

Active Teaching and Learning Systems for Multicultural Educational Environments

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Abstract

Multicultural education environments can enhance students' learning experiences; however, they bring challenges to teachers as students from different cultures may have different approaches to learning and engagement with activities and resources. This paper reports the results of a study that explored computing students' use and satisfaction with technology-supported active learning systems based on their cultural backgrounds. Postgraduate IT students in an Australian university were surveyed using a questionnaire. Three cultural orientation dimensions of Hofstede (power distance, uncertainty avoidance, and individualism/collectivism) were used to investigate how cultural background may influence the use and satisfaction with active learning in class and outside class. The results showed that there were some differences between students from Eastern and Western cultures in their satisfaction with an active learning activity (Peer Instruction) and their use of resources to support active learning.

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Introduction

Over the last two decades, there has been a dramatic increase in the use of technology in higher education. Technology is used to provide wider access to education, offering flexible and convenient ways of learning and teaching through the provision of online resources, activities, and courses. Another important use of technology in education is to enhance learning experiences through the development of innovative and engaging activities and resources. The opportunities afforded by these technologies have also supported new pedagogical approaches. A recent trend has seen an emphasis on *active learning* approaches that are grounded firmly in the learner-centered and constructivist (Ben-Ari, 1998; Deslauriers et al., 2011; Freeman, et al., 2014; Hartikainen et al., 2019) education philosophies. There are many studies of active learning in computing courses that indicate active learning can provide interesting and engaging experiences for computing students working in and out of the classroom (for example, Elliot, 2014; Färnqvist et al. 2016; Freeman et al. 2014; Hayashi et al. 2015; Ratan et al. 2022). However, there are also indications that not all students benefit from active learning approaches. Students may not be motivated by or feel comfortable with active learning leading to less effective learning and less than satisfactory teaching experiences for educators. Students working in online environments can feel confused, isolated, and frustrated (Zaborova & Markova, 2016; Ni, 2013).

There are a number of reasons for different responses to active learning. These may relate to the students, teachers, or the environment. An important consideration is that students from different cultures and educational backgrounds may have different learning strategies and expectations of their teachers (Liu, 2007). Another reason is that students from different cultures can respond differently to different teaching situations (Au, 1993; Gay, 1988; Ladson-Billings, 1992). For example, students from countries in the association of South East Asian Nations (ASEAN, 2018) appear to be more passive in their search for knowledge compared to students from Western countries (Burns, 1991; Renshaw & Volet, 1995). Balta et al. (2017) stated that Peer Instruction was affected by the culture of the country. It is essential to understand how students from different cultures respond to active learning resources and approaches to enable educators to employ these approaches most effectively.

The aim of this research is to explore students' use and satisfaction with active learning systems and compare their responses based on their cultural background. We compare the responses of students from Eastern and Western backgrounds as previous work has shown that Eastern and Western learners have different study approaches and characteristics that require different support in learning (Boondao et al., 2009). For the purpose of this study, the term "Eastern" is used to indicate Asian countries, such as China, Vietnam, Malaysia, Indonesia, Korea, and other countries influenced by Asian cultural value systems. The term "Western" is used to indicate the countries influenced by European cultural value systems.

Active Learning in Higher Education

Active learning is a broadly used term; however, Sanders et al. (2017), drawing from a review of active learning research, define active learning as having two key elements: students actively undertake an activity and they have the opportunity to think and/or reflect about their learning as part of the process, for example, flipped, problem-based, cooperative, collaborative, and peer learning. Peer interaction is a method of students learning from each other (Boud et al., 1999). It is an active learning method used to help students understand the core concepts of a topic and promote deep understanding (Mazur, 2022). Peer Instruction involves students in collaborative problem-solving activities. It is one of the most extensive methods used in active learning in many countries with various cultural backgrounds. The aim is to engage students in explaining core concepts as they collectively attempt to solve problems (Simon & Cutts, 2012). In Peer Instruction, students are required to prepare for a lecture (e.g. by reading a textbook) and complete a pre-lecture quiz. The lecture is interspersed with, or largely replaced by, multiple choice questions and discussion. The questions are specifically designed to engage students in thinking about deep conceptual issues and discussion with their peers (Crouch et al., 2007; Morice et al, 2015).

Culture

In our study, we explored the cultural influences on students' use of technology-supported active learning resources and activities. Culture is an important factor to consider when studying the use of technology in education. A number of studies have shown that cultural background can influence the adoption and use of technology (Baptista, & Oliveira, 2015; Srite, & Karahanna, 2006).

Hofstede (1980) defined six cultural values dimensions that he used to distinguish different cultures. He proposed that these dimensions describe characteristics that have a significant impact on work style and workplace values. Hofstede's cultural values dimensions provide a valuable tool for understanding an individual's fundamental cultural orientation. In this research, we chose three of the six cultural values dimensions. These were the dimensions most related to the student learning environment and had the most impact on students' study behavior (Aparicio, 2016). The dimensions we used were:

- **degree of power distance**, indicating the extent to which a society accepts the fact that power in institutions and organizations is distributed unequally. In a high power distance society students are dependent on teachers and treat teachers with respect, both inside and outside class;
- **the degree of uncertainty avoidance**, indicating the extent to which a society tries to avoid uncertain situations by, for example, establishing more formal rules and believing in, and/or striving for expertise. In a high uncertainty society, students expect structured learning situations. They seek the right answers and expect that teachers will have these answers;
- **the degree of individualism**, indicating the extent to which relationships are based on loose social frameworks rather than on collectivism and when people are tightly integrated into primary groups, such as families and organizations. Individualism and collectivism are reflected in the learning styles of students. In individualistic societies, students are more likely to feel free to speak in class and are encouraged to think independently. In collectivism societies, students are not encouraged to express opinions and are expected to remember and recall what they have been told.

Methodology

This research used a survey method with a questionnaire to gather information about the student's cultural and educational backgrounds, their opinions of active learning, and their use of support activities and resources. The study was conducted in an Introduction to Databases course for Masters level students at an Australian university. All Masters level students are required to take this course if they have no prior study in IT.

The Database course applied active learning with Peer Instruction used in lectures. In addition, various online resources were provided to encourage active learning both in and out of class (online lecture slides, lecture recordings, online tutorial exercises, online textbook, and forum for discussion). The outside class materials help students engage in activities, e.g., reading, discussing, and writing which are related to active learning activities. The objective of this research is to explore the differences in students' satisfaction with active learning based on their cultural background. The research examines the cultural orientation differences among postgraduate students enrolled in an introductory database course that applied active learning activities in teaching.

Participants

The participants were postgraduate students enrolled in Masters programs in Information Technology, Business Information Systems, Network and Security and Data Science. The survey was conducted with 400 students who agreed to participate in the research.

Procedure

Students were assured of their anonymity and written consent for their participation was obtained. Questionnaires were distributed to the students who agreed to participate during their tutorial classes.

The survey questionnaire contained three sections. Section 1 was designed to obtain personal and educational background information. Section 2 comprised questions to determine a student's satisfaction with active learning, and their use of various support activities and resources. Section 3 was used to assess the student's cultural background which strongly affects learning style because culture-based educational experiences tend to influence the way learners participate in education. The cultural dimensions have also been linked by Hofstede (2010) to educational culture. In this research, three cultural dimensions of power distance, uncertainty avoidance, and individualism were investigated using a series of questions that were modified from Hofstede's Cultural Questionnaire (Hofstede, 2011). The questions for sections 2 and 3 required 5-scale Likert responses (*strongly agree, agree, neither agree nor disagree, disagree, strongly disagree*). As these question responses were on an ordinal scale the non-parametric Mann-Whitney U test was used to compare the responses of Eastern and Western students.

Results and Discussion

This section reports the analysis of the data collected from the survey.

Demographic profile

The majority of respondents (93%) were Eastern students with 58.5 percent being Chinese. The Western students (7%) included 3.3 percent who were Australian. Details of the ethnic background of respondents are summarized in Table 1.

Table 1. Ethnic background of respondents

Ethnic background	Number of respondents	Percent (%)
Eastern		
Chinese	234	58.5
Indian	107	26.8
Indonesian	6	1.5
Taiwanese	5	1.3
Bangladeshi	3	0.8
Malaysian	3	0.8
Pakistani	3	0.8
Vietnamese	3	0.8
Other Eastern	9	2.4
Western		
Australian	13	3.3
Other Western	13	3.3

The majority of students (90.6%) were aged between 22 and 25 with 80 percent aged between 22 and 25 years and 10.6 percent between 26 and 29 years. With regard to gender, 64.8 percent were male and 35.3 percent were female. Most respondents (87%) did not have a job while 13 percent had a part-time job. Around 94 percent were international students.

Educational background traditions

The survey showed a number of differences between Eastern and Western students' educational traditions. Most Eastern students (90.3%) indicated that the education tradition in their culture was teacher-centered and only a few (7.5%) claimed their tradition was learner-centered. In contrast, the Western students were equally divided with almost half (46.2%) claiming their tradition was teacher-centered and almost half claiming their tradition was learner-centered (refer to Table 2).

Table 2. Educational traditions of Eastern and Western cultures

Educational tradition	Eastern (%)	Western (%)
Teacher-centered	90.3	46.2
Learner-centered	7.5	46.2
Other	2.1	7.7

More than three-quarters (77%) of Eastern students claimed that rote learning was the activity that characterized the educational tradition in their culture while criticism and/or discussion was the activity in the Western students' educational tradition (38.5%). Table 3 shows the details of the educational traditions of Eastern and Western cultures.

Table 3. Characteristics of the education traditions

Characteristic	Eastern (%)	Western (%)
Rote learning	76.7	30.8
State your opinion	11.0	23.1
Critical discussion	7.2	38.5
Other	5.1	7.7

According to the results shown in Table 4, in situations when the students do not understand something in class, most of the Eastern students prefer to ask their classmates (83.1%) while asking their tutor was the most popular strategy with Western students (69.2%).

Table 4. Students' strategies for seeking help

What do students do if they don't understand?	Eastern (%)	Western (%)
Ask your classmates	83.1	57.7
Ask your tutor	66.2	69.2
Ask the lecturer after class	60.6	53.8
Write an e-mail to the lecturer	40.5	23.1
Ask the lecturer in class	38.9	38.5
Post a question to the class forum	19.8	23.1
Face-to-face meeting	16.6	11.5
Post a question to an online forum	11.5	3.8
Contact via social media	2.7	3.8
Telephone the lecturer	1.9	0.0

Cultural Background

The three cultural dimensions of power distance, uncertainty avoidance, and individualism were each explored using a series of questions. The results are shown in Tables 5, 6, and 7. The results have been aggregated to show the percentage of strongly agree (SA) and agree (A) responses and the percentage of strongly disagree (SD) and disagree (D) responses for each question. The responses to each question for Eastern and Western students were compared using Mann-Whitney U tests.

For the power distance items shown in Table 5, the differences in items 2, 3, and 6 indicate that Eastern students felt unequal to their lecturers when compared to Western students and preferred their classes to be conducted in a formal manner. For the uncertainty avoidance dimension shown in Table 6, Eastern students saw the lecturer as having responsibility for ensuring that an assignment is completed satisfactorily. Eastern students expect well-defined instructions from their lecturer in contrast to Western students who are more comfortable with less direction. In addition, they also felt that high achievement in learning brings honor and prestige to the family, whereas failure brings shame. The dimension of individualism/collectivism is shown in Table 7 which indicates that in a high collectivist society, students hesitate to speak up in larger groups (Hofstede, 1986; Hofstede et al., 2010). Eastern students claimed that being a member of a group is more important than being individual or independent so they prefer a tool that allows them to answer anonymously like peer instruction more than Western students.

Table 5. Students' ratings of the characteristics of the power distance cultural dimension

Power distance	Eastern		Western		U-Test	Sig (2-tailed)
	SA/A	D/SD	SA/A	D/SD		
1. I typically consider my lecturers to have wisdom.	85.6	2.1	76.9	0.0	4053	.121
2. I usually have a great deal of	91.2	0.8	88.5	0.0	3788	.038*

Power distance	Eastern SA/A	D/SD	Western SA/A	D/SD	U-Test	Sig (2-tailed)
respect for my lecturers.						
3. I feel my lecturers and I essentially equal.	73.7	7.2	34.6	26.9	2767	.000*
4. I think there should be express rules of conduct in every class that all students should follow.	66.5	4.1	53.9	15.3	4247	.259
5. I expect my lecturers to be recognized experts in the field in which they teach.	86.6	1.9	73.1	0.0	4294	.287
6. I am more comfortable when my lecturer conducts a class in a formal manner rather than informally.	53.7	13.6	30.7	34.6	3426	.009*
7. I think the quality of learning depends on the excellence of lecturers.	73.7	4.2	77.0	7.7	4604	.647

*Indicates difference is significant at $p < 0.05$

Table 6. Students' ratings of the characteristics of the uncertainty avoidance cultural dimension

Uncertainty avoidance	Eastern SA/A	D/SD	Western SA/A	D/SD	U-Test	Sig (2-tailed)
8. It is the lecturer's responsibility to choose the topic of any project or assignment.	62.2	5.7	46.2	3.8	4484	.491
9. I expect the lecturer to know the answers to any questions and topics in the unit.	70.5	6.5	73.1	7.7	4817	.952
10. It is the lecturer's responsibility to ensure an assignment is completed satisfactorily.	67.0	8.5	46.1	38.4	3576	.018*
11. There are different views on truth. Something may appear true to you but not true to others.	79.1	1.6	73.1	7.7	4403	.397
12. High achievement in learning brings honor and prestige to the family, failure brings shame.	57.1	16.6	30.7	38.5	3288	.004*
13. I tend to over-rate my own performance.	42.1	18.2	26.9	42.3	3497	.013*

*Indicates difference is significant at $p < 0.05$

Table 7. Students' ratings of the characteristics of the individualism/collectivism cultural dimension

Individualism/collectivism	Eastern SA/A	D/SD	Western SA/A	D/SD	U-Test	Sig (2-tailed)
14. Being accepted as a member of a group is more important than being independent.	54.9	12.1	23.1	15.4	3366	.006*
15. Group success is more important than individual success.	51.7	12.3	30.8	7.7	4007	.119
16. Being loyal to a group is more important than individual gain.	61.1	10.1	53.8	3.8	4641	.700

*Indicates difference is significant at $p < 0.05$

Active learning activities

In this section, we report students' satisfaction with Peer Instruction (an active learning system utilized in lectures) and their use of resources and activities outside class to support active learning. The results in Table 8 show that most students agreed that Peer Instruction helped their understanding of concepts introduced in

lectures. Peer Instruction involves students in collaborative problem-solving activities and most students agreed that the discussions helped them understand difficult concepts. Mann-Whitney U test results showed that there were no significant differences between Eastern and Western students in their satisfaction with using Peer Instruction in class. This indicates that both groups felt that Peer Instruction was useful for their study. However, more Eastern students claimed that they would like to have Peer Instruction in other units and the difference was significant. Table 8 shows the detailed results.

The results in Table 9 show the frequency of use of online resources to support active learning. These show that online lecture slides and tutorial exercises were the most used resources for Eastern students. The Eastern students also claimed these were the most useful resources for their learning. On the other hand, Western students used online tutorial exercises most often and claimed the exercises and online lecture recordings were most valuable for their study. The least used resource was social media. This is perhaps not surprising as it was not central to their learning in this course.

Table 8. Students' satisfaction with peer instruction

Item	Eastern		Western		U Value	Sig (2-tailed)
	SA/A	D/SD	SA/A	D/SD		
1. Peer instruction helps me understand the concepts of the lectures.	78.0	2.4	76.9	0.0	4419	.418
2. Quiz questions help confirm my understanding of concepts that are introduced in pre-lecture reading.	84.0	3.5	84.6	3.8	4583	.608
3. Discussing questions groups in class help me understand the more difficult concepts.	78.0	3.0	92.3	0.0	4585	.608
4. The group vote helps me easily participate in classroom.	61.2	4.8	65.4	7.7	4670	.737
5. I would like to have peer instruction in other units.	75.6	2.9	50.0	7.7	3299	.003*

*Indicates difference is significant at $p < 0.05$

Table 9. The frequency of using online resources to support active learning

How often do you use these resources?	Eastern		Western		U Value	Sig (2-tailed)
	ET/AET	AN/N	ET/AET	AN/N		
Online lecture slides	85.0	0.5	61.6	0.0	3835	.051
Online tutorial exercises	75.0	2.7	92.3	3.8	3417	.007*
Online text book	69.5	4.5	69.2	11.5	4789	.912
Lecture recordings	50.4	7.8	46.2	7.7	4791	.914
Online forum for discussion	33.2	20.9	38.4	30.8	4677	.749
Social media e.g. Facebook page	15.3	56.8	15.4	69.3	3787	.053

*ET = Every Time, AET = Almost Every Time, AN = Almost Never, N = Never

Conclusions

Active learning plays an important role in the learning environments of computing courses in higher education, helping students engage in their studies and learn more successfully. In this research, we explored three cultural orientation dimensions and their influence on students' satisfaction with using active learning in class (Peer Instruction) and outside class (various online learning resources). Although we found a number of differences in the cultural dimensions and educational traditions between the Eastern and Western students, there were no significant differences in Eastern and Western students' perceptions of the usefulness of active learning activities for their learning. We did find, however, that Eastern students had more preference for Peer Instruction in other courses. Additionally, we found that cultural dimensions related to how the students seek help when they do not understand something in class. The high percentage of Eastern students who prefer to ask their classmates shows their dependence on each other and perhaps indicates that they value being members of a group. This is well aligned with the collectivist cultural characteristics of Eastern students.

Both Eastern and Western students claimed that online tutorial exercises were the most effective way to learn. However, differences were found in the resources students used to learn outside of class, with Eastern students using lecture slides and Western students preferring lecture recordings. This suggests that in a multicultural

environment, it is helpful to provide learning resources in multiple formats. Our findings provide valuable implications for applying active learning tools suitable for students who come from different cultural backgrounds.

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