cohesive groups versus being expected to look after him/her self,
- femininity/masculinity (MF), which could be interpreted as toughness versus tenderness

In later research Hofstede recognized that, for Western cultures there was another important dimension:

- uncertainty avoidance (UA), the extent to which members feel threatened by uncertain or unknown situations;

and for Eastern cultures:

- long term Confucian orientation, which represented a philosophy of life that was prepared to sacrifice short-term results for long-term gain. This dimension does not discriminate across all cultures in the same way as the dimensions given above. It has been suggested that it discriminates between environment-centric cultures and human-centric cultures (i.e. the "West").

In the wider context of Computer Science Hofstede's dimensions have been applied in a number of contexts. For instance Marcus and Gould (2000) addresses Hofstede and they present guidance for each of Hofstede's dimensions based on a theoretical analysis of websites. Hofstede's work has also been influential in the area of information systems development research (e.g. Merritt and Helmreich, 1996). Rathod and Miranda (1999) found for example evidence that high PD produced high emotional dependence but low task dependence for tele-working.

A closely related concept to Hofstede's individualism-collectivism dimension is Rotter's (1966) locus of control (LC) which refers to whether individuals tend to feel that events are the result of their own actions (internal locus) or the effect of the external environment and powerful others (external locus). It has been suggested that LC influences information-seeking behavior so that "internals" seek more information in problem solving, although the strength of this behavior depends very much on the situation. However when individuals adopt an "external" approach they might not generalize or learn effectively. They learn less because they believe they do not control the relationship between their behavior and reinforcement. It has been hypothesized that externals would suffer depression and anxiety as a result of poor achievement outcomes whereas internals would exhibit more "planful" behavior. For example in Western cultures planning and actualisation is frequently endorsed, whilst in collectivist societies there is less emphasis on having plans that work well, and more upon personal relationships and their causal reasons. This can have many effects including the belief a person has in his or her ability to accomplish computer tasks (Langford and Reeves, 1998). The context of the student activity described earlier is clearly in the Western culture and it focuses on software development (an analytical task involving planing). Thus it is a dedicated learning outcome to work in a team that materializes all of Hofstede's dimensions (PD, IC, MF, UA). In contrast the learning target in respect to LC is to encourage students to adopt an "internal" approach (as described above) for problem solving. For clarity we choose to focus in this paper only on PD; IC, MF and UA as the dimensions of culture, but we should keep in mind that LC and possibly other aspects of culture are as well part of the student experience.

LEARNING TARGETS AND CULTURAL DIMENSIONS

Whilst the main source of identifying the students' *actions* during the assignment are their contributions on the discussion board the students' reflections and even more their own cultural background is better identifiable in the final reports that the students submitted. The questions have been designed such that they closely link to Hofstede's dimensions as we will go on to show. We demonstrate the relationships in more

detail by referring to the responses of the students within their final report. All quotations given below are from these final reports.

Question 1 & 2. The responses to the questions *"When and what were the (at least) two social events?"* and *"Do you think that these events have been suitable for team building?"* are related to all of Hofstede's dimensions. Social events that are just allowed to happen may indicate a low UA. By contrast, some groups chose to meticulously plan their events and therefore may well indicate a culture of avoiding uncertainty at all costs. Similarly, we see also an implicit illustration of PD (is the idea of a strong team an egalitarian one?) and IC (is the idea of a strong team a true co-operative or a collection of talented individuals?) in their responses. MF related issues are also significant here: A male only group chose Go-Karting and Paintballing as their social events. These events carry a "tough" male connotation. However, a group that had one female member only chose to play football that as a consequence excluded the female member from that social activity. The social activities that were chosen the most often were Bowling and going to the local Coffee Shop. Three groups did choose more "tender" (using Hofstede's terminology: feminine) events, that try to build a team by playing games that explore each other's ethnic background or their suitability for a software project (following the wording of the case study). It should be noted that of these three groups two had female leaders while one was dominated by two males. We see here that we should not rush to judgement by seeking to relate MF to gender. "Masculine" events may discriminate against feminine members, but we see the opposite phenomenon as well: The events of a group that did focus on feminine events (understanding each others ethnic background) were described as "childish" by one of the group members.

Question 3. In their responses to the question *"Is the team strong enough to do a software project? If not, why not?"* many students (encouraged by the wording of the question) freely acknowledged that the team is not suitable (despite successful events) as a software team. However the reasons we find in the students' responses are distributed across the dimensions of IC (*"If we cant meet up for social events how would we be able to complete a software project"*), PD (*"we do not have a team member that has a characteristic of a leader"*) and UA (*"Again within the social events, due to time limitation, we could not assess each others IT skills, so when it comes down to who does what in the software development stage, there might be a slight dilemma"*). Note that whether or not the team is considered strong enough we may deduce the level of UA from the respondents answer. If the respondent refers to the teams strength based on the level of (its creative) freedom of the individual team members we may deduce a low level of UA. In contrast, an answer that equates the team's strength with the level of organization achieved indicates a high level of UA. Based on this straightforward analytic approach we find that 38% of all responses show a high level of UA while 43% of the responses indicate a low level of UA (the remaining 18% refer to responses where the level of UA could not be determined).

Question 4, 5, 6. Question four, five and six ask the student to name other team members and somehow to discuss their (positive) contribution to the team. Question five *"Assume that the software project is to be done by only two people. Which other member of your group would you prefer to work with? Why?"* shows different views on PD. While some of the students selected an individual for egalitarian approach (*"Her personality is of a friendly attitude which helps when it comes to communication"*) others chose the team leader (*"I would like to work with R.. who has a good leadership role"*).

Question 7, 8, 9. Questions seven, eight and nine asked students to identify members that may not be fully integrated into the group's normative dynamics. Question seven provides a reflection from a neutral point of view (*"Do you think that some group members have not been properly integrated?"*). Question eight then seeks to identify the responsibility of this possible non-integration (*"Do you think that some group members did not want to be properly integrated"*), and question nine (*"Did you feel excluded from group activities?"*) takes a different point of view. These questions are clearly related to Hofstede's IC dimension since an individualistic view will tend to make the individual responsible for the non-integration whilst a collective view rather assumes that it is the problem of the *team* that was unable to integrate the member. An analysis of the answers to question eight in respect to IC gives that 25% of the responses indicate a collectivistic view while 43% of the responses show an individualistic cultural dimension (in 32% of the reports the IC cannot be determined).

Question 10. Question ten *("This assignment, as you know, is about working relationships and not making friends. Anyway – did you make new friends in doing this assignment?")* is a subtle way to get insight in PD. Especially the interpretation of the term "friends" varies widely in the student groups. Formulations like *"I will also stay in touch with [...]"* and the like often show thoughtful consideration. A systematic evaluation of the answers in respect to PD show that 26% show a high level of PD (i.e. they appreciate a distance between the "leader" of the group and the other members) whereas 60% indicate a low level.

Question 11 & 13. The answers to question eleven *("What do you think was your most useful contribution to the group?")* frequently elicited evidence about the UA dimension. A focus on intellectual contributions, or responsive participation *("I attended all the meetings which took place every Wednesday")* may indicate that the individual is able to cope with a high amount of uncertainty while a high proactive behaviour showed that uncertainty should be avoided at all cost *("I undertook the responsibility and orchestrated the majority of the groups meetings")*. Question 13 *("What was the biggest problem in your group and what did you to solve that problem? Was the problem solved?")* is very much in a similar spirit.

Question 12. Finally, question twelve *("If you had to start the assignment again – would you do it differently? Did you learn something from it?")* allows us to collect statistical evidence about the success of the assignment. Of the group of 145 students that have submitted a final report two third (67%) responded in fact that they did learn something. Only four students (3%) responded negatively, however all of these four students acknowledged that they had already experience with team work (in a real life situation). The remaining 30% do not explicitly answer that question. The question *"Would you do it differently"* has been answered in the positive by 70% of the students. A closer look shows that 92% of the students explicitly acknowledge that they either did learn something or would do things differently. We see this figure as a success as that shows that these students identified their own behaviour as not being optimal and chances are good that they will show a different, possibly more appropriate behaviour in a real life situation at their future workplace. Obviously the learning outcomes have been met by these students, but the answers vary in the details given: Some address a different way of time management *("Of course, the main thing I will do is how to organize the time, that because we had a problem in organizing the time before")* others question their own social behaviour *("I would probably put a little bit pressure on some members and wouldn't be so trustful.")*, or make fundamental observations about basic team skills *("I have learnt from this assignment that good communication skills and enthusiasm has got to be at the heart of each of the team members, [...]")*. The open structure of the assignment that gives the students a high level of freedom on how to solve their tasks evidently shows here its strength.

CULTURAL PROFILE OF GROUPS

The relationship between Hofstede's cultural dimensions and the responses from the students can be used to visualize the group's dimension by means of a cultural fingerprint as introduced by Smith et al. (2004). Based on the responses to the questions as described in the previous section each answer is rated using an ordinal scale (from 0 to 10) for each dimension (for instance a high score for the IC dimension indicates a high amount of individualism). If the student's response does not provide enough information for a particular dimension no score is assigned to that dimension for that question. Each dimension is rated separately by the experimenter. The scores are averaged over the questions. Averaging across the individuals in a particular team then leads to the generation of the cultural fingerprint.

In the following Figure 1 reproduced below we seek to illustrate this process using the example of the group B1. In this group six members have submitted a final report (we will refer to them as A, C, E, I, N, and K). For instance, K's report contains only very short answers that allow to assign a score of 6 for IC. In contrast the reports of C, E, I, and N are very detailed. C's responses to any of the questions (except Question 9) carry enough information to add a score to at least two dimensions. When averaging over the scores obtained we identify a rather high level of UA. This correlates with the fact that C was the most proactive member within the group and adopted an implicit team leader role. In Smith et al. (2004) cultural fingerprints are developed that relate to companies (via their web presentation) and to specific target audiences within a number of different countries. Matching these to our team-related fingerprints we may therefore effectively

deduce the suitability of this team for a particular context. In our example, we find that the group B1 is overall well balanced in the dimensions IC, MF, and UA. We see also that the PD score of 3.0 is relatively low, so in a real life situation the team may be most effective in a company that implements flat hierarchies. The absence of extreme values both for the individual team members and for the group indicates that the group is well equipped for a variety of tasks, or as C concludes in his final report: *"[...] with a little bit more focus and effort, the team members could make a very successful contribution to any team in any company they might choose work with in the future."*

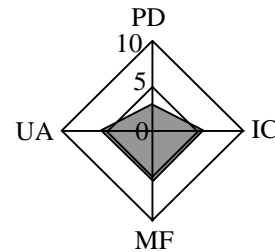| Group B1		PD	IC	MF	UA
Hofstede scores by individual	A		6	8	6
	C	4.6	5.7	5.1	6.7
	E	2.7	4.1	4.3	4.7
	I	2.3	8	4.4	5.3
	N	2.7	3.3	3.6	4.8
	K		6		
Group Score		3.0	5.5	5.1	5.5

Figure 1: Hofstede scores for the individual team members and for the full group B1. Right: Cultural fingerprint of the group according to Smith et al. (2004)

We find below in Figure 2 a contrasting situation in group B2 with the team members B, G, H, L, M, and Y (Figure 2). From an analysis and individual rating of the individuals' contributions to the discussion board this group seems to be relatively happy and successful. A closer analysis that follows our approach outlined above shows a different picture. The two most proactive members M and H have a high score on PD, but quite opposite values for IC. In addition, all of M's scores are different from the other team members. This is clearly visible in the two fingerprints in Figure 2. We may therefore conclude that in a real life situation this team may face difficulties due to cultural tensions.

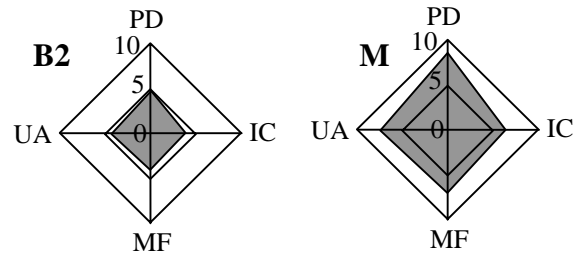| Group B2		PD	IC	MF	UA
Hofstede scores by individual	B	3.9	3.4	3.6	4
	G	2.7	4.1	4.4	4
	H	9	2.7	2.6	4.6
	L	4	3.8	6.1	3.4
	M	8.3	6.7	7.3	7.4
	Y	2.1	3.5	2.2	4
Group Score		5.0	4.0	4.1	4.6

Figure 2: Hofstede scores for the individual team members and for the full group B2. Middle: Cultural fingerprint of the group B2, Right: Cultural fingerprint of M.

CONCLUSION

In a future world where software is increasingly being developed as joint projects between continents and across cultural and ethnic borders using electronic mediation we feel it is highly desirable and indeed necessary that students are fully prepared for working within this e-culture environment. Although Hofstede's taxonomy was originally intended to inform us about individual differences with respect to country of origin, we choose here to establish and verify its worth with respect to mixed ethnic groups working collaboratively with e-mediated tools.

Our results appear to demonstrate that Hofstede's taxonomy does indeed enables us to coherently describe an individual's cultural orientation and contribution to group outcomes. Hence, we claim that it is crucial that in designing and delivering any teaching strategy that seeks to prepare students to work in an e-mediated team is theoretically underpinned by Hofstede's dimensions PD, IC, MF, and UA or a similar cultural model.

In this paper we have seen that an assignment that is founded on a well established cultural theory can be successfully performed by means of a virtual learning environment, indeed it is the virtual learning environment that specifically enables us to probe and gather evidence in support of the theory and mediates much of the student's activies.

Cultural orientation as defined by Hofstede influences human communication at many levels, not all of which have been measured or articulated in our present study. E-mediation influences human communication in ways that we are only just beginning to understand. Hence we plan to evolve a more elaborated variant of Hofstede's taxonomy that is customized for an e-mediated group setting based on the rich responses gathered in this study. Further work will also include a systematic characterization of the cultural dynamics at the group level of abstraction (rather than on the individual level as in this study) as seen in the case study. This would eventually provide a powerful mechanism to exhibit the probability of success of a virtual team for a given task depending of the cultural "fingerprint" of the group.

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