

## Using digital learning technologies to enhance students' learning experiences in the first year of university

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### KEYWORDS

Interprofessional education, clickers, wikis, digital video

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**Abstract** The introduction of a common first year among all health science students at Curtin University in 2011 presented a challenge to engage large classes of students from diverse health disciplines and entry pathways to university. A range of digital learning technologies were trialled in one core compulsory unit of the common first year to increase engagement and collaboration among interprofessional groups of students. Students enrolled in Evidence Informed Health Practice 100 were invited to complete an online survey to evaluate the technologies trialled. Students' opinions of the technologies trialled were mixed. Audience response devices were highly valued as a tool that engaged students in a large class environment; provided formative feedback, and allowed individuals to share opinions without being identified. Students reported contributing to the student-authored wiki summary of weekly learning concepts did not assist them in understanding the learning concepts. Successful application of learning technologies can be enhanced by supporting teaching staff to confidently use the technology, and ensuring the physical learning space including internet connectivity, can support the technologies.

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### Background

There is support at an international level for the inclusion of interprofessional education (IPE) in tertiary education programs to improve the quality of patient care by health care professionals (Hammick, 2007). IPE is defined as “occasions when members (or students) of two or more professions learn with, from and about one another to improve collaboration and the quality of care” (Hammick, 2007, p. 736). In recent years, the Faculty of Health Sciences at Curtin University introduced opportunities for IPE through clinical fieldwork experiences and case-based classroom activities (Curtin University, 2011); however, in 2011 a common first year for all health science students was introduced, thereby creating even greater opportunities for IPE.

In 2011 the common first year of study in Health Sciences was taught to approximately 1800 students from a range of health science disciplines including biomedical sciences, nursing and midwifery, occupational therapy, pharmacy, physiotherapy, psychology,

public health, social work, and speech pathology. Approximately 300 students were enrolled in Semester 1, and the remaining 1500 students were enrolled in Semester 2. The common first year of study is comprised of five compulsory core units and discipline-relevant elective units, which are studied across two academic semesters. Students from all health science disciplines attended class with each other, where learning activities focused on collaboration and sharing of knowledge among students.

Research focussing on factors influencing academic success in the first year of tertiary education has identified several important issues. First, massification and internationalisation of tertiary education has resulted in alternative pathways for entry to university; and consequently first year students present as a diverse cohort from a range of ethnic, socio-economic, academic aptitude and geographic backgrounds (Scutter & King, 2010), that create challenges and barriers to learning. Second, international students, especially those from non-English speaking backgrounds, face challenges in completing a course of study in a language other than their native tongue and integrating socially into the classroom and social environments at university. International students at an Australian university were found to have difficulties in understanding information presented in face-to-face lectures due to the colloquial language used and the fast rate of speech among teaching staff (Ramsay, Barker, & Jones, 1999). Furthermore, international students from Asian countries have been characterised as being teacher-dependent, passive, unwilling to question teaching staff, and focussed on a rote-learning approach rather than applying critical enquiry (Major, 2005). Third, over half of Australian tertiary education students studying full-time juggle their studies with part-time work (Krause, Hartley, James, & McInnes, 2005) and family responsibilities, creating competing demands for time available to complete learning tasks. Finally, retention of first year university students has been associated with a sense of belongingness to the academic and social environments present. Students who do not engage and create bonds with academic staff and their student peers are more likely to not successfully complete their first year at university compared to students who develop these academic and social connections at university (Johnson et al., 2007). Social networks formed at university develop to become the main source of emotional support for many students while at university (Wilcox, 2005). Interactive and collaborative learning methods, such as those based in IPE, can facilitate students' relationships with academic staff and their student peers and improve student success in the first year at university.

In order to address these factors influencing first year student success, the challenges for academic staff delivering the common first year of study at Curtin University were to: (i) manage the increased class sizes to accommodate all internal students (studying on-campus) in metropolitan Perth and at two regional campuses, as well as the large number of external students (studying fully online); (ii) maintain quality, accessibility and relevance of the learning resources, and (iii) engage a large cohort of students in IPE collaborative learning in, and out of the classroom.

These challenges required a shift to more flexible delivery of learning materials and activities, utilising a range of digital learning technologies to engage large cohorts of first year students involved in common introductory units using an IPE approach. This paper describes an evaluation by students of the digital learning technologies trialled in one of the compulsory core units of the common first year of study.

## **Method**

### ***Study design***

A cross-sectional study design was used to determine students' attitudes towards the different digital learning technologies used in Evidence Informed Health Practice 100 (EIHP 100).

### ***Participants***

All undergraduate students enrolled in EIHP 100 in Semester 2 2011 (N= 1484) were invited to participate in this study. Eligibility to participate in the study was dependent upon enrolment status; internal (attending classes on campus) and external (completing the unit fully online) students were eligible. Ethics approval to conduct the study was granted by the Curtin University Human Research Ethics Committee. Participants were provided with information in the preamble to the survey about the purpose of the study, their right to voluntary participation or refusal, risks and benefits of participation, and assurance that their responses would remain anonymous was given. Participants were asked to provide their informed consent to participate in the study, prior to answering any survey questions.

### ***Description of the unit purpose and content***

Evidence Informed Health Practice 100, a compulsory foundation unit was introduced into the common first year in the Faculty of Health Sciences at Curtin University in 2011. The unit syllabus included the various forms of evidence that are used to inform health practice; the role of empirical evidence in making decisions in health practice; the use of different research designs in addressing health practice questions; and processes for critically evaluating the evidence and determining its value in answering health practice questions.

### ***Description of the learning style for EIHP 100***

Learning activities for the EIHP 100 unit were provided either face-to-face in a classroom setting on-campus or fully online via the learning management system (Blackboard). On-campus students were required to attend a weekly two hour seminar-style class, with class sizes of up to approximately 100 students. Students registered themselves into one of 15 available class times. In the first week, students in each class were randomly allocated to one of (up to) 16 teams. Each team was comprised of six students and team composition was re-arranged if necessary, to ensure that each team

included students from a range of health science disciplines in order to provide students with opportunities to engage in IPE. Students enrolled in an external mode of study were placed into a 'virtual team' of six with other external students from a range of health science disciplines, and were encouraged to communicate with their team members via email.

Each IPE team was asked to assign a name and icon for their group, and share their contact details with other members of their team. Students remained in each of these IPE teams for the duration of the semester. Students were asked to contact their tutor and team members to advise them if they were going to be absent or late to class, in an attempt to encourage professional behaviours among first year health science students.

The weekly learning activities were structured around three stages of learning: (i) preparation; (ii) participation, and (iii) review. Preparation involved accessing readings and activities that were available through Blackboard in the week prior to each class. Students were required to view pre-recorded lectures, access any relevant online videos and websites, and complete preparatory readings to support the learning activities to be covered in class. Participation in the weekly learning activities required students to work both independently and in their small teams to complete case scenario activities, interpret statistical data, and learn about different research methodologies. To complete the review stage of learning, one IPE team was randomly selected at the end of each class to write a summary of the learning activity for that week; what concepts were covered; their relevance to evidence-based practice, and aspects the team found challenging or interesting. This summary was posted on a weekly wiki on the EIHP 100 Blackboard site.

There were three tutors (from different health profession disciplines) in each class to facilitate the learning activities and answer questions. This also modelled the IPE approach to the students' learning activities and experience.

### *Description of the physical learning space*

The physical learning space for this class was a large single-level lecture theatre that had been refurbished in consultation with the unit coordinator for EIHP 100, to promote collaborative small team learning. The learning space was approximately 17m x 15m with 16 groups of six tables and chairs. Each group of tables included access to electrical power for students using mobile technologies such as laptop computers.



**Figure 1:** A tutor facilitating interprofessional team work in EIHP 100

Four large projection screens were placed on each of the four walls of the learning space to allow students a clear line of vision to projected images, regardless of their position or orientation in the room. The tutors facilitated the learning activities from the centre of the learning space, and during class activities were available to provide support to each team as required (see Fig. 1).

### *Digital learning technologies trialled*

The digital learning technologies trialled in EIHP 100 included:

- i. large projection screens positioned around the classroom providing visual access to teaching materials used in class;
- ii. digital video clips (via YouTube) that provided students with examples of health research topics and case scenarios that complemented the information provided in lectures, pre-readings and classroom discussion;
- iii. in-class access to laptop computers with internet access to allow students to research information and resources for team learning activities;
- iv. audience response devices (also known as ‘clickers’) that provided students with the opportunity to anonymously answer multiple-choice questions relating to the learning concepts being discussed or to provide agreement/disagreement on ethics and other issues related to research;
- v. a wiki posted on the Blackboard site by a randomly selected IPE team in each class each week (including external student IPE teams), that provided a summary of the learning concepts covered that week. Other teams were encouraged to read the wiki summaries and post feedback to the contributing team. This provided students with a students' perspective of the learning concepts;

- vi. iLectures available via the EIHP 100 Blackboard site. Given that it was not possible to physically accommodate all enrolled students in one lecture theatre, the common first year units abolished face-to-face lectures replacing them with pre-recorded lectures in an MP3 format that students could download to mobile technologies such as laptops, smartphones and tablets, and watch prior to attending (or completing online) interactive learning tasks;
- vii. Elluminate *Live* sessions – these were scheduled with external students in the weeks leading up to the submission of the written assignments for the unit. This provided students with the opportunity to talk directly with a tutor to ask questions and clarify understanding. Students with an internal mode of enrolment (i.e. attended classes on campus) could access a face-to-face meeting with their tutor to receive assistance in understanding the learning concepts.

### ***Method of evaluation***

Students were surveyed using an online survey via Survey Monkey. An invitation to participate in the study was placed as an announcement on the EIHP 100 Blackboard site, and was copied to the student email addresses of all students enrolled in the unit. A link to the survey was embedded in the invitation, and as no login or use of an identifying name, student number or password was required, all responses were completely anonymous and could not be used to identify any individual student.

### ***Data analysis***

Simple descriptive statistics in Excel were used to determine percentage agreement with each of the statements in the survey. Content analysis of qualitative responses in the survey was used to identify major themes or issues common to respondents.

## **Results**

### ***Demographics of participants***

Of the 133 EIHP 100 students who consented to be in the study and completed the online survey, the majority were female (88%); reflecting the higher representation of females enrolled in each of the respective health science disciplines at Curtin University. A large majority of students were enrolled in the internal mode of study (88%), and overall most students fell into the 18 – 24 age group (59.5%), as shown in Table 1.

**Table 1:** Demographic data of study respondents (N=133)

	Response %
<b>Gender</b>	
Male	12.0
Female	88.0
<b>Age</b>	
< 18 years	3.2
18-24 years	59.5
25-29 years	9.5
30-39 years	13.5
40-49 years	11.9
50 + years	2.4
<b>Mode of study</b>	
Internal	88.0
External	12.0

### *Blackboard learning management system resources*

Participants were surveyed about the value of the learning resources provided on Blackboard including downloadable iLectures, weekly readings and the weekly summaries of learning concepts provided by students via the wiki. Participants selected one of four responses on a four-point Likert scale (Strongly agree/agree/disagree/strongly disagree). Responses were aggregated into two categories (agreement versus disagreement) to provide an overall picture of student attitudes. The statements provided and participants' responses are presented in Table 2.

**Table 2:** Percentage agreement with survey items

Survey items	Strongly agree/ Agree (Response %)	Disagree/ Strongly disagree (Response %)
The learning materials were easily accessible via	91.2	8.8
The online iLectures allowed me to access the lecture material at a time that is convenient for me	88.7	11.3
Being able to review the online iLectures as many times as I need has helped me to understand the learning concepts	76.6	23.3
Contributing to the wiki summary has helped me to understand the learning concepts	33.9	66.1
The wiki summary provided by other students has helped me understand the learning concepts	32.2	67.6
Participating in learning activities within a small team has provided me with learning support from fellow students	59.6	40.3

### ***In-class and online learning technologies***

Participants enrolled in an internal mode of study (i.e., attended classes on campus) were asked to identify the learning technologies they found useful for facilitating their learning in EIHP 100. Ninety-five participants completed this question and were positive about the usefulness of the technology in supporting their learning. General feedback was that the in-class technologies were interactive and actively engaged students in their learning. Respondents who reported they were 'visual learners' benefitted from an alternative to information provided via written word alone.

### ***Large projection screens***

Eighty-one per cent of respondents identified the four large screen projectors as being important in facilitating their in-class, team-based learning experience, especially due to the large class size. Qualitative responses included:

*"Having the large projection screens helped to keep up with the material that would be discussed in class, to help me in my own thoughts and ideas about the discussion."*

*"Multiple screens enabled various viewing angles, while remaining focused in a group."*

*"The screens were all around the classroom so we did not have to face a single screen, and it made group activities easier."*

### ***Audience response devices***

Approximately 66% of respondents reported the audience response devices that provided anonymous responses to questions/statements were beneficial to their learning in EIHP 100. Respondents reported the use of the response devices *"changed the tempo of the class and made it interesting and interactive"*; and facilitated students' participation with the class activity; with one survey respondent noting *"the interactive nature of the clickers was fantastic in getting people involved."*

Respondents who were not comfortable in speaking up in front of a large class, found the response devices were a useful way to confirm they understood the content being discussed in class in a safe environment. The fact that responses provided were anonymous was a common theme among the survey participants, as demonstrated in comments such as: *"The clickers were a good way to test knowledge and improve confidence with the anonymous results"*, and *"the anonymity of my responses was appreciated."*

Survey respondents were also interested to know what their fellow students' responses were to multiple choice questions (MCQs) or about others' agreement/disagreement with issues raised in class discussions. They appreciated the opportunity to discuss the diversity in student beliefs and perceptions on a particular issue without individual students being identified.

### **Digital video resources**

Over half (54.2%) the survey respondents found the information provided via YouTube videos useful in facilitating their learning. These videos were accessible to internal students in class, and to external students via the respective links embedded in the weekly Blackboard preparation and learning activities.

The video resources were found to provide a way to explain ideas more clearly, provide different examples of a concept, and put the learning outcomes into a real world context. Respondents found the videos provided complementary information in short durations, were interesting to watch, and provided a 'break' from the tutors speaking.

### **Laptop computers**

Only one-third of respondents found the laptops provided for in-class activities useful in facilitating their learning. Difficulties with logging in and insufficient wireless connectivity were reported as technological issues that negatively impacted on the potential use of this digital learning resource, and contributed to students' frustration, as noted in the following comments.

*"Laptop computers did not work due to students unable to log in, but would be useful if this issue did not arise."*

*". . . most of the time the laptop computers did not work, which made things frustrating when we were told we needed to access a computer."*

### **Participation in Elluminate Live tutor support sessions**

Four of 15 respondents who were enrolled in an external mode of study (i.e., fully online) responded that they participated in the scheduled Elluminate *Live* sessions with a tutor. Those students who participated in Elluminate Live provided positive feedback, including:

*"I found it good to be able to ask (my tutor) questions directly and get personalised answers. I also picked up some information from listening to (my tutor's) conversations with the other student that participated in the session I did."*

*"It was reassuring to discuss my assignment, so I found it very useful. It is hard as an external student to know sometimes if you are on the right track, so having the opportunity to discuss things was great."*

External students who did not participate in Elluminate *Live* reported they were limited by technology issues including no microphone/camera access at home; and the times of scheduled sessions were not convenient due to prior work or family commitments.

## Discussion

The trial of the digital learning technologies in EIHP 100 resulted in some positive feedback from the perspective of the students. Most notable was the provision of the large projection screens around the learning space that provided students with easy visual access to important information being discussed in class. The shift to larger class size (up to 100 students) in the interactive seminar-style EIHP 100 classes required refurbishment of the classroom environment. To fully engage students in such a large room, the traditional concept of teaching from the 'front of the class' was abandoned, and the tutors facilitated the class activities from the centre of the room. This ensured that even students in the outermost groups of desks in the room were only two or three desks away from at least one of the three tutors; and therefore, were able to see and hear what was being said. Despite this, there was overwhelming consensus in the student feedback for EIHP 100 on the university's eVALUate system that students did not like the very large class size, and would prefer to be in an interactive learning environment with no more than 50 students per class.

Almost 90 per cent of respondents to our survey agreed the downloadable lecture content provided them the opportunity to access the necessary information at a time that was convenient to them. This supports the findings from the report by Krause and colleagues (2005) that identified Australian tertiary education students commonly work while studying, in addition to other family commitments. Removing the requirement to attend a face-to-face lecture at a time determined by the university timetabling system, allows students the flexibility to access the learning materials at a time and location convenient to them. While this doesn't guarantee students will access the online materials in a timely manner to prepare for each week's in-class seminar or self-directed online learning activities, it does give students the option to be able to access the material at another time. More than three-quarters of respondents agreed the downloadable lectures also enhanced their learning by allowing them to review the lecture material as many times as needed. This was especially important in EIHP 100 given the large number of international students from non-English speaking backgrounds that were enrolled in the unit.

The use of audience response devices in large size classes is commonly reported in literature (Kay & LeSage, 2009) and generally speaking students enjoy using this technology (Kenwright, 2009). The audience response devices were used during in-class learning activities in EIHP 100, but not for formative assessment. The key themes from the students' qualitative feedback was that the audience response devices (clickers) were effective in capturing students' attention in class; engaging them in the learning activities; and the anonymous nature of the responses increased students' confidence to answer questions in a large class setting. These identified benefits are consistent with the findings of prior studies among students in a large class environment (Bergtrom, 2006; Patterson, Kilpatrick, & Woebkenberg, 2010). Others have identified that the response devices can provide immediate feedback to students and academic staff about how well the whole

class understands the learning concepts being covered, and certain aspects that required further explanation or discussion could be addressed immediately (Kay & LeSage, 2009). However, the application of this technology beyond their use as a MCQ tool should be explored to exploit collaborative and problem-based learning, and development of critical thinking skills (Bergtrom, 2006). Our study did not aim to determine if the response devices improved student learning outcomes, and prior studies are inconclusive about the effect on academic performance when response devices were used; no significant improvement was found by some researchers (Duggan, Palmer, & Devitt, 2007; Stein, Challman, & Brueckner, 2006), while others reported significant improvements in students' test scores when response devices were used in class compared to previous test scores (Hall, Collier, Thomas, & Hilgers, 2005). The impact of this digital technology on achievement of learning outcomes requires further investigation.

Furthermore, the ability of academic staff to successfully use these technologies will impact on how well they are integrated into the in-class activities. Duggan et al. (2007) compared the academic performance and opinions of students, and the opinions of lecturers in two classes where response devices were used, with the academic performance and opinions of students and opinions of lecturers in two traditional classes. Lecturers who valued the use of the response devices tended to be more confident with digital technologies, than those who preferred the traditional format. This highlights the importance of providing adequate professional development, training and mentorship to academic staff that may be unfamiliar with the use and application of digital learning technologies. More training and peer support with the use of the audience response devices will be provided to academic staff in EIHP 100 to further enhance the teaching and learning experiences of both the staff and the students.

The provision of laptop computers for in-class group activities was not successful in EIHP 100 as a result of insufficient wireless capability to support a large number of simultaneous users. Although the teaching space provided wireless capability for up to 70 wireless devices, students' own mobile technologies including smart phones, laptop computers and other personal digital assistants (PDAs) that were brought into the classroom competed for the wireless signal. This resulted in many students being delayed or unable to log onto the university provided laptops in order to complete various team-based learning activities that required students to find relevant information via the Internet. Consequently, the laptop computers were more a source of frustration than support among students and staff. In response to these technical difficulties, the teaching space has now been hard-wired for Internet access. This infrastructure upgrade will remove the delays experienced by students using the laptop computers (iTALC.), and will also allow for other teaching and learning technologies that provide opportunity for collaboration and sharing among and between students in the large size class environment to be trialled, such as the free Intelligent Teaching and Learning with Computers (iTALC.) software.

Only about one-third of respondents found that the student-authored wiki summary of each week's in class learning activity enhanced their learning in this unit. It was hoped that this team task would provide students with an opportunity for just-in-time learning and interactivity through collaborative reflection of the concepts they had learned, and also provide them with feedback about their learning from their peers. However, only very few students provided comments on their peers' wiki entries, despite the fact that some of the team summaries were exemplary. There are possible explanations for why students did not find this activity helpful to their learning in this unit. The first is that while there was an expectation that this team task would be completed by each team of students at least once in the 12-week semester and that other students would review the wiki summary each week to support their learning, neither the writing of the summary nor the comments posted by other students were formally assessed, and so if students did not complete either the wiki summary or review and post comments on others' summaries, there was no penalty to their grade for the unit. Students who are externally motivated to learn rely on rewards and desirable outcomes (e.g. academic grades) compared to intrinsically motivated students who engage in learning activities through curiosity, a desire to be challenged and social bonds formed through learning activities (Williams & Williams, 2011) are less likely to engage in non-compulsory or graded learning tasks that they do not see as valuable. This is related to the second explanation for students' disagreement with the learning value of the wiki summaries; there was no final examination for EIHP 100. The summaries of the weekly learning concepts written by the teams provided a comprehensive overview of the unit content written from the students' perspectives and in language that was accessible to other students. However, without the requirement to study for a final examination addressing this content, students may have perceived there to be no value in reading the weekly summary. Given that EIHP 100 is worth half the credit points of the other compulsory core units in the common first year, and students seem not to value the opportunity for teamwork and collaborative learning provided by this wiki task, the burden of this team activity appears to outweigh potential benefits.

A major limitation of this study was the very low response rate by the total number of students enrolled in the unit who were invited to participate in the study. One reason for the low response rate by students may have been because the same cohort of students were also being surveyed about their learning experiences with the common first year curriculum, especially with regard to IPE, possibly leading to respondent burden. As a result the feedback provided cannot be considered representative of the students enrolled in EIHP 100; however, has provided the unit coordinators with ideas for improvement in the use of the learning technologies for the following academic year.

## Conclusion

A range of digital learning technologies were trialled in a compulsory unit in the common first year of all health sciences degrees at Curtin University in 2011. Students who participated in the survey reported access to downloadable lecture material allowed them to view lecture material at a time convenient to them, and allowed them to view the material as many times as needed to gain understanding of the content. Students also had positive attitudes toward the use of audience response devices during in-class activities as a way to provide anonymous formative feedback about their understanding of learning concepts, as well as an avenue for expressing their opinion on a topic without being identified individually. This was most helpful for students who felt shy about speaking in front of a large group.

Challenges to the successful implementation and uptake of these technologies included limitations to wireless capabilities, variability in the skills and confidence of academic staff to use the technologies in the classroom, and students' perceptions that student-authored review activities were time consuming and of little additional benefit to their learning. Further evaluation of the effect of these learning technologies on students' engagement and learning outcomes is planned in future years.

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