

The Intentional use of Learning Management Systems (LMS) to Improve Outcomes in Studio

*Andrew MacKenzie, Milica Muminovic, Karin Oerlemans**

ABSTRACT

At the University of Canberra, Australia, the design and architecture faculty are trialling a range of approaches to incorporating learning technologies in the first year foundation studio to improve student learning outcomes. For this study researchers collected information on students' access to their assignment information and feedback from the learning management system (LMS) to discover how the students engaged in the design process.

The studio curriculum was designed to encourage students to engage in a convergence, divergence dynamic (Brown 2009, Thomas, Billsberry et al. 2014) in developing their own understanding of the design process. The staff tailored around points of convergence, online instruction, assessment tools and feedback in studio. We argue that using learning technologies in this way can improve intentionality at the beginning of semester, enhance students understanding of feedback and facilitate a more iterative approach to problem based learning in studio practice.

INTRODUCTION

Design and architecture education traditionally relies on personal interactions between tutor and student in a physical space called the studio. Increasingly in Australian universities, studio tutors are expected to adopt LMS for delivery of information and provision of feedback (MacKenzie and Hocking 2014). This approach to blended learning in studio is therefore worthy of investigation. While there is no consensus on the use of the term, blended learning (Funda 2011, Pektaş and Gürel 2014), it is generally defined as the combination of traditional

* Dr. Andrew MacKenzie, University of Canberra. Email: andrew.mackenzie@canberra.edu.au
Milica Muminovic, Assist. Prof., University of Canberra. Email: milica.muminovic@canberra.edu.au
Karin Oerlemans. Email: oerlemans.karin@gmail.com

delivery methods (face to face) with online learning technologies to enhance teaching methods (Hyo-Jeong and Bonk 2010). This paper extends this definition to consciously incorporate a convergence, divergence dynamic (Brown 2009, Thomas, Billsberry et al. 2014) widely used in education, but also synonymous with design thinking to blend traditional ways of teaching design process into the curriculum. The blended learning component of the study is the incorporation of LMS and hand held devices to engage students is design thinking without explicitly teaching theories underpinning the design process they are undertaking. Technology in design education can provide students with rich and meaningful multimedia content that is contextually relevant and can be accessed and enacted upon (Bower, Howe et al. 2014). Technology can provide cognitive support for difficult tasks with pre-packaged learning experiences, allowing the user to control the speed, frequency and iteration of their access to content to suit their learning abilities.

In this context, there is an ongoing need to investigate the pedagogical practices that are most suited to a design curriculum influenced by technologies. For example Van Haren (2010) argues technology should support the agency of students in enacting, developing and determining rather than passively accepting so that they can achieve a deeper understanding of subject matter. While this approach to learning is familiar in a studio environment, using technology for technologies sake should be critically evaluated in both learning and assessment.

This project examines the question; how do LMS support students engaging in the design process? The question can be further broken down to; how do they use feedback to improve and to what extent do these learning technologies support the student to develop a design process around the convergence/divergence dynamic. Understanding how students engage with and benefit from different forms of feedback forms a key part of this enquiry.

DESIGN THINKING AND FEEDBACK

Design thinking is increasingly integrated throughout the curriculum of higher education institutions, particularly at post graduate level. Yet while there is consensus about the value of teaching design thinking, there is little consensus on how it should be taught (Wrigley and Straker 2015). In particular the problems are centred around the generalised approach to design thinking as a universal cognitive practice, ignoring how design is shaped by the role of institutions and socio-cultural developments over time (Kimbell 2011). As a result the value of design thinking in furthering creative output and generating innovation is poorly grounded in evidence-based practices (Dong 2015). Although design thinking lacks a formal definition, this paper adopts of a design thinking approach to curriculum delivery in first year design studio. In this case studio is not the place for learning design studies, but rather opportunity to develop design practice (Tonkinwise 2014). Rather than teaching the theory of how designers

think, the studio tutors incorporate learning technologies in order to scaffold the students' projects and feedback in a way that encourages them to develop their comprehension and practice.

Learning design practice presents students with their own anxieties. Tonkenwise (2014) argues this is unsurprising as studio demands that students harness design thinking to creatively traverse the domains of specialised knowledge yet design education tends to reflect what is done in professional practice; something students cannot comprehend in their early years of training. Underlying this anxiety, in addressing social problems such as sustainability, practical education (learning by doing) is counter intuitive to the more abstract, risk taking approaches that tend to generate more creative ideas, generating a larger solution space for progressing a design problem within its socio-technical context (Bleuzé, Ciocci et al. 2014).

Evaluation of design in the form of criticism also tends to value the students' design work in terms of appearance or affect, privileging the high art content, history and theory courses in the curriculum of most schools and reflecting the research background of faculty staff. While some schools take a more sociological stance to design theory, engaging with the everyday cultural practices, such programs are in the minority (Tonkinwise 2014). In this way feedback in the form of criticism can reinforce the notions that students need to demonstrate adequate discipline knowledge more so than contextually relevant knowledge to the world we live in (Moore 2005).

Research suggests feedback is the most powerful method of engaging with students, and can be used to improve learning (Hattie and Timperley 2007, Hattie 2009). But other research focused on the use of written feedback, seemingly contradicts this finding and states that students actually seldom access their feedback and learn very little from it for a number of reasons. These included a lack of understanding, relying on their memory of what was said, and because they are more focussed on their grades than on the feedback (Higgins 2000, Carless 2006, Weaver 2006). Recent research by Blair et.al. (2013) suggests that immediacy of feedback in written form, timely and accessible, and using a wider range of feedback mechanisms would enhance the student learning experience.

There are a number of definitions of feedback, Hattie (2007) giving a very broad characterisation defined it as the "information provided by an agent about aspects of one's performance or understanding" (p. 187). In a meta-analysis of over 134 studies on the use of feedback in education, he found that it was essential to the learning process and was among the most powerful influence on achievement (Hattie 2009). In an earlier work, Winne and Butler (1994) defined feedback from the perspective of the learner, as the "information with which a learner can confirm, add to, overwrite, tune, or restructure information in memory, whether that information is domain knowledge, meta-cognitive knowledge, beliefs about self

and tasks, or cognitive tactics and strategies” (p. 5740). Carless (2006) limited his use of the term feedback to the responses made on student assignments. For him, “it encompasses written annotations and comments on drafts or on finalised assignments, in addition to verbal dialogues prior to or after submission” (Carless 2006), although he goes on to argue that this form of feedback can serve multiple functions, for improving future assessments (Carless 2007), to justify a grade, or even “the fulfilment of a ritual which is part of academic life” (p. 220). In this paper we limit the meaning to the feedback, verbal or written, given to students for their assessment tasks. But also explore Winne and Butler’s understanding to see how much the learner in fact uses the feedback received to add to, fine tune, or change their responses.

Hattie found that the value of feedback could be described as a powerful motivator and improver of learning, but Carless (2006) found in his study that most students were primarily motivated by marks and did not engage much with the written feedback they received (see also Crips, 2007). Weaver (2006) concurs, arguing that the value of feedback depended on the student’s individual notions and understanding of the written information, which may not be the same as their tutor or lecturer, in which case students would have a great deal of difficulty in using the feedback received to improve their learning. Higgins (2000) also found that many students were simply not able to understand written feedback or knew what to do with it, failing to understand the comments or alternatively misinterpreting them. This may particularly be true if the feedback comments are written as suggestions for improvement, which some students may take as literal, but others may take these as optional (Crisp 2007). In fact Crips argued that students seldom responded to feedback by making changes to their subsequent submissions, as suggested in the given feedback.

This was a problem identified in our research, so in this study we explored whether students used feedback, and what if any impact this had on their subsequent results. Some researchers have suggested that the difference is in the quality, accessibility, timeliness, legibility and relational aspects of the feedback given (Chang, Watson et al. 2013). Similarly, in their study of e-feedback, McCabe, Doerflinger, and Fox (2011) found that students and staff perceptions were that “e-feedback procedures increase clarity of feedback compared to handwriting, save paper and ink resources, and result in faster and also better, more detailed feedback” (p. 178). However, Blair et al (2013) found that although students wanted quality feedback, that directed them in their learning, and that was given in a timely manner, they also found that whilst some students preferred written feedback, others preferred verbal feedback. This was because students found the verbal feedback was easier to understand, they were able to request further clarification, and because written feedback was often poorly constructed or used overly academic language. An assumption could be made here that students view feedback for no other purpose than to see what they need to improve or at least meet the learning outcomes of the activity, depending on whether they were deep or surface learners (Calvo and Ellis 2010).

In this study we asked students what type of feedback they preferred and sought to understand what it was about that feedback that they found improved their learning. The following section describes the methodology followed by the findings of these questions.

METHODS

This research used both qualitative and quantitative data to evaluate the effectiveness of LMS for providing feedback in a first year design studio. Student patterns of access to Moodle, the University LMS, were collected. Data included students' frequency of access, timing of access compared to the release of project briefs, feedback (formative) and results (summative) for each project. Data was also collected data on student views of videos as recorded in EchoSystem, the lecture capture and video streaming system. Other data included student results collated from the rubric, and final grades following the final assessment of each project. Reflective summaries for each assessment were collected from the LMS following the final submission. Semi structured interviews were undertaken with studio tutors to evaluate their perception of the effectiveness and ease of use of the LMS for providing feedback.

CASE STUDY

The case study was an introductory design studio for students studying majors in architecture, landscape architecture, interior architecture and industrial design. The unit was delivered with a combination of online and face to face lectures. All studio work was undertaken in a conventional face to face format in a purpose built studio space. Students were delivered information and feedback via Moodle, the University LMS. Two tutors conducted the studios with approximately twenty students per class. Both tutors participated in the research and research ethics was granted for both surveying and interviewing students and staff.

The curriculum developed for this studio is based on the design thinking approach of divergence and convergence (Brown 2009). The studio had three assessment stages (A01, A02 and A03) based on three interrelated and interdependent assignments that were scaffolded to create a final design piece incorporating all the assessment into a single final presentation. The three assignment themes; idea, form and object guided the students through a design thinking process based on the convergence/divergence dynamic (Figure 1).

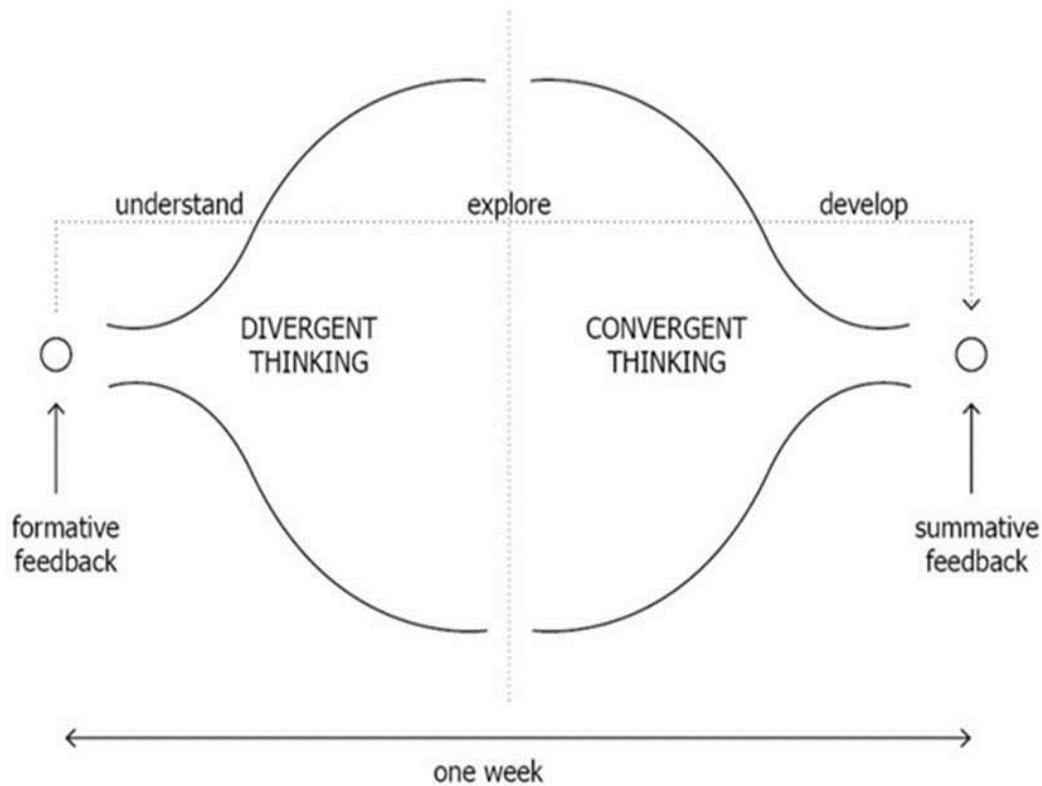


Figure 1 Design thinking process used in the research (adapted from Brown (2009)).

Furthermore, the information for each assignment (project brief, project value, submission requirements, and assessment criteria) reflected the phases of a design process. The delivery of that information along with the provision of online feedback was timed to coincide with points of convergence in the students design thinking process (Figure 2).

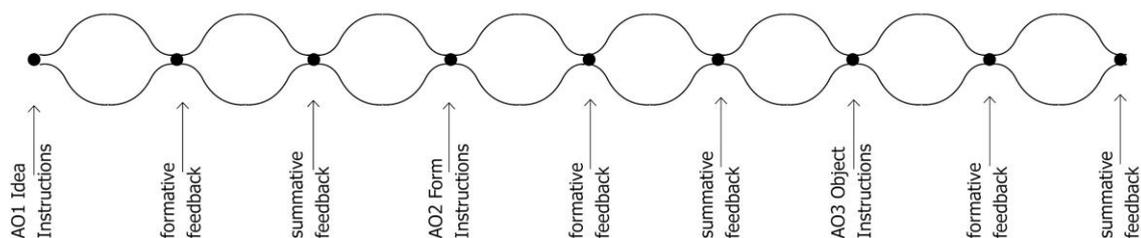


Figure 2 Design thinking process applied to the curriculum.

To set the expectations in the studio, the staff used videos to explain the nature of studio and ways of learning. The importance of feedback has been reinforced with the former students' experiences videos and the process was explained during lectures and studio classes. Students were informed of the nature of feedback and its importance before every formative feedback session at the beginning of the class. The design language was presented and explained in the

lectures and further enhanced during the verbal and written feedback. In this studio, tutors encouraged students to reflect on their feedback by extending the process using the formative and summative feedback and including various techniques of feedback, both face-to-face and online via the LMS.

PROVISION OF FEEDBACK

The feedback was provided in two stages: formative (feed forward) and summative (grade and short comment) (Table 1). During the studios where formative feedback was provided, students presented their work in front of their peers and received verbal feedback and a rubric with comments from their tutors using a touch screen on a hand held device (Figure 6). Students were explained their grade by the tutor using the rubric to help them understand discursively why they achieved the grade and how they can improve. The qualitative terms in the rubric text reflected the University assessment policy relating decryptions to grades. (E.g. satisfactory equates to a pass, excellent equates to a distinction) The verbal comments during the critique sessions were also recorded in form of the notes by a student peer. The students were provided an additional week to improve their assignment based on this feedback. The students were required to reflect on their formative feedback in 200 words and submit that in conjunction with their assignments. The refined work was then submitted using LMS, on which they would receive the summative feedback.

Video views		%	Average total
Video Title	Duration (Minutes)	Students viewing	time
Introduction to Design Studio	3	54%	2.50
Students on Design	5	35%	2.49
Light Tone and Colour	20	6%	17.17
Ordering Elements	21	21%	15.68
Point Line Plane	26	33%	18.60
Volume	12	27%	11.10

Table 1: Percentage of students viewing the videos and their average total time

The most complete feedback process was in the second assignment, and thus we have selected those results for the purpose of this paper. In order to evaluate how effective the rubric feedback was in the process, the tutors were asked to provide verbal and written feedback differently. Tutor 1 adopted a personally tailored and more precise approach to written and

verbal feedback. Tutor 2 used general formulation using generic terms to describe the students work.

DATA ANALYSIS

Use data was collated for each student, descriptive statistics derived, and plotted in excel. The time series data was based on the date and time stamp information for all accesses of information by the students.

The student reflections were collated, information de-identified, and a discourse analysis conducted looking at both the structure and practice of the language used by the students (Jorgensen and Phillips 2002). This enabled the research team to make observations about the language use in the context of the design discipline, and within the practice of the students. This allowed the researchers to tentatively make decisions about the students' change in learning of design literacy, and help contribute to a general understanding of the process. The interview data from the tutors was analysed to identify how the students' experience of receiving the feedback correlated with the tutors' experience of providing the feedback. This triangulation helped us to understand the value of the immediacy of the feedback rather than focussing on the students' comprehension.

FINDINGS

The findings from the research interrogate the students' access to online information. The data is presented in two parts. The first part, resources, includes instructional videos and online lectures, and assessment instructions including assignment briefs and sample assessment rubrics. The second part, feedback, includes formative feedback in the form of written rubrics and comments, and summative, or grade only.

STUDENT INSTRUCTIONS

Throughout the course a number of resources were developed to support the students in their progress, these included short instructional videos, similar to the example videos described by Kay (2012), but with a focus on specific design elements and the use of these in the design process. Extensive documentation and instruction information was developed using the webpage tool in Moodle. Information included submission criteria, and how to submit the work electronically, as well as a sample of the assessment criteria.

VIDEOS

In addition to the online lectures, two additional videos were included. The introduction video established the expectations for the assignments. The students on design video includes past students talking about their experience of the unit. These two videos better meet the definition of extra materials (Kay, 2014), but proved the most popular with the students. Students accessed these items much as expected, as is common across other disciplines (Danielson, Preast et al. 2014). Table 1a shows the percentage of students viewing the videos. The data indicates the instructional videos (1 and 2) provided on Moodle in the first week were the most popular. The aim of these videos was to help student prepare for studio practice, with practical tips and advice from previous students about how to work successfully. Videos 5 and 6 included conceptual examples of successful project outcomes to help students understand what was expected.

The videos are listed in order that they appear on the LMS unit site. As always, not all students will watch all videos. There were 137 students enrolled in the unit who viewed none, one or some of the videos, but not one video was viewed by all students. What is surprising and perhaps contrary to previous findings (Wiese and Newton 2013, Danielson, Preast et al. 2014) is the length of views. Table 1b shows that students who viewed the videos watched approximately 50% of videos 1 and 2 and between 70%- 92% of the remaining instructional videos. This could be an indication of the type of video, which fit more into the category of worked examples (Kay 2012), rather than the more common lecture capture videos.

		AO1	AO2	AO3
Tutor 2	formative	86%	71%	79%
	summative	93%	90%	81%
Tutor 1	formative	100%	95%	75%
	summative	100%	95%	90%

Table 2: Submission of assessments Time 1 and Time 2 for each assessment task

ASSESSMENT INSTRUCTIONS

The team also examined the viewing patterns of the assignment instructions. Figure 4 shows the number of times the assignment instructions were viewed by students. Between 22 and 30 students viewed the assignment instructions once on Moodle for each project. The viewing patterns for each project were similar. As expected students viewed assignment 1 instructions the most, but as they moved through the tasks, they showed less dependency on the instructions.

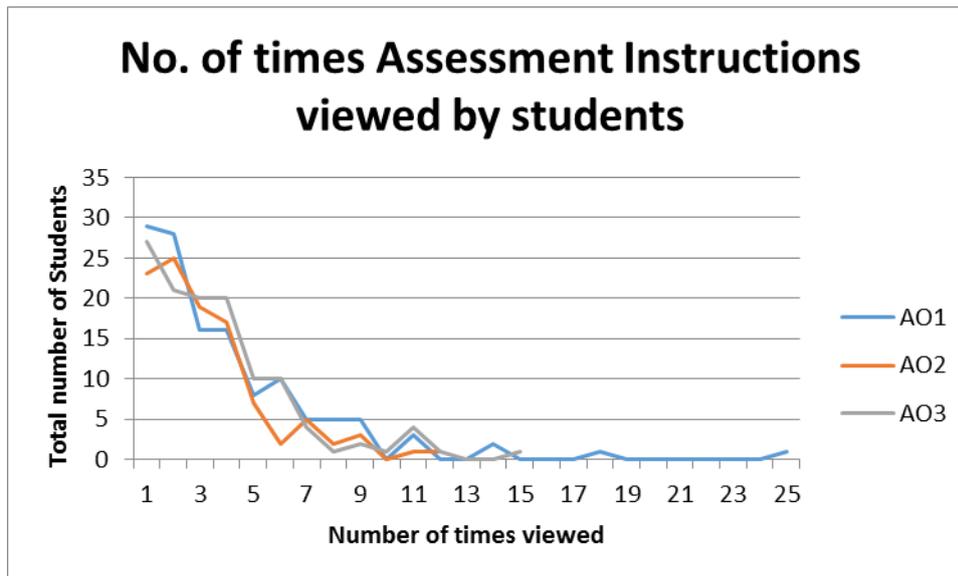


Figure 4 Number of times Assessment instructions viewed by students.

More interesting for our study, is the findings in Figure 5, which shows a timeline of access of the views of the assignment instructions. The x axis shows the weeks of studio, including the assessment window. For example AO1 formative feedback was given in the week starting 7/3/16 and summative assessment was provided the following week beginning 14/3/16. The Y axis shows the frequency of students' access to assessment instructions. For example A01 was viewed 56 times immediately after the first week of formative feedback. There is an ebb and flow showing how students access the assessment instructions in order to understand the project requirements. There are students who will view all the information, but there are also those students who only view what they need to as the tasks get closer to their due date. However, what the time series information shows us is that students engage in convergence moments prior to the submission of their assignments, in order to meet the requirements of the submission. We also see that students engage in convergence moments for subsequent submissions by viewing the instructions from the previous submission.

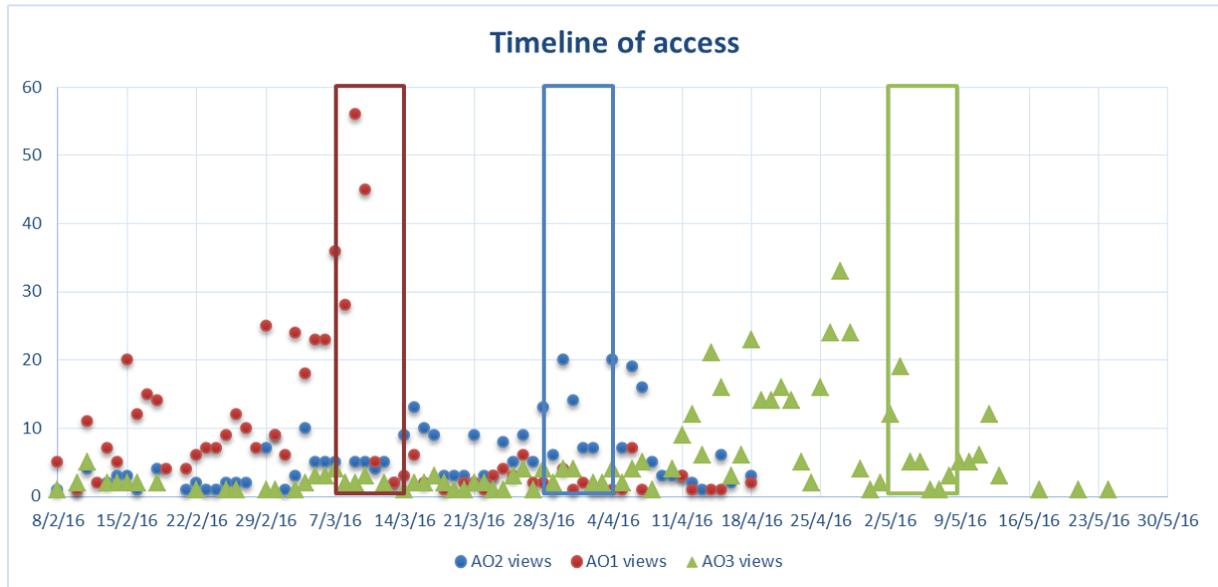


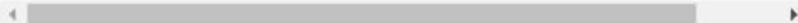
Figure 5 Timeline of access of Assessment Instructions.

STUDENT ACCESS PATTERNS FOR FEEDBACK

The previous section provides an overall picture of how students access information during the semester. This section looks more closely at how students access feedback. Formative feedback (or feed forward) was provided three times during the semester in studio using an online rubric on a handheld touch screen smart device (Figure 6). The students were provided both verbal and rubric feedback in class and given an additional week to improve their assignment prior to receiving a summative grade.

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Grade:	Completion of project requirements	No evidence of submission by the due date	The work is incomplete and/or does not meet the submission criteria	Student has submitted the minimum requirements as per submission criteria and on time.	Student has submitted the minimum requirements as per submission criteria and on time.	In addition to submission requirements, the student has presented additional relevant material in the submission	In addition to submission requirements, the student has presented additional relevant material in the submission
Presentation of work	No work is presented at the time of grading	The presentation of the work is poor showing little evidence or care in the composition and use of appropriate graphic techniques	Satisfactory visual presentation of the design idea. Showing evidence of composition using appropriate graphic techniques. Showing care has been taken.	Well developed visual presentation of the design idea. Appropriate selection of graphics techniques and quality of communication.	Superior work that is well-composed and excellent selection of the graphic techniques and quality of communication	Outstanding work that exceeds the expectation of the tutors in composition, graphic techniques and quality of communication.	
Engagement in the work	You do not regularly attend studio without providing reasons and evidence as required in the unit outline and/or you submit incomplete work.	You attend most studios but rely on your tutors to generate your ideas.	You have attended studio and engaged in your project work as per instruction from your tutors.	You attend studio with thoughtful design solutions and have built on the instruction of your tutors	You attend studio and engage with thoughtful contributions and have supported your peers.	You have attended studio and you actively contribute; challenging and motivating yourself and encouraging peers towards excellence.	
Development of concept	Little or no evidence of a conceptual idea and no discernible connection between component parts of the project (MO1 and MO2)	Conceptual idea or argument for project solution is unclear/ there is no discernible connection between component parts of the project (MO1 and MO2)	Satisfactory conceptual idea and evidence of connection between component parts of the project (MO1 and MO2)	Well-developed conceptual idea and thoughtful connection between component parts of the project (MO1 and MO2)	Excellent conceptual idea and innovative connection between component parts of the project (MO1 and MO2) with more than one idea.	Outstanding and innovative solution demonstrating exploration of connection between component parts of the project (MO1 and MO2) and multiple ideas.	
Resolution of final design solution	Little or no evidence of engagement with the project aims in the project output	Lack of detail and clarity in project output which fails to satisfy the project aims	Designed project output satisfies the project aims	Well-developed project output showing a thoughtful application of the project aims.	Excellent project output showing critical engagement with the project aims.	Outstanding and innovative interpretation in the project output as a response to the project aims	



Current grade in gradebook 86.00

Grading student 1 out of 137

Feedback comments Font family Font size Paragraph % ↺ ↻

Figure 6 – Sample rubric from hand held device screen

Looking more closely at assignment 2, students viewed the rubric during the week between the formative and summative feedback did so in order to get as much feedback as possible for

improving their assignment. There were 91 views of the rubric prior to the submission of Assessment 2 after the in studio formative feedback. There were an additional 289 views of the rubric in total during the week between the formative and summative feedback. We can assume that students who viewed the rubric once were only looking for their results; however, there can be an assumption that those who viewed it more than once were reviewing the result and seeking further feedback from the rubric in order to improve their outcomes. Table 3 shows the relative improvement in grades. Tutor 1 gave rubric, comments and verbal feedback whereas tutor 2 relied on rubric only for formative feedback (Table 3). There is no evidence that the rubric by itself caused an improvement in results, as can be seen from the table below. Despite the demonstrated improvements from tutor 1 student outcomes, compared to tutor 2, is difficult to determine what caused the improvement, as students in both groups frequently accessed the rubric feedback in the week following the formative feedback. It may well be the combination of the 3 forms of feedback that is the most powerful, with the verbal on the day and the written and rubric feedback given online for students to refer back to regularly as they seek to improve their outcomes.

	AO2 Formative	AO2 Summative
Tutor 1 – verbal, written and rubric	57.62%	66.86%
Tutor 2 – rubric	62.74%	62.82%

Table 3: Average marks for Time 1 and Time 2 for Assessment 2 for each tutor

DISCUSSION

The aim of this research was to provide evidence of students' engagement with online information and feedback in a design studio. In addition, the team were interested in how the timing of feedback could coincide with the students' cognitive process of creative exploration (divergence) and design resolution and communication (convergence). The design of the curriculum followed a divergent/ convergent process broadly determined by the timing of assignments submissions and timeliness of feedback. The team consciously designed the curriculum to focus students' attention around points of convergence as they progressively developed their studio assignments.

The focus on points of convergence for data collection served two purposes. Firstly the students' patterns of access in terms of frequency and over time could be mapped. Secondly the students were required to progressively build on each assignment and in doing so creatively engage in a design process that involved both iteration and engaging (though not consciously) in the convergence divergence dynamic. It was hoped that by targeting feedback leading up to convergence points in the assessment rather than providing weekly feedback,

students would be more likely to undertake more divergent thinking in the weeks when feedback wasn't given.

While the evidence of convergence was clear, the evidence of divergence was more difficult to determine, but we suggest the student's execution of the assignments and scaffolding of each submission based on the previous assignment shows improvement in their ability to complete the assignments. Tutors also reported that the students were also prepared to make significant conceptual changes to their final submissions in the week between the formative and summative feedback in order to achieve improvement. This suggests students could comprehend the feedback and revisit their project in a manner that mimics a more iterative design process. As mentioned in the results we can deduce that the frequency of views of assessment instructions coincided with period of work for students that preceded an assessment event. Notably the periods of exploration following the launch of the projects coincide with relatively low levels of access to the LMS in order to read assessment instructions. We would argue that while the data may suggest the students were not engaged in the assessments during this period due to the low level of LMS access, they were engaged in a form of divergence and information seeking in other ways as part of studio practice. We would argue that the early phase of the design cycles allowed the students to learn divergently by exploring without the constraints imposed by assessment criteria. For the team this tentative finding would suggest future research should focus on when not to give students feedback or assessment information in order to encourage the risk taking and creative leaps consistent with divergent thinking.

Tonkenwise (2014) argues that students find the creative leaps required in design practice to be daunting. Therefore encouraging creative exploration through some form of strategic retreat from the student tutor interaction may prove to be useful in complimenting this research to achieve better student outcomes.

In the first phase of this research in 2015, we reported that students preferred verbal feedback; however students who received and accessed other forms of feedback demonstrated the greatest rate of improvement in their grades. Similarly, students who revisited the project information, including accessing previous assignments information for subsequent submissions also demonstrated the greatest improvements. This research is instructive for studio curriculum designers and tutors who want to maximise the efficacy of online information and student interaction with LMS. The concept of traditional weekly studio verbal feedback is both labour intensive and inefficient in terms of students and academic staff time. It could also be argued that the efficacy of all forms of feedback is most evident during period of convergence. Similarly, the points of convergence in the semester are relatively short and focussed leaving large period of time to allow students to explore different ideas and approaches. However, while the use of LMS allows students to access their feedback immediately and revisit the information outside of studio time, it remains to be

seen how this method can encourage students to progress their design process without accessing LMS when divergence is needed.

Tutors should take comfort in changing their patterns of feedback to allow students more time to indulge in divergent processes in between assignments. Similarly students have more flexibility in how they access assignment information and feedback. As Universities demand more flexible and intensive modes of delivery, studio tutors can make the most of face to face time leading up to assessment periods and rely more on LMS to support students learning at other times.

CONCLUSION

By 2013, nearly 18 percent of students in Australia studied off campus, with a further 9 percent choosing to complete at least some of their study online (Norton and Cherastidtham 2014). The implications of this growing trend and demand for use of LMS to support, enhance or replace the more traditional modes of face-to-face teaching at universities (Laurillard 2013) including the adoption of new pedagogies, increased demands on academics time, and changing student expectations, and are well established (Bonk 2009). It is unsurprising that university programs in design education are under pressure to expand the adoption of LMS into the design studio.

While this project doesn't explicitly teach students about creative thinking or design process, it engages students in a design process through a curriculum based on the convergent divergent dynamic. The value to design educators is that a curriculum designed around a creative thinking approach, such as the one we have used, does help students to better understand and adopt a creative process in learning about design. By consciously incorporating LMS into the learning process for students, they can achieve positive outcomes that enhance more conventional forms of face to face verbal feedback. Studio tutors can use LMS to gain a better understanding of how students engage in design outside of formal studio interactions and better target the use of feedback. The research suggests that design tutors should focus on the diversity and timeliness of project information and feedback based on the convergent divergent dynamic in order to achieve better result from students at the beginning of their studio learning journey.

This research focussed on the patterns of access to online data, it revealed levels of engagement in information but not their levels of comprehension of the assignment requirements. Further research to better understand how students comprehended both the words used in the instructions and feedback rubrics may help to improve our understanding of how student progress between convergence points.

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