Students' Social and Behavioural Factors Influencing the Use of Lecture Capture Technology and Learning in Engineering Education

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Abstract

Context

In spite of wider acceptance of lecture capture, questions remain about how the level of difficulties of courses affects the use of lecture capture. Most researches were conducted on the students of health science, arts, general science, or business courses. Little evidence was found for engineering education. Very few studies have focused on the students' social and behavioral factors (e.g. language, cognitive skills, attention level, past experiences) influencing the use of lecture capture and students' achievements in engineering education.

Purpose

This paper presents the influence of the students' attitudes, social and behavioural factors on using lecture capture technology and their learning in engineering courses.

Approach

Both qualitative and quantitative approaches were employed to analyze the perception of the students of various engineering courses in an Australian university.

Results

Results show that social and behavioural factors like mind concentration level, language, and past experience have an influence on using the lecture capture technology. A significant number of students having difficulties in attention to lecture class rely on lecture capture for further understanding. Variation of using lecture capture has also been observed among native and non-native English speaking students, and among the students with different level of past experience of using lecture capture. Despite availability of lecture capture, most students preferred attending lecture classes because of high mathematical contents and the experiments shown in the classroom. The study also gives notional indication that the lecture capture might have helped engineering students for improving their academic performance over the past few years.

Conclusions

Overall, the students' perception of lecture capture is highly positive in terms of improving learning and academic performance regardless of their social and behavioural characteristics. Further research should focus on how the teaching pedagogy for engineering education can be improved through enhancing lecture capture technologies to provide better service to the student with various social and behavioural differences.

Keywords

Lecture capture; Social and behavioral factors; Engineering education; Academic performance

Introduction

Learning and teaching in the universities are transforming towards the technology-based environment. To facilitate the students' learning in flexible, adaptive, iterative and user-friendly manner, lecture capture technologies are adopted by many universities, which make academic resources available to students through web-based media (McIntyre, 2011). Most of the lecture capture technologies use software that records the audio/ video, PowerPoint presentation and other digital materials shown in the computer provided by teachers in the classroom. These digital recordings are usually stored on a web server and are made available to the students via the university's web portal for viewing online or downloading the files (Owston, Lupshenyuk, and Wideman, 2011). Lecture capture technologies were initially evolved with the aim of supporting disadvantaged students who have difficulties in attending traditional lecture classes regularly (Harpp et al., 2004), as well as supporting online distance learning students (Woo, Gosper, McNeill, Preston, Green, and Phillips, 2008). The technology is now available to all students. Recent researches suggest that most students have used lecture capture as a supplement to the traditional face-to-face lecture (Davis, Connolly, and Linfield, 2009), primarily for revisiting complex concepts and having a clear understanding (Chiu and Lee, 2009). Few studies indicated the positive impact of lecture capture on students' grades (Owston et al., 2011; Kay, 2012), though those findings did not consider the other factors (e.g. social and behavioral patterns; academic development by the universities) that could also influence performance of the students (Ramsden and Entwistle, 1981). The impacts of lecture capture has been studied mainly in the field of health science, arts, general science, or business courses, with limited attention in specific courses like engineering courses where many hands-on experimental activities are involved in the classroom. This paper presents the influences of the students' social and behavioral factors on lecture capture use and students' learning approach in engineering courses, as well as impacts of lecture capture use on their academic performance and learning outcomes.

Methodology

This research employed both qualitative and quantitative approaches to collect and analyze the effects of students' social and behavioural factors (e.g. language, cognitive skills, attention level, past experiences) on lecture capture use in engineering education, and how the technology is impacting their learning outcomes. An extensive literature review was carried out followed by a survey of students with a structured questionnaire in an Australian university. This university has introduced lecture capture technology using Echo360 Personal Capture software in 2009, which records only a high-quality video of the computer screen (that showing PowerPoint presentation and other digital materials) and the lecturer's voice and uploads this to the university's learning portal. The students could access the video files online from any places; also, they could download them and view them on their personal computers multiple times. Students were asked to provide information on their attention levels, lecture capture use patterns, and their perceptions on different aspects of lecture capture. 120 students from various engineering disciplines (e.g. civil, mechanical, and electrical engineering) were randomly contacted for the survey, of which 85 students, who had past experience in lecture capture use, have responded to the questionnaire. Out of 85 students, 30 were non-native English speakers, and 92% attended face-to-face lectures. We assumed all the students had similar internet and computer facilities at home and at their university learning centers.

We relied on the students' self-reports about their lecture capture viewing patterns, instead of collecting digital records of online viewing or downloading files from the university portal, and without having further interaction with them. This could be a potential limitation of the research. However, several research studies have used a similar methodology, as students are believed to be accurate and credible reporters of their educational experiences (Owston et al., 2011).

Data analysis was performed using descriptive statistics and statistical tests (t-test, Post Hoc Tukey tests) to extract the influence of students' social and behavioural factors on the lecture capture use and effectiveness through cross-relational analysis. Further, 7-year historical records (2010 – 2016) of academic performance of the students in these five engineering courses were analyzed to assess the effect of lecture capture on their grades, with the intention of justifying the perceptions of the students surveyed.

Results

Student's attention level and attendance in lecture classes

First, the study analyzed the students' behavior in terms of their participation and attention or mind concentration level (MCL) in face-to-face classes throughout the day. 93% of the students stated they attended lecture classes regularly; however, around 50% of students reported they faced difficulties in concentrating in the class due to various reasons. The students were asked to measure their mind concentration levels at different times of the day (8 AM to 10 PM, during which most of the lectures are held) using a 10-point scale.

Most of the students reported that their MCL was very high in the morning around 10 AM - 12 PM, and it diminishes as the time passes (Figure 1). And, their concentration during the lecture class was not always the same, it depended on the time of day, and sometimes they could understand only part of the complex mathematical problems posed in their engineering courses. The students mentioned the major reasons for facing difficulties in concentrating in lectures as 'difficulties to understand/follow lecturers' (48%), 'class time is not suitable' (45%) and 'lecture content is not interesting' (40%). Difficulties to understand/follow lecturers was faced by the students due to lecturers giving either quick or brief explanation of the lecture contents, or students' inability to capture the ideas because of their limited background knowledge and weakness in English. Lecture contents of some engineering courses are mainly based on engineering principles and mathematics, which were reported as not interesting to some students so that they were distracted from the lectures. For a complete understanding, the students were dependent on recorded lecture capture, and additional consultation or study.
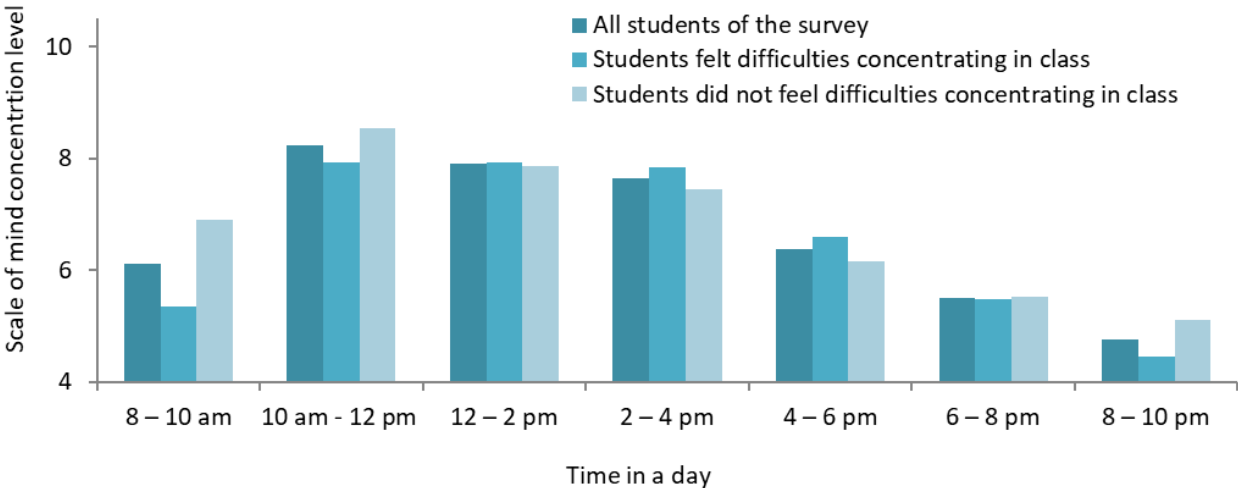

Figure 1: Student's mind concentration level in classroom

Effects of students' social and behavioral factors on using lecture capture

Lecture capture use pattern

Majority of the students (65%) had a long experience of using lecture capture, that is, more than two years. Almost all (93%) has attended face-to-face lectures besides using lecture capture. Most of them used recorded lecture captures regularly (40%) while some did only during the exam preparation (26%). Most students (70%) have used lecture capture more than one day a week with an increasing frequency before the exam periods during Weeks 5 to 7 (mid-semester exams) and Weeks 12 to 14 (final exams) throughout a semester. This trend explains the purpose of lecture capture for assisting the students for further understanding of lectures and preparation for exams.

The students apply various strategies for listening and watching the recorded lecture; most of them listened to the entire recording or certain parts of it multiple times (Figure 2). While listening, they have followed along with lecture notes (55%), as well as taken further notes (40%). The listening strategies of the students and their activities do not show any notable variation with how often they use lecture capture.
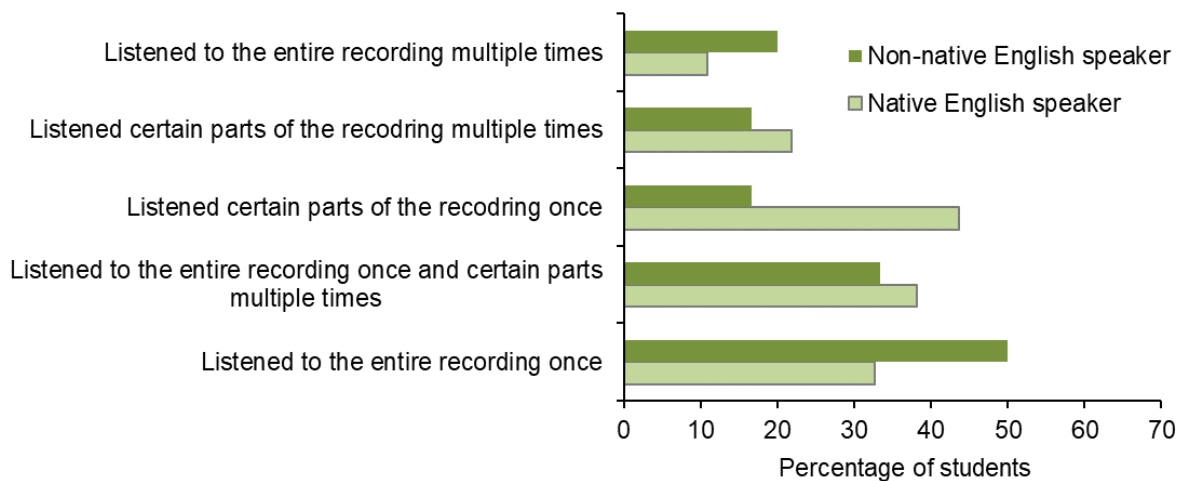

Figure 2: Students' strategies to listen to lecture capture

Influence of English speaking ability

The study has also investigated the effects of social factors, like English speaking ability of the students', on lecture capture use. In regard to the frequency of listening to lecture captures, there is no significant difference between the non-native and native English speakers (t = 0.732, p = 0.46), almost the same percentage of students (50%) from both groups listen to lecture captures regularly. Nevertheless, there is variation between groups in lecture capture listening strategies. Most of the non-native English speaking students listen to certain parts of the recording multiple times (50%), whereas most of the native English speakers (44%) listen to the entire recording once only (Figure 2). The activities during listening lecture capture (e.g. note taking) are similar for both groups.

Influence of past experience

The results showed that the percentage of students using lecture capture regularly increased with the students' past experience of using lecture capture (Figure 3). The students who had long past experience uses lecture capture regularly and during the exam preparation period compared to the less experienced students. However, the students' frequency of lecture capture use may decline slightly when they move on to courses at higher levels (Years 3 or 4) depending on the course structures. Further, the students' past experience did not show any influence in choosing lecture capture listening strategies.
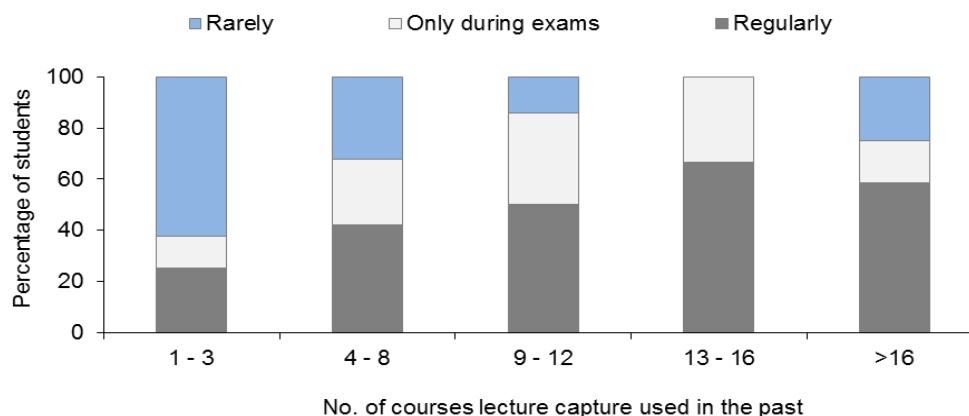
Figure 3: Using lecture capture by the students of different past experiences

Effects of lecture capture use on students' learning outcomes

The majority of students (90%) agree that lecture capture is an effective tool while studying or preparing for assignments and examinations, particularly when they miss classes (Table 1). They feel no stress if they skip a lecture class due to any reason. If they do not understand any important concept during the lecture, they can still use the lecture capture after class and listen to it multiple times until its concepts and contents are understood. Around 70% of students believe that lecture capture helps to raise their grades, as they gain a full understanding of the course materials.

Table 1: Students perception on lecture capture

Reasons for using Lecture Capture	Mean score of Level of agreement [a]
Lecture capture helps me catch up when I missed class.	4.5
Lecture capture is a convenient way to access course materials.	4.3
I could easily access and download the lecture recordings.	4.2
Lecture capture helps me prepare for assignments and exams.	4.1
Lecture capture clarified important concepts discussed in class.	3.9
I learned more in the class by using the lecture recordings than I would have if they had not been available.	3.9
Lecture capture helps to raise my grades	3.8
I could follow all parts of the classroom discussion on the lecture recordings, including student questions.	3.3

a Strongly Disagree (1), Disagree (2), are Neutral (3), Agree (4), or Strongly Agree (5)

With respect to the frequency of using lecture capture, the study has found a significant difference in the level of agreement on certain benefits of lecture capture. The students who used lecture capture regularly have a positive agreement about the benefits compared to those who used rarely. The Post Hoc Tukey test probabilities suggest that regular users agree that lecture capture helped for preparing assignments and exams, improved learning, and helped raise their grades compared to the rare users ($p < 0.05$) (Table 2). However, the study has not found any significant differences in the levels of perception on the benefits of lecture capture between native and non-native English speaking students, or among the

students having varying level of experience in lecture capture use in the past (for all items in Table 1, t = -1.55 to 1.57, p > 0.1).

Table 2: Post Hoc Tukey tests probabilities for various reasons for using lecture capture by students of varied level of viewing frequency

Variables	Comparing groups		*p*
Lecture capture helps me prepare for assignments and exams	Regularly	Only during exams	1.000
		Rarely	.023*
	Only during exams	Rarely	.042*
I learned more in the class by using the lecture recordings than I would have if they had not been available	Regularly	Only during exams	.972
		Rarely	.037*
	Only during exams	Rarely	.039*
Lecture capture helps to raise my grades	Regularly	Only during exams	.118
		Rarely	.022*
	Only during exams	Rarely	.819

*$P < 0.05$

Further, the study investigated the students' grades in five engineering courses over the period of 2010 to 2016 to examine the differences in students' achievement after the implementation of lecture capture in the university. While students' achievement could be linked to many factors, this analysis gives notional indication of the effect of lecture capture on such achievement. The analysis suggested that there was an increasing trend of passing (including achieving higher grades), after the implementation of lecture capture in 2010. Though the individual grades of the students surveyed have not been assessed, this finding can be easily correlated to the positive agreement of the students regarding improving grades due to lecture capture use (Table 1). About 40% students (mainly native English speakers, and having longer past experiences of lecture capture use) urged that most of their study needs can be fulfilled by lecture capture instead of attending lecture classes. Since class attendance is not compulsory, some students believe that they can cover the course study and assessments by using lecture capture only.

On the other hand, the students have expressed some negative effects of lecture capture on their learning. Especially, those students who miss the face-to-face lecture or laboratory classes complain of having difficulties in understanding the engineering courses containing extensive mathematics and drawings that are usually explained on the whiteboard or with hands-on experiments, but not recorded in lecture capture.

Discussion and conclusions

This research reveals the students' behavior of participation in lecture classes and what difficulties they face that lead to deterioration of mind concentration level in the class. The mind concentration level of the students shows a logical trend throughout the day. Other major difficulties in retaining attention are reported as lying with the lecture contents, and how the lecturers deliver it (Wilson and Korn, 2007). The students prefer using lecture capture to cover the lectures which they could not follow properly. This attitude might have an effect on attention in the class. However, lecture capture can only act as a means for the retention of information, not for illustrating further information (Savoy et al., 2009) outside of lectures.

The study shows that most students use lecture capture regularly for an in-depth understanding of lecture contents, particularly during exam periods. Teachers are often worried about having low student attendance in the class because of availability of lecture

capture (Vajoczki, Watt, Marquis, and Holshausen, 2010). However, as our results show, despite availability of lecture capture, most engineering students' (93%) attended the lecture classes, irrespective of their language skills and past experience of using lecture capture. This attitude could be related to the nature of the engineering course contents which need hands-on examples or mathematical derivations on the whiteboard that are not accessible by the lecture capture.

The strategies and activities taken by the students for using lecture capture show typical patterns which have also been observed in other universities (Copley, 2007; Kay, 2012). Students having a non-English speaking background tend to use lecture capture for further understanding and note taking (Leadbeater, Shuttleworth, Couperthwaite, and Nightingale, 2013). We found this purpose to be shared by non-native English speakers in this study, although there was no statistically significant difference between native and non-native English speakers in terms of their opinions in other areas of the survey.

Further, while looking into social factors like past experience with lecture capture, the study shows that students with longer past experience of it tend to use it more regularly than others, however, this was generally true for students in their middle of the undergraduate course (2nd or 3rd year). Final year students may need to use lecture capture less frequently as they have courses like project work and a thesis. The course contents and the teaching pedagogy of the lecturer may have a great influence on how students use the recordings of lectures (Bassili, 2008).

This research also suggests a very positive perception of engineering students for lecture capture, in that they believe it improves their learning and academic performance, which is a similar finding to those of studies conducted in different academic courses (e.g. health science, arts) (Leadbeater et al., 2013). Regardless of differences in social factors (English language skills and past experience), most students agree on the positive impact of lecture capture. Gradual improvement in the students' overall academic achievement in a few engineering courses over the past few years also justifies the students' positive perceptions. Opportunities for taking extensive notes while viewing the lecture recordings repeatedly could have an influence on improving academic performance (Bassili and Joordens, 2008).

Students have complained of the incompleteness of lecture capture in that it does not include the video of notes displayed on the whiteboard, which cause difficulties for understanding complex engineering concepts. This problem is due to technological constraints and also faced by other universities (Read, 2005). Improving video recording facilities with additional resources, often called – 'rich lecture capture' can resolve the issue (Kay, 2012; Pale et al., 2014). For some engineering courses, however, hands-on experiments in the class are included, thus it will not be possible to record all such lectures completely. However, rich lecture capture could be possible for literature-based courses like arts and business, as they require concepts to be explained through theoretical lectures only (Morris, 2010).

Further detail research should be carried out focusing improvement of teaching pedagogy for engineering education with enhanced lecture capture technologies for ensuring better service to the students with various social and behavioural differences including psychological, economic, and access to information technology.

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