Comparison of use of Echo360 generated materials in maritime engineering and nursing disciplines to support student learning

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BACKGROUND
Exploration of technology-enhanced techniques is needed to understand their effectiveness and impact on learning outcomes and teaching efficiency in the higher education setting. There is a lack of empirical evidence to determine whether the implementation and use of technology-initiated methods are beneficial for learning and teaching in different contexts and with different student cohorts. Comparison between undergraduate maritime engineering and nursing students' use of technology-enhanced learning and teaching methods revealed general and discipline-specific strategies used by students to support and optimise their learning experience.

PURPOSE
The purpose of the study was to explore how undergraduate students use Echo360 generated materials for study purposes. Reported use of Echo360 generated materials by students in maritime engineering and nursing disciplines was compared to establish whether there were differences in study approaches by these cohorts in their use of this technology-enhanced learning and teaching method.

DESIGN/METHOD
This cross-sectional study invited 841 students enrolled in seven units across maritime engineering (4) and nursing (3) disciplines to complete a web-based survey seeking information about their use of Echo360 generated materials. The ethics approved questionnaire used five-point Likert scale and open-ended questions to collect information about student use of Echo360 generated materials available in each unit. Data within each cohort was pooled and analysed using SPSS (Version 21). Descriptive and 2-sided Chi-squared analysis was undertaken to determine any differences between the maritime engineering and nursing cohorts. All tests were conducted using a two-sided alpha level of 0.05. Also, focus group interviews with 36 students drawn from the original population of 841 students were undertaken. This feedback provided detailed textual data which was subjected to thematic analysis to further explain the findings made from the web-based survey.

RESULTS
Although gender, age and English as first language were different between the cohorts, their use of Echo360 generated materials showed no difference in their reasons for using Echo360 generated materials. These reasons included revision of notes that were made in class; replay and revision of key concepts that were too difficult to grasp during classes; cover-up for missed lectures due to other commitments; collecting feedback from lecturers; learning presentation skills and gaining classroom experience. There were differences between the engineering and nursing cohorts in using Echo360 generated materials as an alternative to physical lecture attendance; revision and preparation for examinations and to gather information for assignments.

CONCLUSIONS
This study shows there are general and discipline-specific behaviours exhibited by students that use Echo360 generated materials in maritime engineering and nursing disciplines. The implications of this study are to enable improvement in design and development of curriculum to better suit the needs of these cohorts of students. Improved performance and learning outcomes can be achieved when the learning experience for students is optimised through the salient use of technology-enhanced learning resources.

KEYWORDS
Echo360, technology-enhanced learning and teaching, student learning experience

Introduction

Any technology that is deployed in learning and teaching for the purpose of transferring knowledge and skills to students can be regarded as educational technology. Primarily, educational technology uses either active or passive media (Abowd, 2000; Bell et al., 2001) and is composed of a computer hardware and software infrastructure, internet connection (Bates, 1996); and must usually have a support team to ensure that the facility is upgraded to be abreast with new trends (Bates, 2000; Davis, Little, & Stewart, 2004; Levy, 2003). Even though the traditional lecture setting remains an integral part of course delivery at the tertiary level of education, emerging educational technologies are steadily replacing it. Lecture delivery solutions are now capable of offering video recordings and indexing of classroom sessions (Abowd, 2000; Bell et al., 2001). More specifically, streaming audio and video solutions are currently instrumental in the delivery of pre-recorded lectures and laboratory experiments to both residential and distant education students (McGreal & Elliott, 2008). According to Harris, Yanosky, and Zastrocky (2003), educational technology offers more flexibility to students, hence playing a supplementary role alongside the traditional face-to-face mode of lecture delivery.

A wide array of educational technologies has gradually been introduced by universities (Phillips et al., 2010; Salazar, 2010). The most common ones include: learning management systems (Phillips et al., 2010), audio chat and Voice over Internet Protocol (VoIP), push technologies and data channels, streaming video and audio tools, web white-boarding conference systems and peer-to-peer file sharing tools (McGreal & Elliott, 2008). New additions include audio-visual lecture capture systems such as Lectopia, Photonote and Echo360 have been instrumental in the delivery of course content at the tertiary educational level for students including those with disabilities (Vajoczki, Watt, & Fenton, 2011). In particular, students from non-English speaking backgrounds were found to benefit markedly from lecture-capturing educational technologies (Gosper et al., 2011; Shaw & Molnar, 2011).

Of concern from these growing bodies of different technologies is the extent to which it influences student motivation, attendance and learning outcomes. Due to the dearth of research on how technology may influence lecture attendance, Moore, Armstrong, and Pearson (2008) proposed the need to further investigate student attendance in relation to emerging unconventional learning solutions being made possible by the internet. This could lead to a deeper understanding of the relationship between class attendance and student performance. Romer (1993) concluded that students with higher class attendance performed better in course assessments. However, the accessibility to learning materials offered by emerging educational technologies could mean that class attendance may not be a significant predictor of student performance (Fei et al., 2013). Furthermore, it appears lecture attendance is not the only predictor of student performance as the extent to which students are engaged in the learning process is also an important issue (von Konsky, Ivins, & Gribble, 2009). The relationship between the demographic characteristics, reasons and impact for use of Echo360 generated materials on meeting learning outcomes were investigated within these disciplines.

Accessibility, engagement and performance

The extent to which students are engaged in the learning process is dependent on the respective levels of motivation and commitment. With increased motivation and accessibility, the learning experience of students may be improved. Thus the flexible manner in which educational technology affords access to learning materials and space is a motivating factor towards effective learning among students (Phillips et al., 2010). This implies that accessibility could be harnessed to address the side effects of low class attendance among students and also motivate them to learn. Improved access is also advantageous to students having part-time employment commitments (Muir, 2009). This is relevant in Australia where

studies (Applegate & Daly, 2006) suggested that over 72% of university students were engaged in part-time employment and will want learning schedules that suit their daily routines. The limitation that exists for this cohort of students is the inability to ask questions after watching the captured lecture sessions.

The versatility, accessibility and interactivity afforded by educational technology makes students actively engaged in the learning process since they can access course materials from anywhere and with ease (Heafner, 2004). Daugherty and Funke (2007) also concurred that increased student motivation is one of the benefits afforded by educational technologies. The revision of teaching pedagogies is very important if students are to benefit from the emerging learning and teaching innovations in tertiary education. Modern educational technologies are designed to motivate students towards learning through increased accessibility to video and text course materials. Davies and Hardman (2010) suggested that increased access to learning materials as offered by lecture-capturing technologies led to improvement in student performance. This can be achieved when teaching staff directly promoted recorded lectures to their students.

The purpose of this study was to explore how undergraduate students used Echo360 generated materials for learning curriculum content in their units of study. Reported use of these materials by students in the maritime engineering and nursing disciplines was compared to establish whether there were differences in study approaches by these cohorts in their use of this technology-enhanced learning and teaching method.

Methodology

During two semesters in 2013, all participating units had their lectures captured using Echo360 and made available to students via the university's learning management system. Echo360 software provides four recording choices based on the curriculum, instructor preference and the technical complexity of the venue being captured: Capture Appliance; Classroom Capture; Personal Capture; and Media Import. The two most common choices in Australian universities are automated lecture capture using the Capture Appliance (lecture capture) in enabled venues and Personal Capture at any computers using Echo360 software. The students were able to view; listen or download the recordings on their digital devices. At the end of each semester, an invitation to participate in a web-based survey via Survey Monkey was sent via email to students enrolled in these units. Seven units of which four were maritime engineering units and three from the discipline of nursing, sought information about student use of Echo360 generated materials. The questionnaire used a combination of five-point Likert scale and open-ended questions to collect information about student use of Echo360 generated materials available in each unit.

Data within each cohort was pooled and analysed using SPSS Version 21 (IBM Corp., 2012). Descriptive and 2-sided Chi-squared analysis was undertaken to determine if there were any differences between the maritime engineering and nursing cohorts. Fisher's exact test was used where counts in cells were less than 5 (Agresti, 1992), and all tests were conducted using a two-sided alpha level of 0.05 (p-value).

Students were also invited to attend one of five focus groups. The students who participated in the focus group interviews were drawn from the original 841 invited for the web-based survey. Thirty–six students (with an average of 6 students per group) participated in these sessions that were conducted using a semi-structured questionnaire led by the research assistant. Each session was 1.5 hours long. The aim of the focus group interviews was to collect qualitative data to further explain the findings made from the web-based survey.

Results and discussion

An invitation to participate was sent by email to all undergraduate students from the engineering and nursing cohorts. This was necessary as seeking the consent of participants

is an important aspect of ethics in research (Buchanan & Hvizdak, 2009). A total of 261 valid responses were received, of which 217 were from nursing and 44 were from maritime engineering.

As indicated in Table 1, gender and age were different for the two cohorts of respondents while English as first language was similar. Of the participants, females dominated (80%) nursing while males dominated (77%) maritime engineering, reflecting the nature of the two disciplines. The age profile of both nursing and the engineering discipline was markedly different where 81% of respondents in nursing and 34% in the engineering disciplines were over 31 years of age, indicating that there were more mature students in the nursing discipline. In terms of English as first language, both cohorts were high (nursing 66% and maritime engineering 70%), reflecting the overall trend of enrolment of overseas students in Australian universities.

Table 1: Demographic information of respondents by discipline

Item		Nursing	Engineering	Total	*p*-value
Gender	Male	43 (20%)	34 (77%)	77	.000
	Female	174 (80%)	10 (23%)	184	
Age	Under 31	42 (19%)	29 (66%)	71	.000
	Over 31	175 (81%)	15 (34%)	190	
English as first language		143 (66%)	31 (70%)	174	.725

Table 2: List of items related to reasons for Echo360 use by discipline

Item	Description
A1	To revise notes that were made in class
A2	To replay and revise key concepts that were too difficult to grasp during classes
A3	As an alternative to traditional physical lecture attendance
A4	Cover up for missed lectures due to other commitments
A5	To revise and prepare for examinations
A6	To gather information for assignments
A7	Acquire presentation skills
A8	To collect feedback given by lecturers on assessments
A9	Want to experience what a real class feels like

Table 3: Reasons for using Echo360 generated materials by discipline

Item	Nursing			Engineering			*p*-value
	SD + D	N	SA + A	SD + D	N	SA + A	
A1	15(6.0%)	30(12.1%)	203(81.8%)	7(14.6%)	8(16.7%)	33(68.8%)	.059
A2	11(4.4%)	24(9.7%)	212(85.8%)	4(8.5%)	7(14.9%)	36(76.6%)	.094
A3	30(12.2%)	48(19.5%)	168(67.3%)	14(29.7%)	12(25.5%)	21(44.7%)	.011
A4	31(12.5%)	41(16.5%)	176(71.0%)	4(8.4%)	7(14.6%)	37(77.1%)	.438
A5	10(4.0%)	23(9.3%)	215(86.7%)	6(12.5%)	8(16.7%)	34(70.9%)	.042
A6	14(5.6%)	30(12.1%)	204(82.2%)	8(16.7%)	15(31.3%)	25(52.1%)	.000
A7	62(25.2%)	75(30.5%)	109(44.3%)	18(37.5%)	17(35.4%)	13(27.1%)	.164
A8	50(20.4%)	62(25.3%)	133(54.3%)	13(27.1%)	17(35.4%)	18(37.5%)	.293
A9	68(28.1%)	92(38.0%)	82(33.8%)	20(41.7%)	15(31.3%)	13(27.1%)	.210

SD: strongly disagree; D: disagree; N: neither agree or disagree; A: agree; SA: strongly agree

Table 2 lists the survey items related to the reasons for using Echo360 generated materials. Table 3 shows there were differences in the use of Echo360 generated materials as an alternative to physical lecture attendance; revision and preparation for examinations and to gather information for assignments.

Nursing students were more likely (67%) than engineering students (45%) to use Echo360 generated materials as an alternative to traditional physical lecture attendance (A3) (p=.011). This may be due to the higher percentage of mature-aged students in nursing who have other non-study commitments. Engineering students were more likely to strongly disagree or disagree (12%) they used Echo360 for preparation of examinations (A5) (p=.042). Nursing students were more strident in their agreement (87%) that they used Echo360 generated materials for revision and preparation for examinations. Nursing students used Echo360 generated materials to gather information for assignments (82%), whereas engineering students were more ambivalent (31%) (A6) (p=.000). This result can be explained by the less reliance of engineering units on assignments for assessment.

According to the pre-set confidence level of 95% (p<.05), there were no statistical differences found between the cohorts for revision of notes that were made in class (p=.059); replay and revision of key concepts that were too difficult to grasp during classes (p=.094*)*; cover-up for missed lectures due to other commitments (p=.438*)*; collecting feedback from lecturers (p=.293); and learning presentation skills (p=.164) and gaining classroom experience (p=.210). These results suggest there are general strategies used by students to support their learning.

Table 4 lists the item related to the impact of Echo360 generated materials have on learning outcomes and Table 5 shows the results. Nursing students agreed (78%) that using recorded lecture materials and videos were equally effective towards meeting the intended course learning outcomes, whilst 18% engineering students disagreed (B1). Over 50% of students from both cohorts agreed that using Echo360 generated materials created opportunities for students to focus on other commitments thereby affecting their performance negatively (B2). Nursing students agreed or strongly agreed (76%) that they relied on recorded lectures to revise towards examinations whilst 27% of engineering students were ambivalent (B3). Surprisingly, there was 18% disagreement amongst engineering students to the statement that having access to recorded lectures motivated them to revise adequately for assignments and exams (B4). Only 48% of nursing students agreed that using Echo360 without class attendance affected student performance as per course learning outcomes compared to an overwhelming 75% of engineering students (B5). There was similar consensus in both cohorts in the disagreement levels (approximately 4% nursing and 2% engineering) when students were asked if improving accessibility to Echo360 learning materials will help low-performing students to improve their performance (B6).

Focus group participants were asked a series of questions including their opinion on whether absenteeism will affect student performance. Students expressed mixed feelings about this question since they also relied on recorded lectures from the Echo360 learning platform. However, their responses suggested that performance depended on the level of motivation and self-discipline of students. Some students may decide to skip class and watch the recorded materials as a form of substitute to attending face-to-face lecture sessions, but indiscipline and other forms of distractions may prevent them from actually watching the videos (von Konsky et al., 2009). This may lead to poor performance. A disciplined student may be able to achieve high grades if he/she watches the recordings and strives to understand the lessons. Thus the use of Echo360 generated materials may lead to improved performance where the student is disciplined and well-motivated to use it as a mode for learning. This suggests that the impact of Echo360 on student performance is essentially conditional. One of the participants stated:

"So there is more of an opportunity for you to get clarifications from a face-to-face lecture and with the Echo360, you don't have that much of an opportunity to ask questions and get feedback."

The interview question of whether Echo360 generated materials may have influenced the way students approach learning and preparation for examinations, the results revealed that the use of Echo360 was able to positively impact on the performance of students in that it influenced the way students learned. It helped them to prepare for assignments and examinations. For students who were mostly engaged in units that have a lot to do with calculations and statistics, Echo360 use was instrumental in revising how particular mathematical problems were solved. This appears to concur with the findings made in a previous research (Zywno, 2002). Even though there are other sources and videos on channels such as YouTube that may give steps on how certain problems should be solved, the difference is that with Echo360, students were able to follow exactly the steps and procedures used by the lecturer. Hence, the Echo360 generated materials were quite complementary in relation to other study materials during preparation for examinations:

"Using other sources to prepare for examinations, you might do it wrong whereas if you are looking at Echo360 you get how the lecturer's done it and how they want you to do it."

Table 4: Items related to the impact of Echo360 generated materials on learning outcomes

Item	Description
B1	Using recorded lecture materials and videos are equally effective towards meeting the intended course learning outcomes
B2	Using Echo360 materials will create opportunity for students to focus on other commitments (childcare, part-time job, etc) thereby affecting their performance negatively
B3	I frequently rely on recorded lectures to revise towards examinations and execution of course assignments
B4	Having access to recorded lectures will motivate me to revise adequately for course assignments and examinations
B5	Relying on Echo360 recordings without attending classes will affect student performance as per course learning outcomes
B6	Improving accessibility to Echo360 learning materials will help low-performing and average students to improve their academic performance

Table 5: Impact of Echo360 generated materials on meeting learning outcomes

Item	Nursing			Engineering			*p*-value
	SD + D	N	SA + A	SD + D	N	SA + A	
B1	19(8.6%)	29(13.1%)	174(78.4%)	8(18.2%)	5 (11.4%)	31(70.4%)	.208
B2	54(24.4%)	57(25.7%)	111(50.0%)	7(15.9%)	12(27.3%)	25(56.8%)	.670
B3	22(10%)	31(14.0%)	168(76.0%)	8(18.2%)	12(27.3%)	24(54.6%)	.039
B4	17(7.7%)	31(14.0%)	174(78.4%)	8(18.2%)	9(20.5%)	27(61.3%)	.113
B5	40(18.1%)	75(33.8%)	107(48.2%)	3(6.8%)	8(18.2%)	33(75.0%)	.016
B6	8(3.7%)	57(25.8%)	156(70.6%)	1(2.3%)	15(34.1%)	28(63.6%)	.729

SD: strongly disagree; D: disagree; N: neither agree or disagree; A: agree; SA: strongly agree

On what improvements could be made to Echo360 generated materials to achieve the best possible outcomes for both learning and teaching, the responses suggested that students were satisfied with the current state and features of the Echo360 generated materials. Most of the issues concerned the technical aspect of the Echo360 learning platform. For instance, the quality of the video recordings which at times appeared hazy made it difficult for students to see what lecturers were writing on the white boards. Students also advocated the need for video capability to enable them see the interactions when using learning aids such as the white board as well as viewing the body language of lecturers – needed for visual learning.

"I would prefer not to just only have voice lectures but if there be just some video to see things like body language, that will be really helpful for me as well because I am a visual learner."

This study showed there were general and discipline-specific behaviours exhibited by students that used Echo360 generated materials in maritime engineering and nursing disciplines. The discipline specific behaviours that were different in this study related to discipline content or purpose of lectures. Nursing students were more likely to miss face-to-face lectures than engineering students. This is due to the fact that engineering students often rely on the lecture recordings to understand how calculations for subjects such as chemistry, hydrodynamics and mathematics are done. Also, other students might have asked questions on difficult formulae and how a particular mathematical problem is solved. This prompts engineering students to frequently access the recorded lectures to clarify issues they might have forgotten and to prepare for assignments and examinations.

Nursing students were more likely to use the Echo360 generated materials for preparation of assignments, revision and examinations than engineering students. The integrated nature of the content delivered to undergraduate nursing students may explain their reliance on recorded lectures for direction with assignment and examination preparation. Nursing is a dynamic and evidence-based discipline that constantly changes in response to the development of innovation and methods driven by the need for best-practice in health care (Mantzoukas, 2008). Echo360 generated materials provides students with contemporary and salient information on which they will be assessed.

This study had several limitations. There was a difference in numbers between the cohorts that may have skewed the results. Students' maturity in the two cohorts was also significantly different which may have caused different behaviours exhibited by the students in using Echo360 generated materials. Additionally, students self-selected to complete the survey which may have caused respondent bias and the findings may not be generalizable to other undergraduate students.

Implications for the future/recommendations

The strength of this study lies in the use of mixed methods design to investigate the phenomenon. Previous studies dedicated to educational technology and student performance often relied on mono method designs thereby forfeiting the fresh perspectives that could have been yielded through a combination of quantitative and qualitative methods.

Future research needs to focus on the role that lecturers must play in relation to the increasing use of technology-enabled learning environments. Specifically, a study on the extent to which lecturers should be integrated into a technology-enabled learning space to achieve improved student experience is needed. An investigative study of the impact that could be achieved when lecturers act as mere facilitators whereas students become more active is also necessary. It may be that as students become more active in the learning process, adaptation in the pedagogical approach is needed to create the necessary impact on student performance and learning outcomes. In addition, examination is needed to determine the possible correlation between the maturity of the students and the use of Echo360 generated materials. All these are areas that future research could be directed at with regards to the impact of educational technology on teaching practice. There may be

issues relating to faculty competence and how this may impact the pedagogical application of educational technology in the higher education sector. This is also an area that may need commensurate attention for future researchers.

Technology may have varied impact on student learning and eventual performance depending on the nature and type of learning space. A longitudinal study where various types of learning spaces alongside different pedagogies used by teachers can be compared is warranted.

Conclusions

This study explored the impact that lecture capture had on the performance of students. It showed that a relationship exists between the use of Echo360 generated materials and student performance. Students agreed that using the lecture recordings assisted in meeting intended learning outcomes. The impact of Echo360 generated materials on student performance were not automatic, factors such as motivation and discipline are also involved. Differences were found between the engineering and nursing cohorts in how they used Echo360 generated materials to revise for assignments and examinations. The use of focus group interviews provided fresh viewpoints of the two cohorts. Whereas the web-based survey showed general and discipline-specific behaviours among students from the two cohorts, the focus group interviews augmented understanding why such behaviours were evident.

The findings of this study show there are implications for the provision of tertiary education. Principally, the development of educational curriculum will be impacted, as the specific learning needs of the different cohorts of students are to be addressed, at the conception and design stage of curriculum development. Educational technologies must be tailored to motivate students and increase accessibility towards the improvement in learning outcomes. Salient development of technology-enhanced resources will enable students to optimise their learning and improve their performance by accessing and using Echo360 generated materials. This requires that modern day educational technologies are designed to motivate students towards learning through increased accessibility to video and text course materials.

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