

## **BRIDGING THE DIVIDE BY SCREENCASTING IN AN INTRODUCTORY STATISTICS CLASS AT AN AUSTRALIAN UNIVERSITY**

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### **ABSTRACT**

Emerging technologies are being used increasingly to improve the communication and quality of instruction in the statistics classroom. Whereas a decade ago the move commenced away from blackboard writing with chalk towards computer assisted lecture delivery via PowerPoint or Beamer presentations, we are now seeing increasing use of Tablet technology to create dynamic and engaging lectures. While usually only students physically attending lectures would benefit, combined with screencasting – video capturing of the full computer screen along with audio recording – a near live lecture experience can be provided to students who cannot attend lectures. This is particularly valuable at universities with students enrolled in distance mode. This study investigates the benefits and downsides of providing lecture screencasts to oncampus and distance students of an introductory statistics class at the University of Southern Queensland (USQ). After technical issues were overcome, the recorded lectures were well received by the students, and this anecdotal evidence is supported by positive student evaluations.

**Keywords:** Tablet technology; Camtasia Studio; Online and distance teaching; screencast

### **1. INTRODUCTION**

The work presented in this paper has developed from a University of Southern Queensland (USQ) Learning and Teaching Fellowship which provided Tablet PCs to academics in all faculties to evaluate benefits to lecturers and effect on student learning. The Tablet PCs were also equipped with screen recording and PDF annotation software. The project described in this paper investigates the benefits and downsides of providing screencasts of live lectures to students in an introductory statistics class.

About three quarters of students enrolled at USQ study via distance mode, which means they can complete their degree without physically setting foot on campus. Many of these students may be located close to the university campuses and yet simply choose to study in this mode for family or work related reasons. However, most students are located too far away to attend classes; in fact quite a few USQ students study from overseas. When the dual mode (oncampus and distance) was introduced in 1977 long before the availability of personal computers for teaching purposes, the university started its distance teaching via printed mailed out materials. To meet the instructional needs of these students, the university has traditionally been one of the early adopters and developers of new teaching technologies, for instance, when trialing video

conferencing and audiographic tutorials in the late 1990s (Harman & Dorman, 1998), or when moving to an online offer in the early years of the Internet (Reushle & McDonald, 2000).

Today, study material is sent to students via CD (or DVD, as appropriate), including multimedia learning objects, and also made available through the Open Source Learning Management System (LMS) Moodle. The university has even commenced to move away from providing printed material to students.

To decrease the gap between services provided to oncampus students (lectures, tutorials) and distance students, the university developed lecture recording software (“IPLD”), which produced an audio recording and still screen images of a live lecture. This tool, however, did not allow recording of whiteboard writing in class, was cumbersome to use, and has since been phased out. Macromedia Breeze (now Adobe Presenter) was made available in 2005, to record audio on top of PowerPoint slides (Birch, 2009). However, due to its user interface, this tool can only be used for off-line recordings in an office situation rather than for recording live lectures.

Through the fellowship, a Tablet PC was made available to the first author with Camtasia Studio screen recording software and PDF Annotator software to write on PDF documents. The Tablet PC was used to annotate Beamer slides in a large introductory statistics course servicing students from a variety of different disciplines. Screen movement and audio were recorded in all lectures and uploaded to the course LMS site for student access.

This paper is one in a series of investigations into the use of Tablet PCs and related technologies in higher education to promote student engagement and effective learning and teaching practices at USQ. It describes results from a study on lecture screencasts in an introductory statistics course with annotations facilitated by a Tablet PC where appropriate.

## 2. BACKGROUND

Tablet PCs and dedicated tablet operating systems taking advantage of the special ink-enabled features have been available since the beginning of this decade, however their uptake has been slower than one might have expected. In the last couple of years, a steady increase in adoption of tablet technology has been observed in Australia, partly due to the reduced cost to purchase a Tablet PC, but also because of word of mouth about its usefulness in higher education contexts.

For instance, in the mathematical sciences where it is important to write by hand when explaining the pathway to the solution of a problem, and where PowerPoint-only or PDF/Beamer presentations are usually complemented by whiteboard writing, the Tablet PC can become a tool that removes the need for the whiteboard when writing is shifted to the tablet screen, as evaluated for teaching introductory mathematics courses for engineering and computer sciences students (Loch, 2005; Loch & Donovan, 2006) and for a number of mathematics courses (Fister & McCarthy, 2008). Another advantage of writing on the screen in class is that a record of the writing can be kept and annotations can be made available afterwards to students for revision purposes, if they have missed a class, or if they are enrolled in distance mode. However, as with all new technologies, the computer technology (hardware or software) may not be reliable and the level of comfort of the lecturer translates to students’ perceived effectiveness of the tool (Loch & Donovan, 2006).

Screencasting has been available for a number of years, reaching back to 1993 according to Budgett, Cumming and Miller (2007). However, not many accounts of the effective use of screencasting in statistics teaching and the impact on student learning can be found in the literature. Moving on from pre-recorded PowerPoint and audio lectures, Budgett et al. (2007)

tried Tablet PC annotated lecture screencasts recorded in BB-Flashback across a number of courses, one of which was a first year introductory data analysis course similar to the course evaluated in this study. The lecturers wrote on PowerPoint slides in this course, and recordings were regarded as complementary to lectures, not to replace them. The most important reasons for providing the recordings were so students could revise at their own pace for reinforcement, or catch up when they had missed a class. In addition, the recordings could be played back several times, which benefits for example international students who may not have a good grasp of the English language.

Bilder and Malone (2008) give a brief overview of a number of applications of the Tablet PC in teaching statistics courses, for instance writing in lectures, recording screencasts, and broadcasting live classes via web conferencing software. Further applications of Tablet PCs in mathematics or statistics teaching can be found in (Loch & McDonald, 2007; Reushle & Loch, 2008). These also include synchronous handwritten chat tutorials and web conferencing sessions.

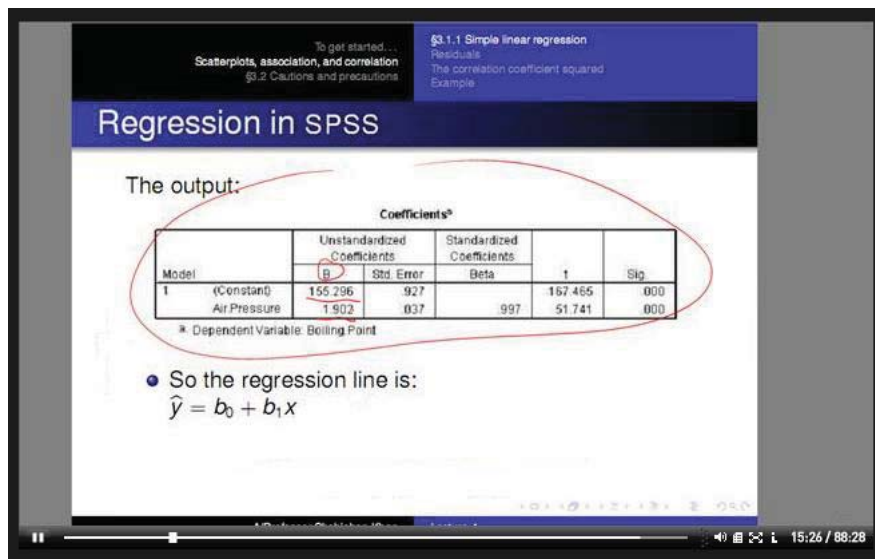
### **3. INK ANNOTATIONS AND SCREENCASTING IN A STATISTICS COURSE**

At USQ Data Analysis is a first year introductory statistics course offered to oncampus and distance students across the university. While taken by mathematics major students, it mainly caters for students not majoring in Mathematics or Statistics who quite often have weak knowledge of the elementary mathematics required to successfully complete the course. This issue is magnified for distance students who do not have the option available to oncampus students to attend lectures or a lecturer's face-to-face office hours. Ink annotations on a Tablet PC and screencasting of these annotations has opened up a variety of opportunities for distance students to engage more effectively with the content of a course which is perceived by many to be difficult.

One of the requirements of the Data Analysis course is that students use the SPSS statistical software package for displaying and analyzing real-life data. Students were provided with a booklet of instructions, including screenshots, on how to use SPSS to perform specific analyses required in the course. Oncampus students were offered classes in computer laboratories where considerable assistance was available. With only these static forms of support, distance students struggled to become competent in using SPSS and often required lengthy email explanations or telephone assistance. In 2007 a member of the teaching team prepared screencasts using Camtasia Studio to capture click-by-click steps performing these analyses and discussing the output produced in SPSS. Students have commented on how helpful these have been and that they have found it easy to learn SPSS using the recorded materials. There have been far fewer calls for assistance since the screencasts were made available.

In 2008 short screencasts explaining particular concepts were produced. These screencasts were targeted at concepts that students found particularly difficult such as probability and sampling distributions. Annotation on blank PowerPoint slides using a Tablet PC allowed the tutor to develop explanations by sketching graphs and writing formulae in "real-time". These screencasts have allowed students to revisit these concepts throughout the semester as necessary. On request short screencasts of ink annotated worked exercises have been emailed to distance students to supplement explanation of the workings of a problem. These screencasts need to be very short to allow them to be made available via email. This has allowed distance students to receive the type of assistance that until now has only been available to oncampus students in a face-to-face consultation with a lecturer.

In Semester 1 2009, all lectures in Data Analysis were recorded live on a Tablet PC using Camtasia Studio. During the lectures the lecturer remained close to the computer and talked into the in-built microphone which resulted in some static being recorded. Using PDF Annotator he highlighted important concepts presented on Beamer slides with the ink annotating functionality of the Tablet PC. He expanded on explanations of statistical and mathematical concepts, for instance providing additional examples that previously would have been written on a whiteboard in class and not captured. Recordings were edited after class where required, and made available in Adobe Flash format for online play back in students' web browsers. A typical screenshot of the recorded lectures using Camtasia Studio is shown in Figure 1.



**Figure 1:** Example of an annotated Beamer slide using PDF Annotator.

Since the Tablet PC allows writing on the screen while presenting lectures in PowerPoint or PDF format, highlighting of the text and modifications to formulae along with drawing of graphs can be incorporated “on the fly”, as needed. This flexibility of writing on the computer screen makes the Tablet PC very suitable to capture the contents of any live lecture. Along with the voice recording, the screencast is almost like a live lecture for distance students except for the lack of opportunity to ask questions or to make comments during the class time. This shortcoming can be offset by the opportunity to ask questions, including any related to the recorded lecture, via the course discussion forum in the Moodle LMS.

Since the introduction of the Moodle LMS at USQ in 2007, all course materials and related resources in Data Analysis have been made available from the course site, accessible to all enrolled students. This includes static content such as an Introductory Book, Study Book, assignment instructions, revision problems and past examination papers with answers, SPSS instructions booklet, lecture slides and tutorial worksheets. Each week as the semester unfolds, the lecture notes and tutorial worksheets are posted in advance on the homepage so that students may download and copy them to use in class. This significantly reduces the need for hand-copying the notes, and thereby allows students much needed time to think about and to grasp the

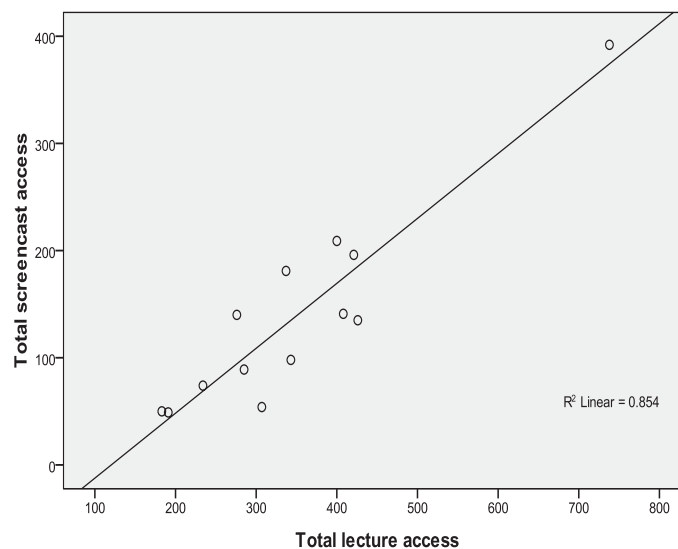
new ideas/concepts and understand the methods, rather than busily copying the notes. It also gives the students a clear idea on the materials to be covered with an opportunity to prepare well before participating in the actual lecture and tutorial.

Since late 2007 these static resources have been complemented by the addition of more dynamic presentations such as screencasts of a variety of activities such as SPSS tutorials, explanations of difficult concepts and now complete class lectures. The provision of these screencasts allows students to view them immediately following a lecture and access them again, as needed, prior to the submission of an assignment or in preparation for an examination. Concepts that were not readily assimilated at the time they were presented in the live lecture can be revisited as often as needed until they have been understood.

To round off the wide assortment of resources offered in Data Analysis, the availability of discussion forums has led to a significant amount of student activity on the course site, where students post any problems and discuss any issues that may arise from their studies. Lecturers and tutors take the opportunity to reinforce concepts and methods by way of answering postings of the students.

#### 4. STUDENT ACCESS AND PERCEPTION

Throughout the semester lecture notes were posted on the course LMS at least 3 days prior to the class in each of the 13 weeks of teaching. Many students, both oncampus and distance, accessed the lecture notes before the delivery of the lecture. Recorded screencasts for each lecture were posted to the course LMS site immediately after the delivery of lecture. Detailed data on the use of the teaching resources on the course site including the number of times the lecture notes and screencasts were accessed were extracted from the site. The data shows very strong correlation ( $r=0.92$ ) between the number of times the lecture notes and screencasts were accessed (see Figure 2). This very high positive correlation reinforces the fact that most of the students who accessed lecture notes also accessed the screencast of the lecture.



**Figure 2:** Scatterplot of the relationship between access to lecture slides and access to lecture screencasts across the 13 weeks of the semester.

The significant slope (see Table 1) indicates that one access to the lecture notes corresponds to an increase in the access to the recorded lecture of 0.606. The large value of R-square (0.854) suggests that 85.4% of the variation in the number of accesses to the screencasts is accounted for by the number of accesses to the lecture notes. Not all students who accessed the lecture notes accessed the lecture screencasts and this could have been due to the size of the download required to access a whole lecture. Students in regional and remote areas of Australia still have limited access to broadband internet and rely on slow dial-up connections, however this is improving.

**Table 1:** Regression analysis of the relationship between access to lecture slides and access to lecture screencasts across the 13 weeks of the semester.

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	-72.924	28.420		-2.566	.026
Total lecture access	.606	.076	.924	8.014	.000

As with the introduction of any new technology, some difficulties with the recording of lectures due to lack of experience in using the Tablet PC and the screen recording software occurred in the first week of teaching. On some occasions, technical difficulties caused freezing of the screen forcing the lecturer to stop the recording and restart the process again. As well as some students' uneasy feelings about any such disruptions, this kind of technical difficulty intermittently created unexpected delays which decreased the time available to cover the planned content of the lecture and material had to be held over to the following week. One student requested that the recorded lectures be posted in a downloadable format instead of the online playback format, so that it could be saved for future use. Some students complained about the voice level in a few of the initial recordings, but this was quickly addressed by using a better quality microphone.

Some typical student comments on the usefulness of the recorded screencasts and lecture notes from the end of semester Student Evaluation report are listed below:

Student A: *That the lectures were posted on StudyDesk so I could go back and look up anything I didn't understand.*

Student B: *As an external student I found the recorded lectures and lecture notes to be most helpful.*

Student C: *Shahjahan and his team did an exceptional job this semester, i.e. recorded lectures and notes, prompt marking and returning of our assignments.*

Student D: *The lecturer was excellent -the audios of the lectures available on the internet were really helpful.*

Student E: *The recorded lectures. Please continue with them. As an external student, I ended up only focusing on the lecture notes.*

Student F: *The recorded lectures were the most helpful resource I had.*

## 5. DISCUSSION

With the introduction of screencasts of lectures there is the question of whether the live lecture will continue to be supported by oncampus students. The oncampus lecture provides more than just an avenue for dispensing content. Students attend oncampus lectures for a variety of reasons, including social interaction, collaborating with peers, keeping on track and the opportunity to ask questions and get immediate answers. Only time will tell if attendance at oncampus lectures will continue at the same level. For the moment there does not appear to be a drop in turnout but it may be that lecturers will need to rethink the purpose of the lecture format and offer a different experience to the traditional lecture presentation for oncampus students. It may be that there will be an expectation that students watch a lecture screencast before coming to class and then participate more collaboratively in a discussion of the content of the screencast in the oncampus "lecture". For distance students the introduction of screencasts has meant that they can now access a more "oncampus experience". Recorded lectures provide equity for all students. Screencasting of lectures in visually rich content such as found in a statistics course is integral to bridging the divide between the oncampus and distance students' experiences.

One of the advantages of recording lectures in Camtasia Studio is that a variety of output formats can be generated; catering for a mixture of student needs and circumstances. Some students will want audio only so that they can listen to the commentary while looking at a printout of the lecture slides on the train to work. This version would also reduce the size of the download. Others may want to play the video on a portable multimedia player such as an iPod or mobile phone. Providing the screencasts in all of the available formats will give students choice.

We agree that one of the benefits of providing screencasts reported in Budgett et al. (2007) is that students, for whom English is not a first language, may be able to replay a lecture as often as needed to understand the material. However, we found in our study that an additional benefit was also in allowing all students to replay lecture recordings by a lecturer whose first language is not English and whose accent may be unfamiliar to most and therefore not as easily understood.

## 6. CONCLUSION

This paper has reported on one of many courses at USQ where Tablet PCs are used to make lectures more dynamic and interactive. Being able to capture this dynamic, using software such as Camtasia Studio, has gone some way towards bridging the divide between oncampus and distance students' experiences of learning introductory statistics since recordings are accessible to all students.

The importance of providing screencasts for distance students has been recognized across USQ, and following trials in 2008 and early 2009, the university has adopted Camtasia Relay in semester 2 2009. Camtasia Relay is the lecture theatre equivalent of Camtasia Studio screen recording software. The software is installed on all lecture theatre computers and lecturers can record lectures whenever required, without the need to purchase an individual license. This has expanded the opportunities that lecturers have for providing distance students with a live lecture experience. As technological advances are taken up by more and more academics in higher education, students will come to expect that all courses should provide such support. The challenge is there to be met.

## REFERENCES

- Bilder, C. R. and Malone, C. J. (2008). Tablet PC Applications in Statistics Education, Part I. In *JSM Proceedings*, Statistical Education Section. Alexandria, VA: American Statistical Association.
- Birch, D. (2009). PowerPoint with audio: a breeze to enhance the student learning experience. *e-Journal of Business Education and Scholarship of Teaching*, 3 (1), 36-42.
- Brodie, L. and Loch, B. (2009). Annotations with a Tablet PC or typed feedback: does it make a difference? *Proceedings of the 2009 AaeE Conference*, Adelaide, December 2009.
- Budgett, S., Cumming, J. and Miller, C. (2007). The role of screencasting in statistics courses. *Proceedings of the International Statistical Institute, 56<sup>th</sup> Session*. Lisbon, Portugal.  
[www.stat.auckland.ac.nz/~iase/publications/isi56/CPM82\\_Budgett.pdf](http://www.stat.auckland.ac.nz/~iase/publications/isi56/CPM82_Budgett.pdf)
- Fister, K. R. and McCarthy, M. L. (2008). Mathematics Instruction and the Tablet PC. *International Journal of Mathematical Education in Science and Technology*, 39 (3), 285-292.
- Harman, C., & Dorman, M. (1998). Enriching distance teaching and learning of undergraduate mathematics using videoconferencing and audiographics, *Distance Education*, 19 (2), 299-318.
- Loch, B. (2005). Tablet Technology in First Year Calculus and Linear Algebra Teaching. In *Proceedings of the Fifth Southern Hemisphere Conference on Undergraduate Mathematics and Statistics Teaching and Learning (Kingfisher Delta '05)*, 231-237.
- Loch, B. and Donovan D. (2006). Progressive Teaching of Mathematics with Tablet Technology. *e-JIST, e-Journal of Instructional Science and Technology*, 9 (2).
- Loch, B., and McDonald, C. (2007). Synchronous chat and electronic ink for distance support in mathematics. *Innovate - Journal of Online Education*, 3(3).
- Reushle S. and Loch B. (2008). Conducting a Trial of Web Conferencing Software: Why, How and Perceptions from the Coalface. *Turkish Online Journal for Distance Education*, 9(3).  
<http://eprints.usq.edu.au/4254/>
- Reushle, S. E., and McDonald, J. (2000). Moving an Australian dual mode university to the online environment: A case study. *Proceedings of ED-MEDIA2000*, June 26-July 1, Canada: Montreal, 907-12.