

# Student considerations on the use of annotated lecture notes and recordings in a learning environment

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## CONTEXT

The on-campus, online and open education environment is changing how education is resourced and delivered. The application of sophisticated computer-based technology, e.g., the blending of a mobile device PC with a Learning Management System is one of the many modern approaches to teaching and learning. Within the higher education sector, new technologies may have significant potential to effect change in both learning and teaching, enabling tertiary institutes to meet a broader range of learners' needs, by adapting traditional teaching methods, and offering a mix of face-to-face and online learning possibilities. Blending different technologies and associated pedagogies require a very different skill-set from more conventional teaching and training for educators and students, especially for first year students. Evidence shows that students are not always being prepared adequately in schools for digital learning. Learning management systems (LMS) and mobile device PC technology have been shown to improve the instructor-learner dialogue resulting in an improved learning process. At the tertiary institute where this study was conducted, a faculty-wide program was initiated to support lecturers using mobile personal device pcs (PMDs) for direct instruction, and an LMS for asynchronous delivery of the teaching and learning material in a blended learning program.

## APPROACH

All students enrolled in this subject were asked to complete an anonymous paper-based questionnaire at the end of the semester but before their exams. A quantitative methodology was utilized for analyzing the response from the questionnaire which contains 20 multiple choice questions. In addition, a series of qualitative free text questions were appended to the questionnaire. These free-text entries were coded, and the responses categorized and then counted to enable quantitative comparisons.

## RESULTS

The key difference between how the two different teaching resources, annotated notes, and the LMS, were that students utilized recordings from the LMS as a means of catching up on missed lectures. The provision of annotated notes was seen as more of a revision tool. The students perceived that both approaches assisted in their learning.

## CONCLUSIONS

Outcomes from the study indicated that students perceived the use of mobile device PCs during a live lecture helped them in understanding the subject material. The LMS recordings of the lecture were primarily used to catch up on missed lectures. These resources provided students with the flexibility to engage in learning at a time that was convenient for them. The students' responses suggested that for their learning process, more annotated notes and recording be made available in other subjects.

## KEYWORDS

Notetaking, recordings, learning management systems, Mobile device PC.

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## Introduction

The current student cohort (those born between 1980 and 1996) are often referred to as the Net Generation (Jones, Ramanau, Cross, & Healing, 2010; Koh, 2015; Tapscott, 2008). They have been brought up in a world where information technology (IT) items are often their first manipulative toy. Their use and familiarity with a variety of IT mobile devices have demanded the delivery of instructional material in K-12 education and at the tertiary level to correspond with the student's own personal mobile devices (Chiu & Churchill, 2016; Judd & Kennedy, 2011; Judge, Floyd, & Jeffs, 2015).

Personal mobile devices (PMDs), allowing handwritten annotations to be projected onto a screen and saved, are now established technology and have been implemented in a variety of ways in both secondary and higher education teaching. PMDs have been shown to improve the instructor-learner dialogue in lecture delivery type projected presentations with associated note-taking (Ebner, Schön, Khalil, & Zuliani, 2016), and are part of the technology-rich learning environments (Brown, 2015; Galligan, Loch, McDonald, & Taylor, 2010; Galligan, McDonald, Hobohm, Loch, & Taylor, 2015; Kali, McKenney, & Sagy, 2015).

At the institute where this pilot study was conducted, a faculty-wide program was initiated to support lecturers using PMDs (write-on devices), incorporated into a Learning Management System (LMS) allowing for asynchronous delivery of both the teaching material and recordings of the lecture process. All lectures were recorded audio-visually and synchronized with the PowerPoint slides as an integral part of the LMS. This approach is one of many considered to be a blended learning initiative to extend the classroom experience into a multimedia environment.

Often in science classes, many students are not effective note-takers (Sandblom, 2015; Stacy & Cain, 2015). To ameliorate the effect of ineffective note taking, several instructional material delivery methods have been suggested, including pre-class full notes (Chen & Lin, 2008), pre-class partial or "gap" notes, post class full notes and recorded classes with a variety of notes, (Chen, Teo, & Zhou, 2016; Gee, 2011; Heward, 2004; Worthington & Levasseur, 2015). The benefits of student learning on improving student outcomes with partial notes have been ambivalent. Results from these studies (in the areas of psychology and education) suggested that students receiving partial notes performed better on examinations later in the semester and on conceptual questions during the cumulative final examination than students receiving full notes. However, students perceived that they learned "better" with partial notes in some instances students who received full notes self-reported that class attendance was minimal. Similar studies in the areas of science and related areas have not often been reported. The outcomes reported in this paper do not identify the success of material delivery regarding examination results but instead focusses on both the students' perceptions of the IT technology and their preferences in how information is disseminated using IT, as well as how the students use the different teaching materials produced or their learning.

The aim of this study is to evaluate student perceptions of the effect of portable IT technology in a large, compulsory, first year engineering subject. It is an extension of previous work (Cook, Blicblau, & Keane, 2013). The focus of the project is to assess students' perceptions of their preferred information delivery mode and the implementation of an LMS, and specifically, to gauge the success of electronic handwriting (e-inking) from the learning and teaching perspective. This research study then explores how students use available learning materials, and how introducing new technology to lectures impacts on students' learning so as to inform the development of future learning materials.

## Methods

The engineering subject assessed runs for 12-weeks across one academic semester by two lecturers (Frank and Peggy) who team-teach. Frank and Peggy each take six weeks of lectures (18 in total), and used the same IT Mobile device technology, as well as providing students with notes using a pdf version of their PowerPoint slides. Peggy taught the first six weeks, and supplied the students with partial notes, and using the PMD, filled in note sections, solved problems and drew diagrams with e-ink during the lecture. However, after the end of the lecture, she provided students with a full set of annotated notes from that lecture and placed the file on Blackboard (LMS) for dissemination. Frank, who taught the second six-week section, provided students with a full set of notes and did not do any annotations. He also supplied a copy of his full set of notes on the LMS after the lecture.

A questionnaire was specifically developed to measure student perceptions and attitudes to their learning regarding their note taking requirements. As this unit was delivered in both semesters, but by the same lecturers and for the same section of the semester, the questionnaire was distributed to the two different cohorts of students, i.e., semester 1 students and then semester 2 students. Participants were assured that the results of the study would be solely used for research purposes to improve the teaching and learning methodology, and would have no effect on their current or final results. At the end of each semester, and before exams, all students enrolled in this subject in both Semesters 1 and 2 (a total cohort of 284) were asked to voluntarily complete an anonymous paper-based questionnaire. All participants belonged to the same cohort of first year engineering students enrolled in the one subject in the same undergraduate program. Students were briefed on the nature of the questionnaire and confidentiality was confirmed. They were invited to complete the questionnaire before their final examination. They were allowed as much time as was necessary to complete the questionnaire, which typically varied from 15-20 minutes. A quantitative methodology was employed comprising of a questionnaire with 20 questions and opportunities for participants to provide qualitative responses. This instrument contained multiple choice and open-ended questions.

From a total student cohort of 284 (across both semester), 103 students participated in the questionnaire; semester 1, (n=72) and semester 2 (n=31). The data from both semesters were aggregated. In semester 1, there was a higher participation rate (48%) than in the second semester (21%). According to work done previously (T. Clark, 2008; Cleary, Siegfried, Escott, & Walter, 2016), the reduced participation rate compared with the overall student enrollment can be attributed in part to research fatigue experienced by students who have been overwhelmed by questionnaires from various sources being requested in a short period of time.

Entries to questionnaire tick data were compiled to provide quantitative data. Free text entries were repeatedly read and scanned to enable the coding and categorisation of responses, then counted to enable quantitative comparisons (Bogdan & Biklen, 2007; Boyatzis, 1998).

The questionnaire analysis involved the following predominant research themes;

- perception of students of the benefits of retrieving complete lectures asynchronously as an aid to learning
- perceptions of students in the use of partial/annotated notes as an aid to learning compared to a full set of notes
- perception of students of the subject delivery method with a Mobile device PC as a conduit for learning of lecture material

## Results and Discussion

### Preference to annotated(completed) notes or recordings

All annotated(completed) slides were uploaded to the Blackboard site for Peggy's section of the course. Students commenting on how they used the annotated notes stated they mostly used them for revision, while a larger percentage used them if they had missed a lecture while a few, (5.4%) were unaware of this learning resource.

Although viewing lecture recordings were not favored by all students (about half viewed the lecture material), it did allow students to fit their learning around their schedule. While other students commented: "there is an 8.30 lecture on Thursday, and it is my only class, so I watch the lecture at home rather than going." This last quote show indicates that the live lecture is a valid learning resource for students despite the plethora of digital learning alternatives.

However, about 40% used the recordings as a substitute for lecture attendance. One student explicitly stated "I only use them when I am unable to attend. There is no substitute to actually going." Even with the availability of recordings, attendance at the lectures was still preferred.

Comments about the recordings indicated that students used the recordings in much the same way they use the annotated note, namely to revise and catch up on work from missed lectures. They also expressed the added benefit that the diagrams were clearer in the recordings. The key difference between how the resources were used is that recordings were primarily viewed as a means of catching up on a missed lecture, whereas the provision of annotated notes was seen as more of a revision tool.

### Preference to partial lecture notes

Given in Table 1 are the results of the survey of students' preference between partially annotated notes and a complete set of notes (incorporating annotations done during class time). Although over 50% of students preferred the partially annotated notes, further studies would be required to arrive at a conclusive answer.

**Table 1: Student preference to annotated or partial lecture notes.**

Preference	Student response (percent)
Annotated notes-style 1	52.9
Complete notes style 2	28.4
Either note style	6.9
No preference to note style	11.8

### Motives for a particular style of note delivery.

Shown in Figure 2a and 2b is a comparison of the student motives for a particular style of note delivery method. Both those who preferred annotating partial notes and those who preferred to be given complete notes cited their preferred method made the lecture content "easier to understand."

The majority of those who preferred annotated notes did so because it kept them active during the lecture making it easier to stay focused on what was being said and ultimately helping them to learn better.

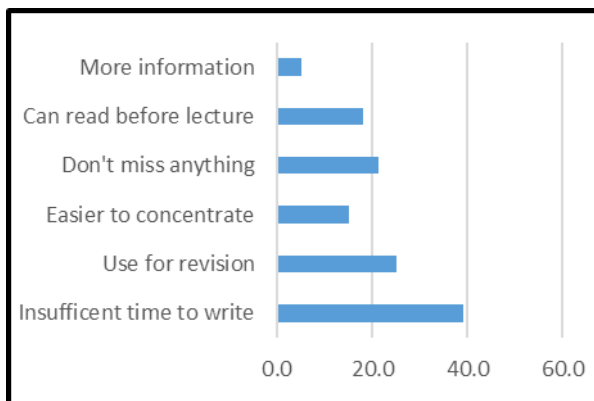
The disadvantage to this approach was that sometimes the lecture moved too quickly, and there was insufficient time to fill in all the necessary information.

Samples of student responses to this method of note delivery included:

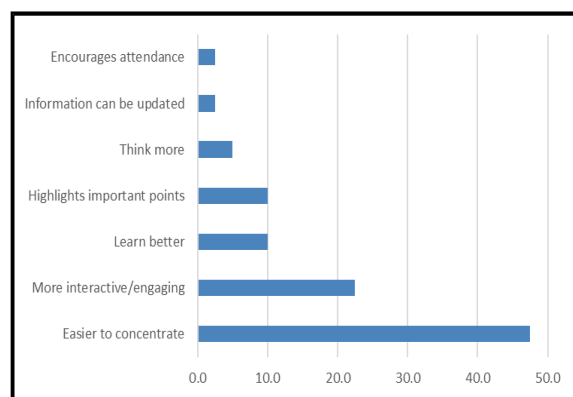
“I liked annotations of the lecture because it made you participate, read and actually learn.”  
“Annotations because keeps you focussed but sometimes moves too quickly and don't have time to copy.”

Students also felt that the use of partial notes gave them an indication of which information was, “usually the annotation half is the most critical of the notes.”

The students who preferred being given complete notes, (by Frank), most frequently mentioned their preference for this method of note distribution because they; did not have time to fill in partial notes during the lecture as their reason, and they felt that complete notes contained more information and prevented them missing anything during the lecture.



**Figure 2a. Students' reason for preferring complete notes**



**Figure 2b. Students' reason for preferring annotating notes.**

Other students also mentioned that they benefitted from being able to access the complete notes before the lecture and not just having the annotated version available afterward, i.e. “complete notes, can read ahead and look back as well,” and “complete lecture notes allow you to “focus more on what's being said instead of writing things down.” All these student comments support the blended learning approach adopted by the lecturers.

### **Further Student responses and suggestions**

In addition to videos of lectures, students were asked to comment on other potential uses of the PMD technology in the teaching of other first year subjects. Even though the comments distribution was very spread out, grouping similar comments, resulted in the following four as being of major importance:

- 17%- Podcasts of key concepts (S. Clark, Taylor, & Westcott, 2012)
- 14%- Links to videos of theory being applied in real life, e.g., Youtube/Vimeo (Sengupta, 2011)
- 18%-Audio-visual solutions of tutorial questions (Falzon & Brown, 2005)
- 14%- Hands-on demonstration and props used in lectures

This set of data provided a useful insight into how students would like to see this technology develop and evolve in their lectures for their learning, despite being few in number. The results obtained are consistent with those obtained by other workers and are indicated by the references provided. Additionally, students suggested that IT technology could also be used to produce video/podcasts of key points and broadcast on Social Media (Lau & Lee, 2010).

Students noted that active lecture demonstrations are a substantial and popular part of this particular lecture course and should be recorded as a video or podcasts and “put on the web.” The recording and broadcasting of demonstrations and their impact on learning is an area of investigation in future work. Many students surveyed here wanted screencasts because they had been exposed to this method of teaching through the maths studies (McLoughlin & Loch, 2012) and the desire to have a screencast on a subject that is taught very “hands-on” indicates they have had a positive response to this use of the material delivery.

## Concluding Remarks

Students perceive that live lectures are important to their learning and that the distribution of complete notes and recordings were useful if missing a lecture and as revision aids. More than half of the students used these annotated notes for revision. Moreover, the process of annotating partial notes during a lecture was viewed as making it easier to concentrate on the lecture, and even making it more engaging.

The lecture recordings, made available to students through the same LMS as the partial/annotated notes, and were primarily used to catch up on missed lectures, with revision as a secondary purpose. An additional and unexpected use of the recordings was that students used them to better view graphs and diagrams which were not clear when viewed on the screen and most likely too small when printed in the notes.

Accessing the notes through the LMS allowed students to study off campus and at a time which suited them. Students commented that they access the notes to “read on the train” or download the recordings and “read on phone,” or “take to work.” This portability and flexibility of learning resources are an important addition to the traditional lecture with online learning materials making it possible for students to take control of how, when and where they study.

In conclusion, it appears from this pilot study that the use of PMDs for annotating slides during a live lecture, recording the total lecture, and making the annotations available online has been useful for students. This research study shows that students use available learning materials, and the implementation of available IT technology to lectures impacts on students’ learning so as to inform the development of future learning materials.

These blended resources provided students with the flexibility to engage in learning at a time that was convenient for them.

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