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Cultural Diversity, Leadership, and Collaborative Learning Systems: An Experimental Study

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ABSTRACT

Collaborative learning systems (CLS) have received increasing research attention owing to advances in technology as well as paradigmatic shifts in the educational arena. This paper reports on a laboratory experiment with a 2X2 factorial design, conducted to investigate the effects of cultural diversity and leadership within a CLS context. The dependent variables were individual learning performance, satisfaction with process and attitude towards the CLS usage. Leadership was found to have a positive effect on performance; however, it lowered learners' satisfaction with the process because it narrowed the openness of the discussion in the collaboration process. As compared to the culturally homogeneous groups, a more positive attitude towards CLS usage was observed in the culturally heterogeneous groups.

1. INTRODUCTION

The basic premise of collaborative learning is that learning emerges through shared understandings of multiple learners (Leidner and Jarvenpaa, 1993). Collaborative learning systems (CLS) are computer-supported systems for facilitating collaborative learning. CLS have received much research attention, as educators ponder upon the potential of collaborative learning environments. A substantial body of empirical evidence demonstrates that computer-mediated cooperative learning tended to have positive impacts on learning (Yu, 2001).

We posit that issues surrounding CLS cannot be adequately addressed without considering pertinent contextual factors. Whereas there may be a myriad of relevant factors, this paper focuses on two, cultural diversity and leadership. A most striking feature of today's classroom is the cultural diversity of the student body. Such diversity adds complexity – beyond individual differences in behavior in groups – to understanding group learning behavior and processes (Murphy, 1996). In this study, cultural diversity is treated in terms of national cultures. Hofstede (1997) has defined national culture as the collective programming of the mind which makes the inhabitants of one country distinguishable from another.

Heterogeneity in national backgrounds, which are by nature less prone to the "groupthink" (Janis, 1982) syndrome, is expected to bring together a wider variety of skills, beliefs, values and experiences, and therefore generate high quality solutions. Notwithstanding this, there are aspects of culture that can impede collaborative learning particularly in the short term; these include language, cognitive style and learning style (Geneva, 1978). The question on the net effect of cultural diversity remains an empirical one.

The second factor of interest to this paper is leadership. Studies of distributed groups suggest that team leadership is crucially significant (Hiltz et al., 1991). In this paper, leadership is defined as the exercise of influence, (the activity of influencing people to cooperate towards a common goal (Tead, 1935)), with which the communication dimension of effective leadership aligns (Kayworth and Leidner, 2001). The role of a leader here is to keep the group focused on the assigned learning task, and make sure that all members of the group have an opportunity to participate in the collaboration (Skala et al., 2000).

There are interrelations among leadership, culture, and teamwork effectiveness (Snow et al., 1996). As shown by Hofstede's (1997) work on cultural dimensions, particularly "power distance", it is fairly evident that different cultures may react differently towards leadership. Correspondingly, this study looks into the joint effects of cultural diversity and leadership.

2. RESEARCH MODEL AND HYPOTHESES

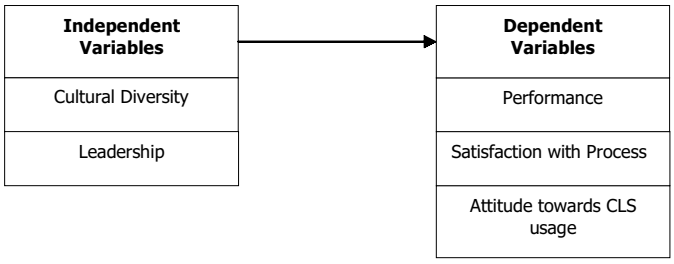
2.1 Dependent Variables

Figure 1 depicts the research model. Facets of CLS usage can be assessed by various outcomes achieved by individuals after using the system. The performance variable refers to the learning outcome measured using exam result (Susman, 1998). The satisfaction variable is about the collaboration process. Attitude towards CLS usage is an important gauge of how well (or positive) the learner has accepted the CLS technology. How positive or negative an individual is about a technology would be strongly indicative of whether he will eventually adopt it.

2.2 Hypotheses on the Effect of Cultural Diversity

A direct consequence of cultural diversity is communication distortion as basic modes of communication differ among people from different national, cultural backgrounds (Chidambaram, 1992). Such communication distortion is likely to affect learners' social component[1] of understanding and hence decrease their performance. However, the CLS technology has the potential to help the communication better accommodate cultural diversity (Chidambaram and Kautz, 1993). A commonality among collaborative learning technologies is they allow important communication features that are radically different from the face-to-face setting; prominent examples include parallelism and group memory (Nunamaker et al., 1991). For example, words "spoken" can be revisited for a second and hopefully more accurate interpretation.

Figure 1. Research model



These features are expected to enhance learning effectiveness. The negative effects of cultural differences are reduced, if not eliminated, by computer-aided systems, as learners of different cultures gain more accurate understanding of each other. Thus, with the aid of CLS, the potential strengths of heterogeneity in cultural diversity can be optimized and cause the learners in heterogeneous group to outperform those in homogenous groups.

H1a: Learners in heterogeneous groups will achieve better performance than those in homogeneous groups.

The CLS technology is expected to pervade the communication process, thus minimizing the influence caused by cultural diversity. As far as the process is concerned, we therefore anticipate the heterogeneous groups and homogeneous groups to be equally satisfied.

H1b: There is no difference in learner's satisfaction with process between heterogeneous groups and homogeneous groups.

Learners in heterogeneous groups are proposed to be more positive towards CLS usage because the system makes their communication with members of different cultural backgrounds easier as compared to their previous experience in face-to-face setting. In the case of homogeneous groups, since members would not encounter communication barriers even in a face-to-face setting, they would not appreciate CLS to the extent their counterparts in the heterogeneous groups would.

H1c: Learners in heterogeneous groups will exhibit more positive attitude towards CLS usage than those in homogeneous groups.

2.3 Hypotheses on the effect of leadership

Leadership has been found to affect, through the leaders' influence acts, the performance and satisfaction of group members in a computer-mediated environment (e.g., Lim et al., 1994). Leader of a learning group takes the responsibility for keeping the group focused on the assigned task and ensuring that all members have an opportunity to participate during the collaborative learning session. Such centralized leadership tends to better group members' performance (Napier and Gershenfeld, 1985).

H2a: Learners in groups with a leader will achieve better performance than those in groups without a leader.

Morale of group members tends to drop in groups with a leader (Napier and Gershenfeld, 1985). Since the leader exercises greater influence than other members, he naturally becomes the dominant member of the group. Consequently, other members gain less access to participation as compared to the leader, and the discussion becomes less open. Therefore, group members have lower satisfaction with the collaboration process in groups with leadership compared to those in groups without leadership.

H2b: Learners in groups without a leader will gain higher satisfaction with process than those in groups with a leader.

3. RESEARCH METHOD

3.1 Experimental Design

A laboratory experiment with a 2X2 factorial design was conducted. In this experiment, each learning group consisted of three members, two of whom were confederates. The use of confederates was instrumental in the manipulation of the two independent variables. It is worth pointing out that learning outcomes were studied at the individual, as opposed to group, level; the use of confederates did not pose an obstacle in this regard. Confederates' participation strictly followed a script designed for each treatment. Subjects were checked using a post-experiment question on whether there was any detection of confederates. Two that showed possible detection had their data discarded.

Forty three subjects from a large university participated in the experiment, yielding forty usable data points. All of them were foreign students who came from China to attend a university in Singapore under a scholarship program. In the heterogeneous groups, two confederates acted as local students. While in the homogeneous groups, they acted as foreign students under the same scholarship program as the subjects. All sessions were conducted in English. Based on prepared scripts, the same confederates appeared in one role or the other accordingly in all sessions; essentially, the different roles (local or foreigner) were manifested by designing into the scripts distinguishable use of the English language (Romaine, 1994). The content of the scripts remained comparable for all treatments.

A subsequent interview was conducted to investigate how the subjects perceived the cultural diversity in their respective groups. The results showed a high match (87.5%), thus the manipulation of variable cultural diversity was considered effective.

In treatment groups with leader, one confederate acted as the leader and the other a normal group member. The leader made sure that all members had an opportunity to participate. On the other hand, both confederates in treatment groups without leader acted as normal group members. Manipulation check on the leadership treatment was performed through observation of the discussions.

3.2 CLS

A collaborative learning system was developed involving a science lesson about identifying poisonous mushrooms (Cooper and Stone, 1996). There were three components of the system, reading materials, online quiz, and chat-room. The chat-room facilitated exchange of ideas among group members during the collaboration session.

3.3 Experimental Procedure

Prior to the experimental session, the subject completed a questionnaire aimed at ensuring no pre-experimental differences in terms of computer experience (Hilmer and Dennis, 2000) and collaborative learning (Ross, 1996).

Next, the subject learnt the course material in an individual capacity and took a quiz consisting of both multiple choice and short essay questions relating to the material. The purpose of this step was to ensure that the subject had undergone learning of the topic before the group discussion. The subject then discussed with the other two members (confederates) on the quiz in the chat-room for an hour. For all sessions, the subject was not aware of who and where the other two group members were. To encourage the subject to participate actively in the collaboration, he was reminded that the average of the group performance would be measured. After the discussion, the subject was allowed to modify his answers to the quiz. The answers were then evaluated to measure the performance variable.

Finally, the subject answered a questionnaire on satisfaction with process (Nulden, 1999) and attitude towards CLS usage (Leuthold, 1999).

4. DATA ANALYSIS

The results of factor analysis and reliability test reveal that the questionnaire was a good indicator to measure satisfaction with process and attitude towards CLS usage. The ANOVA model was used to detect significant effects; for each observed significant effect, a subsequent one-sided t-test was conducted to check the related hypothesis. A 5% level of significance was used in all tests. Table 1 summarizes the descriptive statistics. Table 2 presents the results of the hypothesis tests.

The main effect of leadership on attitude towards CLS usage was not hypothesized, yet a significant effect was detected. Users in groups without a leader reported more positive attitude towards CLS usage ($F=19.21$, $p<0.01$).

Correlational tests were performed on satisfaction and attitude. In general, the result was intuitive: higher satisfaction with process corresponded with more positive attitude towards CLS ($r=0.58$, $p<0.01$). Breaking the data according to treatment conditions, however, showed a positive correlation ($r=0.53$, $p<0.05$) in groups with leadership but no correlation in groups without leadership. These findings seem to indicate that the concomitance occurred in the lower ranges of values pertaining

Table 1. Results: Mean (standard deviation, number of groups)

Cultural Diversity	Dependent Variables	Leadership		Total
		With Leader	Without Leader	
Heterogeneous	Performance	6.40 (1.43, 10)	4.60 (1.35, 10)	5.50 (1.38, 20)
	Satisfaction with process	3.05 (0.65 10)	4.05 (0.71, 10)	3.55 (0.84, 20)
	Attitude towards CLS usage	3.63 (0.43, 10)	4.28 (0.48, 10)	3.95 (0.55, 20)
Homogeneous	Performance	6.10 (1.10, 10)	4.50 (1.35, 10)	5.30 (1.45, 20)
	Satisfaction with process	3.08 (0.88, 10)	4.00 (0.37, 10)	3.54 (0.81, 20)
	Attitude towards CLS usage	3.05 (0.88, 10)	4.03 (0.43, 10)	3.54 (0.84, 20)
Total	Performance	6.25 (1.25, 20)	4.55 (1.32, 20)	5.40 (1.53, 40)
	Satisfaction with process	3.06 (0.76, 20)	4.03 (0.56, 20)	3.54 (0.82, 40)
	Attitude towards CLS usage	3.34 (0.74, 20)	4.15 (0.46, 20)	3.74 (0.73, 40)

Table 2. Summary of hypothesis tests result

Hypothesis	ANOVA	T-test (if ANOVA results reveal significance)	Conclusion
H1a: (Performance) Heterogeneous > Homogeneous	Not significant		Not Supported
H1b: (Satisfaction with process) Heterogeneous = Homogeneous	Not significant		Supported
H1c: (Attitude towards CLS usage) Heterogeneous > Homogeneous	Significant (F=4.95, P<0.05)	Confirmed (p<0.05)	Supported
H2a: (Performance) With leader > Without leader	Significant (F=16.73, p<0.01)	Confirmed (p<0.01)	Supported
H2b: (Satisfaction with process) With leader < Without leader	Significant (F=19.96, p<0.01)	Confirmed (p<0.01)	Supported

to the two dependent variables; beyond a certain level, more positive attitude does not guarantee greater satisfaction.

5. DISCUSSION

5.1 Performance

In spite of the reasoning that heterogeneous groups were availed a wider variety of information and understandings contributed by members, and hence should have improved quality of learning, no significant difference in individual performance was found between heterogeneous and homogeneous groups. Quite likely, the detectability was hindered by the small group size used in this study. As diversity is propositional to group size, future research should look into this issue towards uncovering the "critical value" of group size beyond which a culturally heterogeneous group can provide sufficient diversity to effect a positive change in performance.

In collaborative learning, learners learn by recognizing flawed reasoning from each other during the discussion. This highlights the criticality of the discussion session with regard to an individual's learning process. In this study, leaders helped ensure that every member had a chance to express his opinion and understand others' during the discussion. Consequently, group members could achieve better performance because the social component of their learning was enhanced. Hence, leadership had a positive impact on performance, as found in this study.

5.2 Satisfaction with Process

In face-to-face collaborative learning without CLS, learners in heterogeneous groups may suffer from communication distortions which make the communication more difficult and less efficient, thus bringing detrimental effects to one's satisfaction with the process. However, as in the context of this study, CLS had the capability of making "visible" the communication pattern. The ideas contributed were displayed (not just uttered) and learners could gain a better understanding of these. With the aid of CLS, the undesirable elements in communication within heterogeneous groups were eliminated. As a result, learners exhibited no significant difference in satisfaction with the learning process in both heterogeneous and homogeneous groups because neither posed visibly difficult learning processes.

Leadership had been found to affect, through the leaders' influence acts, the satisfaction of group members. The scripted guidelines provided by the leader in the discussion had negative effects on group member's morale and their participation because members appeared to perceive that they could only express their opinions when they were asked to do so. Consequently, learners had lower satisfaction with process when there was a leader.

5.3 Attitude towards CLS Usage

Learners in heterogeneous groups benefited from the anonymity feature, electronic recording, and display capabilities of CLS, which helped mar the diversity in terms of communication. A positive attitude was resulted. Comparatively, the advantage of CLS in homogeneous group was much less apparent; consequently, a less positive attitude towards CLS usage was reported.

Results showed that learners in groups without leadership generated more positive attitude towards CLS than those in groups with leadership. A possible explanation for this finding is that learner's attitude was influenced by his satisfaction with the process. Both satisfaction with the learning process and satisfaction with the learning outcome have been previously found to impact on learners' perception about computer and communicational technology usage and hence affect their attitude accordingly (Gardner et al., 1993). In this study, consistent findings were obtained in the CLS context.

5.4 Implications

Empirical evidence can be used to develop practical guidelines to better assist in structuring learning environments (Yu, 2001). CLS make collaborative learning in heterogeneous groups more efficient by smoothing the communication process. CLS are therefore expected to play an important role in virtual learning teams with members of various cultural backgrounds. Moreover, system developers should consider providing multiple interface designs to cater to groups of different language backgrounds. As well, learners have greater performance in groups with a leader albeit enjoy less during the process. This highlights the role of leaders in collaborative learning for bettering performance. Where practical and feasible, all members can take turns to assume the leadership role so as to increase their overall satisfaction with and commitment towards the collaboration process.

6. CONCLUDING REMARKS

Leadership had positive impact in terms of performance. In general, this finding tallies with the leadership literature that "groups with centralized leadership tend to organize more rapidly, be more stable in performance, and show greater efficiency" (Napier and Gershenfeld, 1985, p.49). Future research should look into ways to mitigate the negative influence of leadership on satisfaction and attitude towards CLS usage.

The current research has defined cultural diversity exclusively in terms of nationality; however, more factors should be taking into consideration for future studies. Two examples are time and degree of heterogeneity. First, cultural diversity may be affected by the time factor. Although cultural background of a person is mainly inherited from the society where he originates from, it can change with time when he moves to a new society. Next, the concept of cultural diversity can be more precisely calibrated in terms of the extent of variety of cultures embedded in a given team. Group size and composition are the implicated aspects.

ENDNOTE

[1] There are two components of understanding, personal component and social component. Understanding in the personal component depends on the previous knowledge used by the learner to interpret new information (Jenkins, 1974). Understanding in the social component is built up through conversations with other individuals about the subject matter (Pask, 1976).

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