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ABSTRACT

This article presents the outcome of an investigation into the provision of lecturecasts to students. The objective was to ensure that both those who attended live lectures of a second-year engineering course and/or watched recorded versions of the lectures had an experience that supported their learning. A range of data was drawn on including the personal reflection of the lecturer of the course, questionnaires, and student interviews. The qualitative data were analysed through an inductive process that drew on the principles of grounded theory and the findings that emerged included the role of the "talking head" in recordings, balancing the needs of the live and recorded audience, the importance of digital annotation using e-ink, content navigation using index markers, the availability of the lecturecasts, and the importance of considering intellectual property. These findings demonstrate how the design and implementation of lecturecasting can be improved to ensure that students have the best possible experience of the material being presented.

Keywords

Lecture capture, lecturecast, pedagogy, podcast, PowerPoint

INTRODUCTION

The recording and distribution of lectures—typically including both an audio and video component—is an educational technology that is changing the approach of academics to their teaching. What began almost a decade ago as the distribution of short, audio-only recordings for students in the form of podcasts (a contraction of iPod and broadcast) has rapidly evolved to include numerous ICTs to create a multimedia experience for students to engage with course material outside of the classroom. The terminology used to describe these resources has evolved during this time. Where the generic term podcast has often been used as an umbrella description for all recordings of this nature (cf. McGarr, 2009's "continuum" of use: substitutional, supplementary, and creative), a more nuanced use of the term has been employed in this article. Here podcasts are defined as concise recordings made to support the

work being covered in a course, while the capturing of full lectures (lecture capture) for provision to students, or indeed the broader community, is referred to as lecturecasting (Kao, 2008; Lorenz, 2011; McKay & Brass, 2011).

The number of institutions that make recordings available to students continues to increase (Griffin, Mitchell, & Thompson, 2009). A review of recent literature suggests that focus has begun to shift from the technical issues related to the technology itself (cf. Campbell, 2005) – and implementation strategies in classrooms – to issues relating to the student experience and its impact on their learning (Alpay & Gulati, 2010; Salmon & Edirisingha, 2008). While there is an ever-growing literature on the impact that making resources like this available to students has on their learning, there is little research that focuses on the design and implementation of lecturecasting and its associated impact on an academic's classroom practice.

In this article, an analysis of the outcome of an investigation into the provision of lecturecasts to students is presented. It describes how an academic's classroom practice changed to ensure that both those who attended a live lecture and/or watched the recorded version of that lecture had an experience that supported their learning.

DESCRIBING THE CLASSROOM

While an ever increasing number of institutions are introducing centralized recording of lectures using systems such as Opencast's Matterhorn (opencast.org), many academics still make use of personalized solutions and take responsibility for all aspects of the technical as well as teaching and learning requirements of the production. These personalized solutions commonly make use of the functionality available in laptop or desktop computers and associated peripherals. Such a personalized solution was employed in a second-year manufacturing processes course in an Engineering department at a research intensive South African university. This was a twelve-lecture course that lent itself to the use of multimedia-rich presentations given the process-related videos, imbedded animations and illustrations that made up most of the content of the course. There are typically approximately 160 students enrolled in the course.

The teaching and learning rationale for introducing lecturecasting has been well described in the literature. For example, the Learning and Teaching Enhancement Office at the University of Bath has recently published five reasons to "capture your practice" (University of Bath, 2011), which include closing the knowledge gap, enabling broader approaches, promoting peer review, supporting accessible content, and encouraging reflection. Zhu and Bergom (2010) illustrate how making lecturecasts available to students has the potential to "improve students' mastery of the course material" (p.2) as well as allowing them the opportunity to more deeply engage with the material – all with "no noticeable impact" (ibid) on students' attendance at lectures. McGarr (2009) argues that the distribution of course material in this manner "provides greater flexibility" (p.311) to students, increases accessibility – particularly mobile access – to the material covered, and enhances learning by aiding in the revision of material covered as well as the comprehension of that material.

In preparation for introducing lecture capture in this course, an extensive review of available literature was undertaken to inform how the recording of course material could be approached as a pedagogic strategy (including Gipson and Richards, 2011; Lonn and Teasley, 2009; O'Bannon, Lubke, Beard and Britt, 2011; Scutter, Stupans, Sawyer and King, 2010; Woods and Phillips, 2009). McGarr (2009) suggests that the use of the material recorded in this way can be located on a continuum from substitutional on the one end, moving through supplementary, to creative on the other. The nature of the manufacturing processes course

unfortunately did not lend itself to the creative end of the continuum, where McGarr argues that students are "active constructors of knowledge" (ibid, p.318) through their creation of podcasts in the context of a course. Rather, the approach adopted for the course was located toward the other end of the continuum. Here shorter podcasts were produced to provide supplementary material to "assist learning" (ibid, p.317) and full lecture recordings of each lecture were also made available to students. Although the complete lectures were made available to students as lecturecasts, the intention was never to facilitate a substitutional approach to attending lectures.

The approach adopted for the manufacturing processes course was to use both podcasts where appropriate as well as make lecturecasts of all twelve lectures available. For the supplemental podcasts, Edirisingha et al.'s (2007) approach was used where the topic to be covered each week was introduced – in audio-only format. Furthermore, the solutions to past tutorials and assessments were also recorded as podcasts containing both video and audio. All these recordings (both podcasts and lecturecasts) were made available to students through the university's virtual learning environment (VLE) based on the Sakai platform (sakaiproject.org).

Drawing on the work of Griffin et al. (2009) who looked at the impact of synchronising PowerPoint slides with associated descriptive audio rather than making each available to students separately, multimedia-rich slides were used as the primary mechanism of delivery in the classroom based on the largely descriptive nature of the material covered and the ability to include embedded animations and videos of processes.

DATA COLLECTION AND ANALYSIS

This article draws on a range of data collected during the course. The first source of data was the academic's personal reflection that took place during the twice weekly production and distribution of the full-lecture lecturecasts. The second source of data was from students who completed a resources survey (n=141) at the beginning of the course and a month later a survey on lecturecasting in the course specifically (n=131). Both questionnaires contained open- and close-ended questions. The third source of data was that obtained from the course's VLE where all downloads and other activity was logged (n=166). The final source of data was a series of in depth interviews with a purposive sample of students. Some of these interviews were of an individual nature (n=3) and some took place as a number of focus groups (n=13). As these interviews were undertaken prior to the students having completed the course (the interviews took place just before their final examination), and to ensure the trustworthiness of these data, a person not involved with the course interviewed the students. These data were not accessible for analysis until after the finalization of the marks for the course. In all instances, the data were collected after clearance had been granted by the relevant Ethics in Research committee and access to the students had been authorized by the University. Both survey questionnaires were completed anonymously and students were also informed that they were under no obligation to participate. The students who consented to being interviewed were given the assurance that their identities would remain anonymous.

The qualitative data were analysed through an inductive process that drew on the principles of grounded theory (Glaser and Strauss, 1967). Through a process of coding and constant comparison of the data, categories emerged that accounted for the data under analysis. These resultant categories, whose description is not the specific focus of this article (see Collier-Reed, Case and Stott, 2013), elucidate how the design and implementation of lecturecasting can be improved to ensure that students have the best possible experience of the material being presented.

FINDINGS AND DISCUSSION

A review of recent literature suggests that the technical issues associated with creating lecturecasts are increasingly less focused on the technology used as their production matures. However, the results that emerged from the analysis of the data suggest that pedagogical issues associated with lecturecasts remain an important focus. It is argued that it is important to ensure that both the students who attend the live lectures and those who "participate" after the fact have an experience that supports their learning of the material covered in the course. With this in mind, the results point to a number of areas where the design, implementation, and use of lecturecasts in the class were improved through the approach adopted in the course. The objective was to improve the design and implementation of lecturecasting – one's practice – in the course through careful reflection combined with actively changing the lecturer of the course's approach where appropriate in a systematic way. The following discussion presents some of the more important areas that emerged from the analysis of the data collected through the course and discusses these in the context of its on-going impact on an academic's classroom practice.

Rejection of the "talking head"

It was clear from discussions with students after the pilot of this project the previous academic term that there were particular characteristics of the audio and video that made an impact on how they were able to use the lecturecast to support their learning. To produce the lecturecasts, Camtasia Studio (www.techsmith.com) was used to record, in real time, the changes in PowerPoint slides displayed in the live lecture as well as the videos and animations embedded therein. Initially, during post-production, an external video feed of the presenter/class activity was included as a picture-in-picture window superimposed over the full-screen video of the slide presentation. It was clear from the students that they tended to give primacy to the animated and embedded imagery – requesting that the videos and multimedia embedded content be made as close to full-screen size as possible – and regarded the "talking head" as adding little value. This finding is supported by Mathiasen (2010), who in a study that included investigating students' views on the recording of whole lectures, suggests that "[n]early all students found that the "talking head" [lecturecast] category was a waste of time during the semester" (p.4048). She concludes that if a "talking head" is to be included in the lecturecast that it "does not fill the entire screen display and that space is made for such features as slide shows, a Whiteboard/SmartBoard, [and] written dialogue" (p.4055). This notwithstanding, the analysis of the data for this particular course suggested that including a video image of the presenter in such a descriptively rich multimedia environment was not particularly effective. While it is technically possible to post-process the recording to transition from one view to another creating what could be considered a more polished performance, the results suggest that it is more important to make the recording available to students sooner rather than engage in lengthy post-production.

Balancing the needs of the live and recorded audience

Recording lectures on a notebook computer that includes an integrated microphone works well when the presenter is constrained to operate in a space around the microphone. To retain reasonable audio quality while interacting with the class, a wireless lapel microphone together with a wireless slide advancer was employed – a common technical solution to the problem. This solution resulted in the presenter's freedom to move within the class and engage the students in the teaching and learning space while the recording was progressing. Importantly, being liberated from the lecture podium allowed one to regain the connection with the class that is lost by being located next to the notebook computer. An important aspect of presenting a lecture is being able to take the class on a journey through the material

– something it is argued that can only be accomplished if one can actively move within the classroom. However, feedback was received that as engaging as the live lectures were, students who were watching the recorded version of the lectures felt disconnected from the lecture. In the live version of the class the lecturer would typically indicate, using a pointer, areas on a slide of importance, talking through processes by circling, scribbling, marking, writing, etc – and the visual effect of this interaction was completely absent in the recorded version. Students reported that the lectures lost their power of engagement when sight and sound were not integrated; what was crafted as a specific experience for the students in the live classroom was now simply a voice over "dead" – or un-annotated – slides when they were in their quiet place of study watching the lecturecasts.

Digital annotation using e-ink

Students participating in the live lectures arguably had a more complete experience of the material being covered when contrasted with those watching the lecturecasts. In an effort to address this limitation, a capacitance touchscreen notebook was introduced to the live presentation and a capacitive stylus was used to make the relevant markup on the slides themselves (see Figure 1) in a way similar to that described by Johnson (2008) where she "use[s] the 'ink' annotation feature of PowerPoint … for real-time classroom activities that require input during class" (p.655). Johnson goes on to suggest that the use of technology in this way involves the students "in the development of their knowledge" (p.656). Similarly, students watching the lecturecasts in this study described a greater level of engagement with the material being presented and in the excerpt below, a student indicates just what it is about the use of this form of annotation that aides them in their understanding of the material being presented.

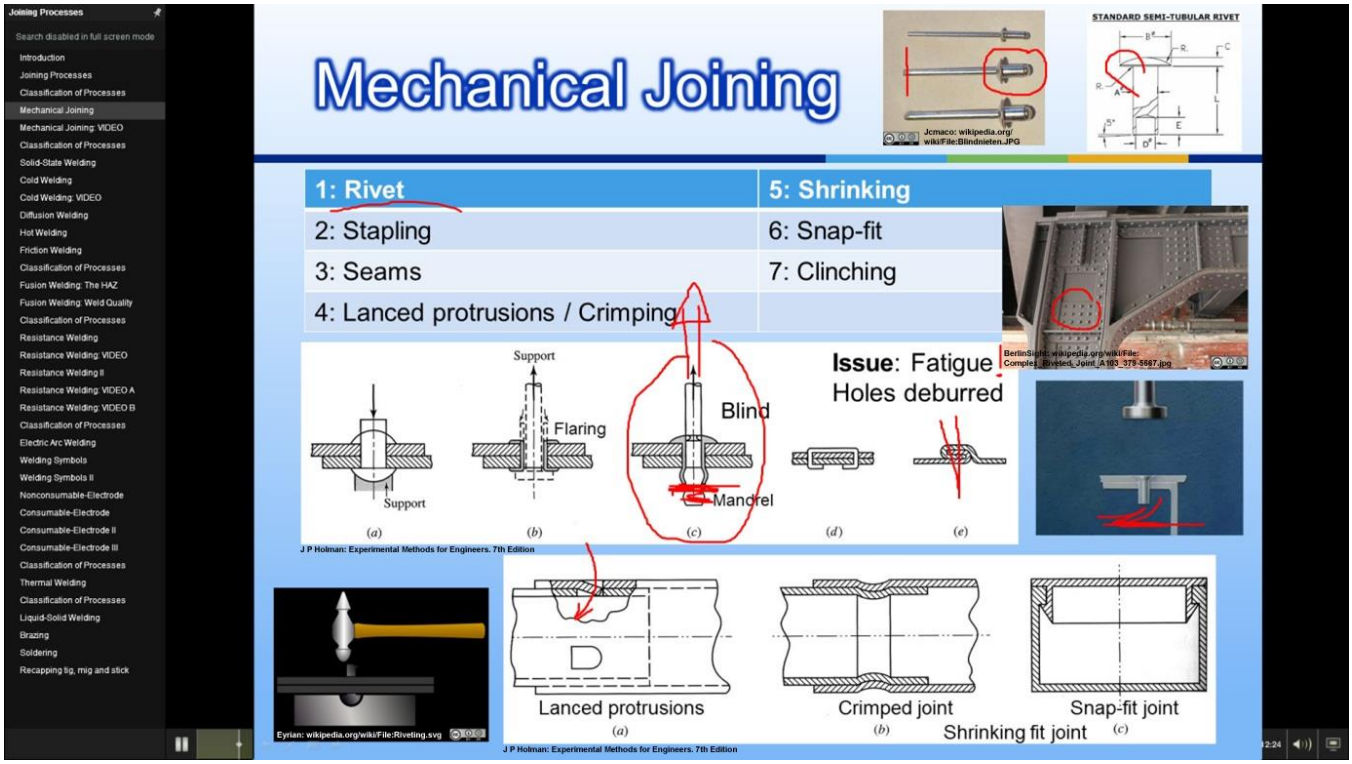

Figure 1. Slide showing 'e-ink' markup and Adobe Flash interface for navigation

> *"Say for instance on a diagram – diagrams are always full of lots of information – a design diagram is full of so many dimensions and labels and*

> *signs but not all of them are relevant. It was nice that he could circle, or underline or highlight the bits of relevant information on diagrams. Otherwise you just look at a diagram and it has so much stuff you don't know what you are trying to look for."*

Unfortunately, this "e-ink" solution required a return to the podium to be able to write directly on the capacitive touch screen. This method had the direct consequence of once again limiting interaction with the live class as one could no longer gesticulate at or describe areas of interest on the screen where the image was projected. What evolved through reflection, by the end of the course, was a delicate balance between moving within the class, the podium and the projection screen – in each case ensuring that both audiences were held in mind during the interaction.

Content navigation using index markers

Literature suggests that an important aspect of a lecturecast that improves the experience that students have with it is the ability to quickly move between sections to locate precisely the aspect that they wish to review (see for example Engstrand and Hall, 2011; Seo, Curran, Jennings and Collins, 2010). Camtasia Studio can create an Adobe Flash presentation which allows a student to navigate to any part of a presentation using a menu structure as shown on the left of Figure 1. An important feature of Adobe's Flash is that it is installed on almost all computers (Adobe Systems Inc., 2011), which means that no special software would be required by the students to watch or listen to a recorded presentation. The analysis of the data suggests that the students actively made use of these index marks to assist them in their interaction with the lecturecast ("[the] nice thing about the Flash though was that you could jump to sections which were relevant") as well in their understanding of the material covered, "from there I would jump into pieces that I didn't get writing down for a visual guide to get understanding of those concepts". It is the titles of the PowerPoint slides that are used to generate these index markers, and as the course progressed it became clear that how the live presentation was structured in terms of titles as well as slide development were important to navigation.

Availability of the lecturecasts

Table 1 illustrates the topics covered each week during the course (in the second row) and how many copies of a lecturecast (or podcast in some cases) were downloaded during this time (shown in the second column of each pair of columns). In the table, square brackets are used to indicate whether a particular file contained audio only [A], video and audio [V], or was an Adobe Flash compilation that included index marks for navigation [F]. It is quite clear from these data that students were in many cases downloading the recorded lectures shortly after the material had been presented.

It was argued earlier that it was important to make recordings of lectures available to students as soon as possible after the material was covered in class rather than spend time in lengthy periods of post-production. The analysis of the data suggests that students watched the lecturecasts regularly: "I used it almost every day – I'd rather listen to [lecturecast] than look at the text book. I'd take like thirty minutes to listen to the [lecturecast] …". Others found this frequent viewing less important as the course went on: "Initially I was using them every day but sometimes you feel confident you saw it live in the class and you understand almost everything – for me it wasn't enough reason to go over them again." It was more common however for students to make use of the weekends after a topic had been covered to review the material as "it is only two lectures per week – probably less than two hours of lectures so during the weekend you can actually recap and get everything done in a sense." The excerpt

below illustrates how a student strategically reviews a lecturecast during the week followed by a more thorough engagement with the material during the weekend:

> *"… at first I would just watch it which is about 30 minutes long – from there I would jump into pieces that I didn't get writing down for a visual guide to get understanding of those concepts which would be on a Saturday – not only on a Saturday because I was doing it again during the week. Like Saturday was the day I did it really properly."*

04/04/20XX	
Introduction	
Introduction [A]	23
Introduction [F]	31
Introduction [V]	44
PodCast ONE - Teaser	31
PodCast TWO - Tech	39
Shaping - Trailer [A]	25
04/04/20XX	78
05/04/20XX	76
06/04/20XX	31
07/04/20XX	8
Total Downloads	**78**

08/04/20XX	
Shaping	
Forming - Trailer [A]	16
Introduction [A]	25
Introduction [F]	31
Introduction [V]	32
PodCast ONE - Teaser	30
PodCast TWO - Tech	34
Shaping - [F]	32
Shaping - Trailer [A]	44
Shaping [A]	21
Shaping [V]	35
08/04/20XX	39
09/04/20XX	11
10/04/20XX	32
11/04/20XX	80
12/04/20XX	83
13/04/20XX	37
14/04/20XX	18
Total Downloads	**300**

15/04/20XX	
Forming	
Forming - Trailer [A]	24
Forming [A]	11
Forming [F]	23
Forming Part 1 [F]	11
Forming Part 1 [V]	15
Forming [V]	22
Introduction [A]	6
Introduction [F]	9
Introduction [V]	9
PodCast ONE - Teaser	11
PodCast TWO - Tech	11
Shaping - [F]	23
Shaping - Trailer [A]	9
Shaping [A]	13
Shaping [V]	24
15/04/20XX	9
16/04/20XX	6
17/04/20XX	35
18/04/20XX	53
19/04/20XX	65
20/04/20XX	4
22/04/20XX	8
24/05/20XX	4
25/05/20XX	22
26/05/20XX	14
28/04/20XX	1
Total Downloads	**221**

29/04/20XX	
Wasting	
Forming - Trailer [A]	4
Forming [A]	3
Forming [F]	10
Forming [V]	7
Introduction [F]	3
Introduction [V]	5
PodCast ONE - Teaser	5
PodCast TWO - Tech	6
Shaping - [F]	7
Shaping - Trailer [A]	1
Shaping [A]	6
Shaping [V]	4
Wasting Part 1 [A]	7
Wasting Part 1 [F]	8
Wasting Part 1 [V]	17
29/04/20XX	33
01/05/20XX	15
02/05/20XX	7
03/05/20XX	3
05/05/20XX	8
06/05/20XX	16
08/05/20XX	11
Total Downloads	**93**

09/05/20XX	
Joining	
Forming [A]	1
Forming [F]	1
PodCast TWO - Tech	1
Shaping [V]	2
Wasting Part 1 [A]	5
Wasting Part 1 [F]	4
Wasting Part 1 [V]	7
09/05/20XX	1
10/05/20XX	7
11/05/20XX	3
12/05/20XX	2
13/05/20XX	3
15/05/20XX	5
Total Downloads	**21**

16/05/20XX	
Finishing	
Finishing [A]	8
Finishing [F]	18
Finishing [V]	13
Forming - Trailer [A]	4
Forming [A]	4
Forming [F]	12
Forming [V]	5
Introduction [A]	4
Introduction [F]	6
Introduction [V]	4
Joining [A]	9
Joining [F]	17
Joining [V]	12
Class Test Feed Back	14
PodCast ONE - Teaser	5
PodCast TWO - Tech	6
Shaping - [F]	11
Shaping - Trailer [A]	4
Shaping [A]	6
Shaping [V]	5
Wasting Part 1 [A]	4
Wasting Part 1 [F]	14
Wasting Part 1 [V]	6
16/05/20XX	25
17/05/20XX	37
19/05/20XX	6
20/05/20XX	123
Total Downloads	**191**

21/05/20XX	
Exam period	
Finishing [A]	18
Finishing [F]	18
Finishing [V]	23
Forming - Trailer [A]	14
Forming [A]	14
Forming [F]	14
Forming [V]	18
Introduction [A]	13
Introduction [F]	12
Introduction [V]	16
Joining [A]	17
Joining [F]	21
Joining [V]	26
Class Test Feed Back	30
PodCast ONE - Teaser	20
PodCast TWO - Tech	21
Shaping - [F]	17
Shaping - Trailer [A]	13
Shaping [A]	29
Shaping [V]	21
Wasting Part 1 [A]	14
Wasting Part 1 [F]	17
Wasting Part 1 [V]	23
23/05/20XX	7
25/05/20XX	1
26/05/20XX	1
27/05/20XX	1
31/05/20XX	3
01/06/20XX	8
02/06/20XX	39
03/06/20XX	6
04/06/20XX	18
05/06/20XX	68
06/06/20XX	14
07/06/20XX	86
08/06/20XX	39
09/06/20XX	55
10/06/20XX	83
Total Downloads	**429**

11/06/20XX	
Vacation	
Finishing [A]	15
Finishing [F]	18
Finishing [V]	20
Forming - Trailer [A]	4
Forming [A]	4
Forming [F]	18
Forming [V]	13
Introduction [A]	2
Introduction [F]	5
Introduction [V]	16
Joining [A]	4
Joining [F]	12
Joining [V]	11
Class Test Feed Back	31
PodCast ONE - Teaser	7
PodCast TWO - Tech	10
Shaping - [F]	16
Shaping - Trailer [A]	3
Shaping [A]	10
Shaping [V]	11
Wasting Part 1 [A]	1
Wasting Part 1 [F]	9
Wasting Part 1 [V]	12
11/06/20XX	4
13/06/20XX	16
14/06/20XX	1
15/06/20XX	1
16/06/20XX	12
19/06/20XX	2
21/06/20XX	3
22/06/20XX	21
27/06/20XX	3
02/07/20XX	5
04/07/20XX	1
11/07/20XX	23
12/07/20XX	5
15/07/20XX	10
18/07/20XX	39
19/07/20XX	4
20/07/20XX	23
21/07/20XX	32
22/07/20XX	12
23/07/20XX	3
24/07/20XX	32
Total Downloads	**252**

25/07/20XX	
1st week	
Finishing [A]	29
Finishing [F]	32
Finishing [V]	44
Forming - Trailer [A]	16
Forming [A]	12
Forming [F]	33
Forming [V]	103
Introduction [A]	14
Introduction [F]	19
Introduction [V]	19
Joining [A]	16
Joining [F]	29
Joining [V]	46
Class Test Feed Back	39
PodCast ONE - Teaser	23
PodCast TWO - Tech	34
Shaping - [F]	24
Shaping - Trailer [A]	11
Shaping [A]	28
Shaping [V]	39
Wasting Part 1 [A]	70
Wasting Part 1 [F]	60
Wasting Part 1 [V]	36
25/07/20XX	198
26/07/20XX	81
27/07/20XX	208
28/07/20XX	70
29/07/20XX	51
30/07/20XX	59
31/07/20XX	109
Total Downloads	**776**

01/08/20XX	
2nd week	
Finishing [A]	18
Finishing [F]	23
Finishing [V]	62
Forming - Trailer [A]	2
Forming [A]	4
Forming [F]	17
Forming [V]	45
Introduction [A]	2
Introduction [F]	8
Introduction [V]	20
Joining [A]	7
Joining [F]	15
Joining [V]	49
Class Test Feed Back	107
PodCast ONE - Teaser	5
PodCast TWO - Tech	9
Shaping - [F]	13
Shaping - Trailer [A]	3
Shaping [A]	18
Shaping [V]	27
Wasting Part 1 [A]	7
Wasting Part 1 [F]	15
Wasting Part 1 [V]	41
01/08/20XX	135
02/08/20XX	80
03/08/20XX	178
04/08/20XX	124
Total Downloads	**517**

Table 1. Number of times that lecturecasts were downloaded from the VLE

These results are similar to those of Hill and Nelson (2011) who found that just more than half of the students interviewed watched the recordings within a week of each lecture. The rest of the students watched before the end of that section of teaching. This finding further strengthens the case to have the lecturecasts available for review as soon as possible after the lecture had taken place.

Also apparent from Table 1 is that students typically downloaded the bulk of the lecturecasts while on campus making use of the institution's bandwidth. This is likely because the cost of data in South Africa is still relatively high and the size of the files makes using institutional resources an attractive proposition. Given the availability of institutional bandwidth, the approach adopted was to not minimise file size but to rather focus on providing a clear video with not too much compression given the richness of the multimedia content in the recordings.

Considering intellectual property and access

Once a lecturecast has been uploaded to a VLE and downloaded by students, it has left the security of a firewalled environment and can "easily be passed from one person to the next" (Read, 2007). A potential concern in this regard is ensuring that there is uniform acknowledgement of material used in the lecturecasts. One approach to ensuring compliance is to use material under Creative Commons licence (see creativecommons.org) or Institutional copyright clearance. What is not possible is to assume that because the files are located on a password protected site that they are for internal use only. Kao (2008) has gone

so far as to suggest that helping people understand what plagiarism is has become "cardinally important … [as o]nline materials are increasingly becoming more stringently scrutinized for the infringement of copyright" (p.8).

In Table 1, lecturecasts that contain elements that could potentially contain copyright issues are indicated as [V] or [F] – essentially the recordings that contained images of the PowerPoint slides. The data from the VLE's log (also shown in Table 1) indicates that the suite of lecturecasts that included graphics, animations, or video clips were downloaded a total of 1,714 times over the duration of the 12-lecture course. It is quite clear from these figures that issues of copyright needs to be carefully considered.

CONCLUDING REMARKS

This article presents the outcome of an investigation into the provision of lecturecasts to students in a manufacturing processes course. Although specific technical issues associated with creating lecturecasts are increasingly less of a barrier as the technology used in their production matures, it is clear from the findings that more than simply a video recording of what took place in the classroom during a lecture is required to add value to a student's learning experience. The challenge throughout was to ensure that both those who attended the live lecture and/or watched the recorded version had an experience that supported their learning. The issues discussed above relating to how the lectures were presented, recorded and made available to students enabled this dual imperative to be operationalized. The findings highlights how classroom practice – one's pedagogical approach to teaching – changed to support this new teaching and learning space for the students in a way that directly benefitted their learning.

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