Technology in Public Health Higher Education

PRA Baker, PhD, BSc[1], D Demant, PhD MPH[1,2], A Cathcart, PhD MSc[3]

[1] School of Public Health and Social Work & Institute of Health and Biomedical Innovation, Faculty of Health, Queensland University of Technology, Victoria Park Road, Kelvin Grove, Queensland, 4059, Australia

[2]Australian Centre for Public and Population Health Research Faculty of Health, University of Technology Sydney, 235-253 Jones Street, Ultimo, New South Wales, Australia

[3] School of Management, QUT Business School, Queensland University of Technology, GPO 2434, Brisbane, Queensland, 4001, Australia

Daniel Demant: +61 02 9514 5499; daniel.demant@uts.edu.au

Abby Cathcart: +61 07 3138 1010; abby.cathcart@qut.edu.au

Corresponding author:

Philip RA Baker
School of Public Health and Social Work, Faculty of Health, Queensland University of Technology
Victoria Park Road, Kelvin Grove, Queensland, 4059, Australia
Tel: +61 07 3138 5596
Email: p2.baker@qut.edu.au

Abstract

Streamed and recorded lectures as well as audience-response technology are increasingly used in Public Health tertiary education, to train practitioners to address Asia-Pacific region's rapidly changing health needs. However, little is known about the impact on student performance, satisfaction, and understanding. This study aimed to assess postgraduate student's perceptions and their use of technology in a large epidemiology subject at an Australian university in internal and external modes. The study used both routinely collected student data (n=453) and survey data (n=88). Results indicate that students accept and use technology-based learning tools, and perceive audience response technology as well as streamed and recorded lectures as useful for their learning (96.6%). Students have shown a preference to review recorded lectures rather than viewing streamed lectures. Analyses further suggest that the use of recorded and streamed lectures may be linked to better student performance for external students (passing, any use OR = 3.32). However, these effects are not consistent across all student subgroups and externally enrolled students may profit more than those enrolled internally.

Key words: Audience response technology, digital broadcasting, student learning, higher education, teaching, technology use,

Introduction

Advances in technology have provided new tools to enhance student learning experiences and to support access to higher education. Audience response technologies (ART) as well as recorded and live-streamed lectures are increasingly used to enhance Public Health students' learning experiences in face-to-face, blended, and online learning environments. These technologies may ease the preparation of lecture content and increases teaching capacities without the need to increase staff resources[1] providing greater efficiency in the light of increasing tertiary student numbers.[2,3] Training Public Health practitioners for the changing needs of the Asia-Pacific region requires that the methods of teaching must also be adapted.

Until recently, much of the content in tertiary education was delivered on-campus in predominantly large class settings, employing didactic, passive approaches to teaching[4]. Amongst the approaches to enhance the learning experience, ART, such as interactive polling with wireless 'clickers' or web-based apps, enables students to engage directly, creating more active lecture environments.[1,5] ART has the potential to give voice to and deepen the participation of students who may struggle to speak during lectures, including linguistically diverse students.[6] ART is often employed as a formative assessment of students' knowledge of lecture content, providing lecturers with immediate feedback on the effect of their teaching, and allowing a tailored, audience-centred approach to teaching.[7] Previous research showed that students perceive the use of ART as beneficial, with positive effects on course interest, attendance, and content understanding.[7] Furthermore, ART may have a positive effect on understanding evidence-based research outside of tertiary environments in continuing professional development.[8]

ART systems have continued to develop with newer solutions that incorporate lecture recordings and streamed lectures with video, broadening the availability of these systems.[9] The

current body of literature on potential effects of ART on students' performance is generally positive but limited in scope for international students[5].

Other commonly employed technologies in Public Health tertiary education are recorded and live streamed lectures. Lecture recordings are a convenient and low-cost technology, allowing access to lecture content to students who are not able to attend lectures, and provide a possibility to review content if concepts are not understood during lectures.[10] Similarly, linguistically diverse students from the broader Asia-Pacific region may supplement face-to-face participation with recorded lectures.

Lecture recordings are often the primary teaching mode of fully online distance learning programs. The Asia Pacific Consortium for Public Health (APACPH) was the pioneer in on-line distance learning in the Asia-Pacific Region, when, in 2004 it launched the International Cyber University of Health. Since that time, through the contribution of APACPH members, training in the Public Health Certificate Program is available to those with a Bachelor's degree.

Lecture recordings are also the mainstay for online and blended modes of a-synchronic learning in 'bricks and mortar' institutions. However, in contrast to ART, lecture recordings may not be beneficial for all students, and their increased use in the sector has been associated with falling attendance rates[11] and reduced student engagement and collaboration.[12] Others have argued that lecture capture primarily benefits low achieving students who tend to view lectures more frequently, whereas they offer 'minimal added value' for students who are high performers[13]. However, students generally appear to perceive lecture recordings as positive and useful, and the current body of research demonstrates positive associations between accessing lecture recordings and students' performance.[14] Lecture-capture may empower students to take control of their learning experience, assessing videos strategically in ways that are tailored to their

preferences and needs[15]. Although live streaming of lectures (synchronic access) is increasingly used; research into the impacts of this technology is scarce.[16]

This study analysed the use of ART and recorded and streamed lectures in a large postgraduate Public Health subject (Epidemiology) at an Australian university. The overall aim of this research is to assess students' perception on the use of these technologies and their potential effect on lecture attendance and grades. This study addresses the following questions:

1. To what extent do Public Health post-graduate students access recorded and streamed lectures? Is there a difference in access by mode of learning (e.g. external vs. internal enrolment)?
2. What is the level of participation in ART when it is provided?
3. To what extent do students perceive that these technologies help them learn?
4. What is the relationship between the level of use of recorded and streamed lectures, and academic achievement (grades)?

Methods

Setting

Data from students in internal (face-to-face) and external (online) modes of learning, containing a large proportion of international students from the Asia-Pacific region, at Queensland University of Technology (QUT) in Brisbane, Australia, were analysed. Primary content delivery of a postgraduate epidemiology course occurred through weekly two-hour 'lectures' provided with audience response technology TurningPoint® (wireless 'clickers') and supplemented with a mobile response software application (GoSoapbox) a-synchronically over

a 13-week-period. Provided were weekly two-hour tutorials for internal students, and seven 1.5-hour online tutorials for external students. Internal students received a total of 48 hours of face-to-face training. Lectures included the incorporation of simulations such as a mock randomised controlled trial based on active learning principles and designed to promote participation and deeper learning.[17]

Data Collection

Routinely collected student data such as enrolment status (domestic/international) and attendance mode (internal/external) from 453 students enrolled over four semesters (Semesters 1 and 2, 2015, and Semesters 1 and 2, 2016) in the subject were sourced from administrative systems. Student identification numbers were used to link enrolment status with grades (dependent; range: 1 (low fail) to 7 (High Distinction)), sourced from the University's grading system. Individual student's usage of lecture recordings (unique views and lecture downloads) and live streaming (unique views) was sourced from the Echo360 lecture recording system. Echo360 analytics data are not available by enrolment status. The formative assessment occurred objectively blinded to the student's use of the lecture recording system. The subject's content remained consistent over the two years analysed.

Furthermore, a short, anonymous online survey was conducted among students enrolled in semester 2, 2014 and semesters 1 and 2 2015. Participants were asked about their enrolment status and mode of attendance, as well as lecture attendance in percentages, awareness of lecture recordings (yes/no), use of audience-response system Go SoapBox (yes/no), and the perceived usefulness of technology on their learning process. Internal students were also asked about their use of wireless clickers during lectures (yes/no) and external students about reasons

not to use live-streamed lectures. Data was not linked to students' performance or recording usage.

Ethical approval to conduct the survey and to use data from the university's online systems was obtained from the QUT's Human Research Ethics Committee (Approval number: 1500000191).

Statistical Methods

The ordinal measures of the student's grade scores were analysed as continuous measures as they appeared normally distributed[18].

Pearson Chi-square (χ^2) analyses were applied to categorical variables such as pass or fail, and analysis of variance (ANOVA) was applied to compare continuous variables. Means and standard deviations, percentages and number as well as odds ratios and 95%-Confidence-Intervals are provided. Differences were interpreted using the certainty of difference ($p \leq 0.1$) and of meaningfulness of its size.

Results

Participant flow

Data from all 453 postgraduate epidemiology students over the four semesters were analysed for this study. Of the 357 students of students invited to complete the survey, 88 students participated (response rate: 24.6%). Sample characteristics for data derived from the university's system can be found in the supplementary file. Most students were enrolled as internal (54.7%, n=248) and domestic (52.3%, n=237) students. External students performed

better than internal students with mean grades of 5.37 (SD: 1.36) and 4.90 (SD: 1.37), respectively. Domestic students performed better than their international counterparts with 5.35 (SD: 1.35) and 4.85 (SD: 1.37), respectively. No meaningful differences in group means between semesters could be detected with mean grade ranging from 5.01 (SD: 1.54) in Semester 2, 2015 to 5.19 (SD: 1.35) in Semester 1, 2016. Forty-four students (9.5%) failed the subject.

Sample characteristics for survey participants can be found in Table 1. Similarly to the overall enrolment in the unit, most of survey participants were enrolled internally (62.5%, n=55), studied full time (58.0%, n=51), and were domestic students (59.1%, n=52). Most of the internal students (81.5%, n=44) attended at least 76% of all offered lectures (see Table 1).

-> insert Table 1 about here <-

Survey participants (100%, n=88, see Table 1) were aware that lectures are recorded and accessible to them via link on the university's system. Students were also highly aware of live streamed lectures (80.7%, n=71). ART hardware (wireless response clickers) offered to students during lectures were used by nearly all participants (98.2%, n=54) consistent with the teaching team's experience that students borrow response hardware, and in-class polling typically obtains a response rate >95%. Additionally, 46.6% (n=41) of students surveyed also used the audience response software GoSoapbox (web based application) at some point during the semester; however, application data suggested very low weekly usage.

Meaningful differences could be detected in system collected data of the use of recorded and live viewed lectures between internal and external students (see Table 2). Consistent with their enrolment status, external students were more likely to access any kind of lecture in the online

system compared to their internal counterparts (80.5%, n=165 vs 60.5%, n=150), and were more likely to access more than 50% of all lectures offered (48.3%, n=99 vs 13.7%, n=34). External students were also more likely to complete watching at least 50% of all lectures (9.8%, n=20 vs 2.4%, n=6), more likely to view lectures live (18.5%, n=38 vs 2.4%, n=6) and more likely to repeat-view at least one lecture (64.4%, n=132 vs 37.5%, n=93). The actual rate of live-viewing of available lectures per student was relatively low (mean 0.4 views per external student for the entire semester) indicating this was the students' least preferred method of viewing lectures. In the survey, more than half of external students (57.6%, n=19) stated that they did not use live streamed lectures with most stating that the lecture time conflicted with other appointments as the reason for not watching live lectures (78.9%, n=15). Differences between international and domestic students were neither meaningful nor significant. Overall, nearly all students (96.6%, n=85) perceived the use of technology as helpful to learning.

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Table 3 outlines the potential effects of online engagement on performance for external students. External students with any kind of online lecture engagement attained higher mean grades than those not engaging with lectures online; however, this difference is not statistically significant (5.45, SD: 1.28 vs 5.00, SD: 1.65; p=0.058). Differences are statistically significant and academically meaningful for those accessing more than half of all lectures (5.59, SD: 1.14 vs. 5.16, SD: 1.52; p=0.025) and those with a completion rate of over 50% (6.20, SD: 0.89 vs 5.28, SD: 1.38; p=0.004). Differences between students who viewed lecture live or repeated lectures and those who did not were not statistically significant.

-> insert Table 3 about here <-

Furthermore, those engaging with lecture content online were more likely to pass the subject, with a grade higher than pass, and to pass the unit with a distinction or high distinction (see

Table 3). However, not all results were statistically significant. Those with any access to the lecture system showed a strong association with obtaining a pass grade for the subject (OR=3.29; 95% CI: 1.16 to 9.27; $p<0.05$), students accessing more than half of all lecture were similarly associated with a pass grade (OR=3.32; 95% CI: 1.04 to 10.55; $p<0.05$) and to also more likely to obtain a grade greater than pass (OR=2.18; 95% CI: 1.12 to 4.24; $p<0.05$). An average completion rate of above 50% was strongly associated with students obtaining a grade of (high) distinction (OR=4.22; 95% CI: 1.36 to 13.11; $p<0.05$).

Discussion

Use of recorded and streamed lectures

Overall, from both self-reported survey and system logged lecture recording usage, students have a high level of awareness of the technological opportunities, using ART during lectures and lecture recordings. Students furthermore perceive the use of technology in the unit as beneficial. This perceived benefit is consistent with the analysis of the academic achievement and lecture recording access. Previous studies on the general use of technology on student learning processes showed similar results.[5,14,22] External students are more likely to use any kind of online-based lecture resources as a result of their enrolment status. Although it has been speculated that international students are more likely to revisit lectures for reasons of language, no differences between international and domestic students were detected in the rates of access.

The use of Audience-response technology

Students were more likely to use hardware response technology than a software application (Go SoapBox) while attending lectures on-campus. We speculate that the reason may be the

collective synchronous use of polling with 'clickers' complemented by lecturer interaction provides a greater perceived benefit than polling that is only used for personal feedback. With the increased availability of mobile devices, software ART may play a vital role in the future and may offer more benefits than current hardware devices[9]. However, a study by Stowell[19] has shown that the use of mobile devices over hardware 'clickers' may lead to a higher number of missing and incorrect responses as well as missing internet connections and distracting content on mobile devices. Students in the same study were slightly more likely to approve of audience polling when using mobile devices over hardware 'clickers' even though hardware clicker technology was easier to use. Research with students and other target groups show overwhelming support of ART use and provided some evidence that ART may assist in students learning processes, is associated with a better understanding of material, and with a perceived increase in opportunities to engage with educators[5,8]. However, research on postgraduate and remote students remains limited, and more research is needed to develop a further understanding of the potential benefits, particularly for linguistically diverse students[20,21]. Further research should also identify potential differences in use-patterns between hardware and software solutions, and how these affect learning environment, classroom engagement, and student performance.

Benefits of recorded and streamed lectures

Analysis from administrative data provided some evidence that online engagement with live lectures and lecture recordings may be beneficial to external students and that increased use of university online lecture services may result in higher grades for these students. However, while the direction of the effect is consistent for all results, there was uncertainty for some analyses. Accessing a large proportion of lecture recordings has shown a strong association

with better performance. However, the benefits of live lecture broadcasting and the repeated view of lectures on student grades are unclear; at this point findings were inconclusive as to whether or not an association was present. These results add little to the scarce evidence of live streamed lectures[16]. Furthermore, our results point to a clear student preference (for both internal and external students) for reviewing lecture captures asynchronously overlive-streaming. Internal students were significantly less likely to use the lecture recording system than their external counterparts; probably due to high attendance rates. However, lecture recording systems may still be beneficial for internal students, particularly for students who speak English as their second language[6]. Further research on the potential use of lecture recordings for internal students and student who speak English as their second language is needed. Concerns that lecture recordings may have negative effects on attendance[11] and collaborative learning among students[12] could not be detected in the present study. While most internally enrolled students used recordings at some point, lecture attendance was still at a very high level. Further research needs to investigate the underlying reasons why students use lecture recordings, and how current systems can be adapted to improve their usefulness. A needs-centred adaptation of systems may hold the key to increase use and usefulness of lecture recording systems[22].

Strengths and Limitations

This study has some limitations. In the present study, no data were available to test potential effects of ART software on learning processes and student grades in this unit as the survey results were not linked to academic performance. Furthermore, the number of students using ART software (GoSoapBox) was too small to analyse potential differences in reasons and perceptions to compare with hardware solutions (‘clickers’). The survey was only conducted

over a period of three semesters and the overall response rate was comparably low with 24.6% of invited students participating. Survey data may not be representative of all students enrolled resulting in a risk for selection bias. Data on live streamed lectures (Echo360) are not available by enrolment status (international/domestic); however, international students are required to attend lectures in person as a visa requirement and are therefore unlikely to watch live streamed lectures. Furthermore, effects of use of streamed and recorded lectures on internal students' performance was not adjusted for attendance in face-to-face-lectures as this data are not available.

A strength of this study is the linkage of data from two different administrative systems allowing the analysis of automatically collected data without response and recall bias. Furthermore, the separate survey allowed to take student feedback and perceptions into account.

Conclusion

This study used system's collected data, allowing for an analysis of all enrolled students. Furthermore, lecture recordings and live streaming usage were measured independently and automatically rather than by self-report. A separate cross-sectional survey allowed for an in-depth analysis of utilisation and perceived usefulness of technologies employed. The results of this study suggest that postgraduate students studying epidemiology are likely to accept and use technological learning tools when provided and firmly perceive that they are beneficial in the learning process. Furthermore, the use of technology appears to be strongly associated with better academic performance, particularly among external students. As access to higher education continues to grow, and the intake of students becomes increasingly diverse, ART as well as lecture recording and live lecture systems will play an important role in engaging and

supporting learners. However, these findings suggest key gaps in our understanding of factors shaping student use of and benefit from digital learning tools.

There is a growing focus in Universities across the world on delivering value to students and operating within a tight resource context. For some Universities, lecture-capture is seen as a way of increasing student numbers without also adding to the infrastructure costs needed to support them. Here, the analysis points to a more complex and nuanced picture of student need and preferences, and positions both ART and lecture capture as tools that students engage with in different ways and at different times. Both can support learning, but neither replaces tailored and responsive feedback from educators. Finally, we found student's participation in an end-of-semester online survey of teaching to be low. In-class polling using ART may provide a more trustworthy analysis of internal learners' experience and preference. Synchronous polling also enables the educator to respond to learner needs in real-time to feed in to the way they teach and support their current students[23]. Furthermore, these systems can, in combination, allow students to conduct an individual assessment of their current understanding of the unit content, and results may be used by teaching teams to plan future lectures.

Conflict of interest

PRAB and DD are members of the subject's teaching team.

Acknowledgement

This work was supported by a QUT Teaching and Learning Grant (Grant Number: Baker, 2014).

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Supplementary file:

Table S1: Sample characteristics, data sourced from university administrative databases

Semester of Teaching					
Mode of Attendance[#]	Sem 1, 2015 n=76	Sem 2, 2015 n=148	Sem 1, 2016 n=84	Sem 2, 2016 n=148	Mean Grade
Internal , n=248	60.5% (n=46)	54.1% (n=80)	57.1% (n=48)	51.0% (n=74)	4.90 (SD: 1.37)
External, n=205	39.5% (n=30)	45.9% (n=68)	42.9% (n=36)	49.0% (n=71)	5.37 (SD: 1.36)
Enrolment Status[#]	Sem 1, 2015	Sem 2, 2015	Sem 1, 2016	Sem 2, 2016	Mean Grade
Domestic, n=237	55.3% (n=42)	45.9% (n=68)	57.1% (n=48)	54.5% (n=79)	5.35 (SD: 1.35)
International, n=216	44.7% (n=34)	54.1% (n=80)	42.9% (n=36)	45.5% (n=66)	4.85 (SD: 1.37)
Final Grade	Sem 1, 2015	Sem 2, 2015	Sem 1, 2016	Sem 2, 2016	
Low Fail (1), n= 6	1.3% (n=1)	0.7% (n=1)	3.6% (n=3)	0.7% (n=1)	
Fail (2), n=20	2.6% (n=2)	5.4% (n=8)	3.6% (n=3)	4.8% (n=7)	
Marginal Fail (3), n=18	6.6% (n=5)	4.7% (n=7)	3.6% (n=3)	2.1% (n=3)	
Pass (4), n=99	19.7% (n=15)	17.6% (n=26)	28.6% (n=24)	23.4% (n=34)	
Credit (5), n=120	30.3% (n=23)	31.8% (n=47)	19.0% (n=16)	23.4% (n=34)	
Distinction (6), n=112	27.6% (n=21)	22.3% (n=33)	21.4% (n=18)	27.6% (n=40)	
High Distinction (7), n=78	11.8% (n=9)	17.6% (n=26)	20.2% (n=17)	17.9% (n=26)	
Mean Grade (SD)	5.11 (SD: 1.37)	5.01 (SD: 1.54)	5.19 (SD: 1.35)	5.11 (SD: 1.38)	

Australian law usually requires students on student visas to enrol as internal students.

Table 1: Survey Results by Semester

	Sem 2, 2014 (n=20)	Sem 1, 2015 (n=24)	Sem 2, 2015 (n=44)	Total (n=88)
Enrolment Status and Mode of Attendance by Semester				
Internal	65.0% (n=13)	54.2% (n=13)	65.9% (n=29)	62.5% (n=55)
External	35.0% (n=7)	45.8% (n=11)	34.1% (n=15)	37.5% (n=33)
Domestic	65.0% (n=13)	62.5% (n=15)	54.5% (n=24)	59.1% (n=52)
International	35.0% (n=7)	37.5% (n=9)	45.5% (n=20)	40.9% (n=36)
Part-time	55.0% (n=11)	54.2% (n=13)	29.5% (n=13)	42.0% (n=37)
Full-time	45.0% (n=9)	45.8% (n=11)	70.5% (n=31)	58.0% (n=51)
Lecture Attendance* by Semester				
<25%	7.7% (n=1)	7.7 % (n=1)	7.1% (n=2)	7.4% (n=4)
26-50%	0.0% (n=0)	0.0% (n=0)	0.0% (n=0)	0.0% (n=0)
51-75%	23.1% (n=3)	7.7% (n=1)	7.1% (n=2)	11.1% (n=6)
76-100%	69.2% (n=9)	84.6% (n=11)	85.8% (n=24)	81.5% (n=44)
Lecture Recordings by Semester				
Awareness	100.0% (n=20)	100.0% (n=24)	100.0% (n=44)	100.0% (n=88)
Live streaming by Semester				
Awareness (general)	80.0% (n=16)	70.8% (n=17)	86.4% (n=38)	80.7% (n=71)
Aware but did not use[#]	n=3	n=5	n=11	n=19
Did not use because…[#]	./.	./.	./.	./.
attended lecture in person	33.3% (n=1)	2.0% (n=1)	45.5% (n=5)	36.8% (n=7)
no reliable/sufficient internet connection	0.0% (n=0)	0.0% (n=0)	9.1% (n=1)	5.3% (n=1)
wants to learn at own pace and time	0.0% (n=0)	2.0% (n=1)	45.5% (n=5)	31.6% (n=6)
does not add anything more than a recording	0.0% (n=0)	2.0% (n=1)	0.0% (n=0)	5.3% (n=1)
could not ask lecturer questions in real time	0.0% (n=0)	0.0% (n=0)	18.2% (n=2)	10.5% (n=2)
timing of lecture conflicted with other duties	33.3% (n=1)	80.0% (n=4)	90.9% (n=10)	78.9% (n=15)
Response technology by Semester				
Used GoSoapbox	65.0% (n=13)	45.8% (n=11)	43.2% (n=19)	46.6% (n=41)
Used Wireless clickers*	100.0% (n=13)	100.0% (n=13)	96.6% (n=28)	98.2% (n=54)
Overall, Technology helped me to learn	100.0% (n=20)	91.7% (n=22)	97.7% (n=43)	96.6% (n=85)

*internal students only; [#] external students only (multiple answers possible)

Table 2: Lecture Recording and Streaming Use by Mode of Attendance and Enrolment Status

	Views, Overall		Views, External Students		Views, Internal Students		Views, International Students	Views, Domestic Students
	Total (n)[&]	Mean(SD) Median(IQR)	Total (n)[&]	Mean(SD) Median(IQR)	Total (n)[&]	Mean(SD) Median(IQR)	Total (n)[&]	Mean(SD) Median(IQR)
Recorded Lectures viewings	1,624	3.6 (4.0) 2 (0 to 6)	1,060	5.2 (9.4) 5 (1 to 9)	549	2.3 (2.9) 1 (0 to 4)	n/a*	
Downloads of lectures^	223	0.5 (1.0) 0 (0 to 1)	143	0.7 (1.1) 0 (0 to 1)	87	0.4 (0.8) 0 (0 to 0)		
Live viewing (ECHO360 live streaming)	99	0.2 (0.9) 0 (0 to 0)	89	0.4 (1.2) 0 (0 to 1)	10	0.0 (0.3) 0 (0 to 0)		
	Overall (n=453), % (n)		External Students (n=205) , % (n)		Internal Students (n=248) , % (n)		International Students (n=216) , % (n)	Domestic Students (n=237) , % (n)
Any access to recorded lecture	69.5% (n=315)		80.5% (n=165)		60.5% (n=150)		60.5% (n=130)	60.6%(n=20)
Accessed 7 or more lectures (>50%)	29.4% (n=133)		48.3% (n=99)		13.7% (n=34)		14.0% (n=30)	12.1% (n=4)
Average completion rate >50%[#]	5.1% (n=23)		9.8% (n=20)		1.2% (n=3)		0.1% (n=3)	0.0% (n=0)
Viewed any of the lectures live	9.7% (n=44)		18.5% (n=38)		2.4% (n=6)		0.2% (n=5)	0.3% (n=1)
Repeated viewing of at least 1 lecture	49.7% (n=225)		64.4% (n=132)		37.5% (n=93)		36.3% (n=78)	45.5% (n=15)

All data were sourced from the Echo360 Lecture recordings and streaming software; & Unique views; # All students with an average completion rate above 50% also accessed at least 7 lectures; * Information not available from ECHO360 Analytics by enrolment status; ^Lectures are downloaded by students for later viewing (e.g. MP4 files)

Table 3: Comparison of Online Engagement and Grades (External Students only)

	Mean Grades (SD) by Engagement			Passing unit, OR (95-%-CI)^	Grade higher than Pass, OR (95-%-CI)^	Distinction/High Distinction, OR (95-%-CI)^
	Engaged	Not Engaged	Sig			
Any access	5.45 (SD: 1.28)	5.00 (SD: 1.65)	p=0.058	3.29 (95-%-CI: 1.16-9.27)*	1.93 (95-%-CI: 0.91-4.07)#	1.58 (95-%-CI: 0.79-3.18)
Accessed 7 or more lectures (>50%)	5.59 (SD: 1.14)	5.16 (SD: 1.52)	p=0.025	3.32 (95-%-CI: 1.04-10.55)*	2.18 (95-%-CI: 1.12-4.24)*	1.46 (95-%-CI: 0.84-2.53)
Average completion rate >50%	6.20 (SD: 0.89)	5.28 (SD: 1.38)	p=0.004	4.26 (95-%-CI: 0.25-73.49)	6.85 (95-%-CI: 0.89-52.50)#	4.22 (95-%-CI: 1.36-13.11)*
Viewed lectures live	5.66 (SD: 1.19)	5.30 (SD: 1.40)	p=0.144	1.78 (95-%-CI: 0.39-8.12)	2.43 (95-%-CI: 0.89-6.62)#	1.55 (95-%-CI: 0.76-3.18)
Repeated at least 1 lecture	5.42 (SD: 1.28)	5.27 (SD: 1.51)	p=0.475	2.18 (95-%-CI: 0.80-5.92)	1.43 (95-%-CI: 0.75-2.76)	0.90 (95-%-CI: 0.51-1.59)

Significant at p<0.10; * Significant at p<0.05; ^ Odds Ratios: reference group those without use (e.g., without any access, accessed less than 7 lectures, completion rate below 50%, did not view lectures live, did not repeat any lecture)