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From studio practice to online design education: Can we teach design online?

De l'enseignement pratique en studio à l'enseignement en ligne : peut-on enseigner le design en ligne ?

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Abstract

Digital technology is reshaping the way higher education subjects are taught, including design. Various design disciplines use studio teaching as a pedagogy to educate students for professions in art and design. Studio teaching bases a high premium on face-to-face interactions which guide learning through dialogue and feedback on individual work. Many design educators believe it is difficult or even impossible to teach design online because of studio-based interactions. Is design one of those disciplines that cannot be taught online because of the studio culture? This study explores that question by investigating the effectiveness of teaching design subjects that employ a virtual classroom to manage peer-to-peer critiques, instructor feedback, and assignments. Twenty-eight first-year students participated in two online design subjects that required them to interact with fellow students and the design instructor via a Learning Management System. The experienced benefits and challenges of students and instructors are presented, and future research is highlighted.

Résumé

La technologie numérique transforme la façon dont sont enseignées les disciplines de l'éducation postsecondaire, y compris le design. Différentes branches du design se servent de l'enseignement en studio comme pédagogie permettant de former les étudiants pour les métiers des arts et du design. L'enseignement en studio accorde une importance considérable aux interactions en personne qui orientent l'apprentissage par l'entremise du dialogue et de la rétroaction offerte sur le travail individuel. De nombreux enseignants de design croient qu'il est difficile, voire impossible, d'enseigner le design en ligne à cause des interactions en studio. Le design est-il l'une de ces disciplines que l'on ne peut pas enseigner en ligne à cause de la culture des studios? Cette étude explore la question en investiguant l'efficacité de sujets qui étudient le design à l'aide d'une salle de classe virtuelle, qui sert à gérer les critiques entre les pairs, les rétroactions de l'instructeur, ainsi que les travaux à effectuer. Vingt-huit étudiants de première année ont pris part à deux cours de design en ligne qui exigeaient d'eux qu'ils interagissent avec leurs camarades et avec l'instructeur par l'entremise d'un système de gestion de l'apprentissage.

Les avantages et les défis dont les étudiants et les instructeurs ont fait l'expérience sont présentés, et des pistes sont proposées pour des études futures.

Introduction

Studio teaching occupies the pedagogical heart of higher education design disciplines that prepare students for professions in such diverse fields as industrial design, graphic design, digital media design, architectural design, interior design, and fashion design. The characteristics of studio-based teaching in art, architecture and design, have been identified as supporting interaction, active learning, as well as social engagement (Crowther, 2013; STP, 2009). Studio teaching places a high premium on face-to-face interactions which guide individual student learning through interactions and dialogue (Blair, 2006; Kuhn, 2001; Lee, 2006). Part of this dialogue revolves around the studio critique. The critique or "crit" is the central method of formative assessment in art and design education (Blythman, Orr, & Blair, 2007; Day, 2012; Fleischmann, 2016). At critiques, students present their work-in-progress to the design educator, peers, and at times, design professionals to receive feedback. The critique and learning in a studio environment support peer learning; instant feedback is dialogic and highly social, and it enables students to benchmark themselves against peers (Blythman, Orr, & Blair, 2007). The student-centred, socially interactive characteristics of teaching and learning design has always rendered it distinct from more conventional academic disciplines, such as history, philosophy, or business, for example (Loy & Canning, 2013). These disciplines can be faced with large class sizes of over 150 students, where knowledge transmission occurs in lecture format and individual student engagement is challenging to accommodate. Students often receive feedback only after learning has been completed (through summative assessment like an exam), while design students' learning is guided by individual and ongoing feedback and is informed by a cycle of action and reflection.

It is these socially interactive characteristics of teaching and learning design that colours many design educators' opinions that it is difficult or even impossible to teach design online (Bender, 2005; Fleischmann, 2015; Park, 2011; Wood, 2018). Comparatively few fully online design courses exist while other academic disciplines are experiencing rapid growth in offering fully online subjects (Kumar, Kumar, Palvia, & Verma, 2019).

From the studies available, most research into teaching online design subjects has focused on a blended learning approach where only some elements of the subject are introduced online, such as streaming video lectures or using online platforms for discussion board communication. Part of the reason for the scarcity of research into offering purely online design subjects may be influenced by uncertainty about how to present the studio critique in a virtual design studio. Can a traditional design studio be transformed into a fully online learning experience? This research examines that central question and provides some practical answers. This study explores the effectiveness of two introductory design subjects (Introduction to Media Design and Time-based Media Design) which were offered fully online. The effectiveness of teaching design online is explored by student and instructor feedback through detailed questionnaires and interviews; benefits and challenges are presented, and further areas of research are suggested.

Design Studio Pedagogy

The way design is taught and learned illuminates the challenges design educators face when attempting to create blended or online learning experiences for students. Design is a project-based discipline with studio-based teaching as its core pedagogy (Park, 2011; Saghafi, Franz, & Crowther, 2010). Projects which are either real or fictional present students with open-ended problems to which no single answer exists (Blair, 2006; Crowther, 2013). Possible solutions are discussed with peers and design educators and these discussions guide the learning process (Kwan, 2010; Park, 2011; Shreeve, 2011). The traditional design studio is a physical space which nurtures this project-based learning through open discussions and hands-on activities (Sara, 2006).

The pedagogical concept of "learning-by-doing" (Schön, 1983, 1987) is grounded in Kolb's (1984) experiential learning model. Generally, studio-based teaching involves the principal design educator and instructors, who are often design practitioners, guiding student learning and development, often through one-on-one activities (Crowther, 2013; Park, 2011; STP, 2009). Outside professional designers are occasionally brought in to give a lecture or to critique student work from a working designer perspective.

Studio critiques function as a catalyst to improve students' creative output, thinking processes, and techniques when students present their work-in-progress to peers, instructors, and design professionals for comment (Ellmers, 2006; Kwan, 2010; Lee, 2006). The focus of a studio critique is to trigger individual creative development through a circle of action and reflection (Ellmers, 2006; Schön, 1987). The crit attains a key goal of design education, which is to foster the ability in each student to reflect on the quality of their creative output and that of others. This reflective practice has always been central to the education of design students (Fleischmann, 2016; Shreeve, 2011; Uluoglu, 2000).

What Can be Learned from Existing Research Specific to Online Design Education?

Design studio classes are commonly taught in smaller groups of up to 20 students (Crowther, 2013; STP, 2009), so most of the larger sample sizes in the literature involve blended learning subjects, where digital technology is specifically used to cope with larger-sized, often geographically dispersed, design classes. Blended learning seems to be a middle ground to introduce online elements to design classes (Fleischmann, 2018a, 2018b) with various educators trialling social media platforms like Facebook as a collaborative and communication tool. But these trials do not offer students a completely online experience. Online courses combine all the teaching materials, discussions, display of design process and production into a virtual environment where instructor and peers critique creative work and project submissions are done via the Internet.

Early research recognized the power of the internet for collaborative projects in design education (Cheng, 2000). The limitations of distance, time, and physical location are not present on the web. But it is not easy to create an online learning experience (or virtual design studio) where the social interaction of face-to-face, problem-based learning is done over the Internet and where students must assume basic organizational skills (Kvan, 2001). Researchers also suggest that the key to the successful implementation of online collaboration in design depends on high

student participation rates and quick instructor feedback (Bender & Vredevoogd, 2006). Investigators Afacan (2016) and also Power and Kannara (2016) found that ease of navigation and well-designed modules are critical to the success of student-centric virtual studios. Investigators also found that training on internet tools positively impacts both student and teacher engagement in the course material; the smooth operation of technology platforms and tools can make or break a blended or online design class (Power & Kannara, 2016).

Barber (2011) examined conducting the studio critique online at a Canadian university's' graphics design foundation course as part of a blended learning experience. Barber's theory is that the crit could work in a blended learning mode with critique feedback undertaken in online discussions while hands-on practice is carried out in the classroom (Barber, 2011).

When reviewing the literature, it becomes apparent that currently no 'one size fits all' online design education model exists. The highly student-centred approach of design learning and teaching is based on learning that is guided through ongoing feedback and the process of action and reflection does not easily translate into a fully online learning experience (Fleischmann, 2015). In comparison, conventional disciplines with a traditional way of knowledge transfer appear to have a head start in translating their teaching and learning approaches (e.g. lecture, exam) into an online environment. Nevertheless, examples of strictly online approaches to higher design education subjects point out the following advantages in terms of critiquing and feedback:

- Outside experts can provide feedback (Kvan, 2001; Lapolla, 2014),
- Asking students to critique online leads to higher level of participation in collaboration (McIntyre, 2007),
- Reviewing the design process of students' works facilitates focusing on the process rather than on the final product (Saghafi, Franz, & Crowther, 2010),
- Unlimited exposure to peer progress is possible (Güler, 2015),
- Immediate response and feedback are possible (McNamara, 2015),
- Students become more self-reliant when it comes to developing their own expertise if an expert is not available in the studio for immediate feedback (Lotz, Jones, & Holden, 2015).

As technology advances, so do options for design educators to introduce online elements to their subjects, particularly Internet-based collaboration and classroom critiques; Student participation and a willingness to take responsibility for self-directed learning are key to making this online approach work.

Structure and Design of the Online Design Subject

The Design major is part of a three-year Bachelor of Arts and Creative Media degree at the author's regional university; it was decided to offer two first-year design subjects online in order to attract more students to the major. The subjects were designed in a similar way to provide continuity within the Design major. The central online learning platform was the Learning Management System (LMS), Blackboard, which was used as a repository for study materials, assessment sheets, and grades, as well as used as a communication tool and to set up

virtual collaborative classrooms. Each subject was taught by one design instructor using Blackboard.

The Online Lectures: Creating an Engaging Viewing Experience to Support Learning

Various approaches to delivering the core lecture material were considered and it was decided to use streaming videos, similar to MOOC platforms such as EDx and Coursea. The most common video approaches were voice-over presentation slides (screen cast); classroom recordings; filmed group conversations/interviews; and the talking head style where the presenter–either sitting or standing–talks directly into the camera. Video lecture length was considered critical in retaining student interest in the subject materials. Brame (2016), who published on principles and guidelines for maximizing student learning from video content, identified three critical aspects to consider when making videos: the cognitive load, student engagement, and active learning. Students learn better when important information is highlighted in the videos; for example, key words can be used to highlight important elements on screen. Segmenting information into smaller chunks is another strategy that can be used to help and encourage students learn and remain engaged.

Following suggestions by Coyne, Lee, and Petrova (2017), who used online videos effectively in a flipped classroom model for design education, the design educators recorded lectures running 8 to 15 minutes per video. During recording, design educators talked directly to the camera using a personal, enthusiastic, and friendly tone–often employed in the studio setting–to connect with student viewers, as is recommended by Brame (2016). A post-production team added graphic elements, such as summarizing lists, keywords, images, and animations. Up to five videos were offered each week, although Brame (2016) suggested using shorter videos (6 minutes or less) to cater to students' attention spans. That recommendation was rejected because it would offer too many videos per week. The decision was supported by findings from Coyne, Lee and Petrova (2017) who discovered that students become easily overwhelmed when too many choices are offered. To test the decision to provide students with fewer but longer videos, satisfaction with video length was explored as part of this research. The videos were hosted on a YouTube channel which could be accessed with all other subject materials though Blackboard.

Weekly Learning Activities: Developing Software Proficiency

Besides learning design principles, developing creative potential, and critical thinking skills, design students needed to become proficient in industry-standard design software, such as Adobe Illustrator–a vector graphics program for creating logos, illustrations, and typography. Although there are a multitude of free software tutorials available on the Internet, it was decided to use a professional online provider–Lynda.com–which specializes in the production of learning videos for the development of business, software, and creative skills. Access to Lynda.com is available to all students and staff at the author's university.

Weekly Learning Activities: Tutorial Tasks and Assessments

To encourage students to apply their newly acquired knowledge and software skills in their design projects, weekly tutorial tasks were assigned. Students were assessed on two practical design assignments (weighted at 30% and 50%) and a multiple-choice test (20%). The

test was given at the end of the semester to test knowledge of lecture materials and to encourage students to watch the online videos. Each assessment was first introduced by posting the assessment sheet online, followed up with a meeting in a virtual classroom (Blackboard Collaborate) to allow students to ask questions about the assessments directly. Assessment grades and feedback were available on the LMS via the online gradebook and rubrics which included additional feedback comments.

The Studio Critique in the Online Space: Simulating the Crit as Learning Opportunity

Given the significance of the studio critique in design education, students were actively encouraged to engage in the cycle of action and reflection through receiving and giving feedback. Students were asked to upload their work on the Blackboard discussion board to receive feedback from the design instructor on the progress of their work. Students were also asked to provide feedback for the uploaded work of their peers. This activity was intended to help students learn to explain their thinking and give constructive feedback. The feedback was in the form of written comments.

Building a Community: Online Meetings and Communication

To further build the sense of a community and to offer the opportunity to ask questions directly, the educator set up three Blackboard collaborative sessions. Blackboard describes its digital tool, Collaborate, as “a simple, convenient and reliable online collaborative learning solution that makes learners feel like they're together in the same room” (Blackboard, 2019). A virtual collaborative classroom was felt to be a constructive attempt to engage students more actively. however, scheduled online meetings could disrupt the flexibility of the online class. Some students were working full time, for example, and would not be able to attend the meeting on a particular day/time. To circumvent possible problems, the sessions were recorded and made available to students who could not attend.

Methodology and Research Design

The presented study is framed by a pragmatic approach. This allowed the researcher to choose methods that suit the real-world practice nature of the situation (Creswell, 2003; Johnson & Onwuegbuzie, 2004; Punch, 2009). The stakeholder perspective from two groups, design students and design instructors, was sought to enable triangulation of data (Teddlie & Tashakkori, 2009). The study surveyed 28 first-year undergraduate design students in two design subjects that were taught fully online and two design tutors who taught the subjects. Online questionnaires were used to collect quantitative and qualitative data from design students. Semi-structured interviews were used to obtain feedback from the two design instructors who were asked the same questions, which deepened a line of inquiry (Kvale, 2007). Data collection from the two stakeholder groups would add depth and/or breadth to the study through “expression of different facets of knowledge or experience” (Bazeley, 2004, p. 146). An in-depth qualitative data analysis was conducted on feedback received from students and design instructors. Broad coding themes such as benefits and challenges were established at the beginning of the analysis and sub-themes emerged by grouping responses. When presenting student perspectives, the qualitative feedback is used to enrich the statistical result and to illustrate the situation in more depth (Rossman & Wilson, 1985; Fielding, 2012). For design instructors, verbatim quotes are

used to present a closer insight into their thinking. The following themes were explored to evaluate the effectiveness of the online learning experience:

- Was the online subject considered beneficial and why?
- What are the positive and challenging learning/teaching experiences students and instructors encountered?
- How did students like receiving/giving feedback?
- Was the video length effective, and should there be any changes?

Although small by statistical standards, the participant numbers represent a sample size congruent with the size of design classes taught in a traditional studio environment. Case studies presented in the literature exploring online design subjects and projects generally rely on small sample sizes using qualitative and quantitative surveys to gauge student and instructor responses to pilot projects.

Findings: Design Instructor Perspectives

Overall, both instructors agreed that the subject delivery went well. Students achieved the learning goals and, in their view, had a valuable learning experience. Students had easy access to the learning material. The videos were "well presented" and one instructor felt that students must have watched the online lectures since "they did well" in the online multiple-choice test. Both instructors agreed that students "were fine with the assignments–the work produced and submitted was of good quality". When discussing the merits of online design education versus face-to-face, the design instructors mentioned flexibility for students to choose time and place of learning as a major benefit, which allowed students to study away from the campus.

Encouraging Feedback: Cycle of Action and Reflection

One of the biggest challenges of the online subject was getting students to engage in the feedback process. Both instructors noted that some students were reluctant or unwilling to share their work with the group online and some students had difficulty understanding the iterative process of design. This frustrated both instructors, and one commented: "It was very hard because you can't give feedback if students don't want to show their work."

The design instructor described her experience: "Probably half of the students sent me some drafts and I gave them feedback and they took it up and made changes and improved their work… but it seemed there was a desire in students to keep it to themselves until the very last minute."

The other instructor mentioned her positive experience:

> …the students that sent me something, were really happy about the feedback and I got emails back saying, 'Thank you for the feedback. It really helped me.' … and you could see that they took the feedback on board. So, as soon as this happened, the subject worked really well. I just would have wished that more students would have taken the opportunity to receive more regular feedback on their work – not just from me but also from their peers.

The Virtual Classroom as Social Place

One of the characteristics of traditional design studio culture is active participation in a community, which afford the opportunity to engage in peer learning and experience the design studio as a social space. Both design instructors tried to replicate these inclusive characteristics in the online environment with sometimes disappointing results.

> In the beginning I tried to replicate the studio culture. I'd hold a Collaborate session where I asked every student to introduce themselves and also to create a poster that told the class something about themselves. I designed a poster about myself, too. I thought this would help to create a virtual community… The participation rate in creating the poster was rather low and it was quite disappointing to me …

Instructors also felt challenged by getting students to communicate with one another online.

> I tried to replicate the interactions of the traditional design studio …but some students were just not responsive. The only way I could see that they participated was because the assignments were really good. Otherwise, I would have said there is something going wrong. But it wasn't. The assignments...were very good.

A critical comment from the other instructor questioned how online could work in more advanced subjects that deal with the design of "things that we can physically touch, like the design of a book. How do you actually implement this? How do we teach things that really work better when taught face-to-face?" This comment may reflect an important limitation of online design instruction in certain design disciplines which focus on the creation of physical objects; the other instructor saw blended learning as the most beneficial teaching mode: "I think the combination of online and face-to-face is the best, because students can watch the online lectures in their own time and they can replay them. Students can look up things straight away. I think this works really well. And, the tutorial gives you more the hands-on and does connect it all with practical aspect of the subject".

Both instructors felt somewhat disconnected by teaching a fully online subject. One instructor pointed to the challenge of not seeing students' immediate reactions to gauge comprehension when teaching face-to-face. Although both instructors felt students could have been more responsive, the practical outcomes and test results were satisfactory.

Findings: Design Students Survey Results

Overall Learning Experience: Design Student Perspectives

Of the 28 students who participated in the online design subjects, 18 students (64%) had previously studied a subject either online or in blended learning mode, while 10 students (36%) had not.

Participating students had the following age range: 18-21= 43% (12 students); 22-25 = 25% (seven students); 26-30 = 14% (four students); over 30 = 14% (four students); over 40 = 4% (one student).

When surveyed, the majority of design students, 75% (21 of the 28 students), "liked" the online learning experience and 14% (four students) were undecided–"sometimes they liked it and sometimes not". Only 11% (three students) stated that they "did not like" the experience.

Overall, when students were asked whether or not they would study the subject again in an online study mode, 68% (19 students) said yes, 14% (four students) were not sure and 18% (five students) would not study the subject online again. The percentage of students who said they would study the introductory design subjects online again roughly corresponds to the number of students who had previous experience with online or blended learning subjects.

Aspects Experienced as Positive by Students in the Online Subject

A variety of themes emerged when analyzing students' interview feedback on the positives of their learning experiences in the online subjects. The student comments presented draw attention to different aspects within each theme. Major benefits are presented below:

Provided flexibility

> "I was able to better coordinate with my work and social life while studying."
>
> "I could follow a job opportunity in Sydney and did not need to discontinue my study".
>
> "I have a range of disabilities that make it difficult for me to schedule attendance at lectures and tutorials."

Beneficial for individual learning style

> "I could study at my own pace; it was easy to revisit the lectures."
>
> "I liked access to the lectures, especially when I could take the time at home to thoroughly absorb them and participate in the activities."

High quality of learning content

> "The online lectures were very engaging and well delivered"
>
> "The friendly attitude portrayed through the lectures even though it was through a screen."

Speed of communication and feedback; responsiveness of instructor.

> "The instructor was so responsive and helpful"
>
> "The tutor was wonderful. She ensured that we had prompt feedback, both by email and on the discussion board."

Aspects Experienced as Challenging by Students in the Online Subject

The following challenging themes emerged when analyzing all student feedback and are presented with sample comments:

Submitting and understanding assignments

> "Sometimes understanding what was required of the assignments was a little challenging however any questions I had were easily sorted via email."
>
> "The only issue with the external study was the difficulty of submitting assessments to the university server which did not work. So, I had to submit my assessment directly to the instructor as an attachment to the email."

Technical software instruction

> "I spent quite a bit of time teaching myself how to use Adobe programs through online tutorials; this would have been easier if I was in a class and could ask the teacher a question face-to-face rather than searching the Internet or the solution I needed."

Missing lecture script

> "The only part I found challenging was identifying which parts I should be taking notes of and which parts will be tested."
>
> In general, positive student comments far outweighed negative comments.

Online Lectures: Design Student Perspectives

Much thought, preparation, and post-production was spent on the creation of the online lectures. Considerations included how to make videos engaging, informative, and short enough to avoid boring students with short attention spans. When asked about the length of the video lectures, 75% of design students (21) agreed the length was good. The rest of the students expressed a mix of preferences: some wanted videos of 15 to 20 minutes while other students preferred shorter ones. The results indicate that while there isn't a one size fits all students' learning style, following the recommendations from existing research worked positively for the majority of students as a learning experience. A large majority of the students 86% (24 students) found the Lynda.com online software tutorials as "helpful" while four students did not like them.

Online Feedback: Cycle of Action and Reflection?

Iteration is a key component of the creative design process, so it was important to explore student attitudes toward receiving feedback via an online format. The majority of the students found that online feedback on their design projects worked for them as did online peer critiques. Table 1 gives an overview of the student perspectives on receiving feedback in an online forum.

Table 1

Student Feedback on the Effectiveness of Receiving Feedback on Creative Work

You received feedback on your design work via the discussion board, how did you like receiving feedback?		
	Number of students	%
I think it was good; the feedback was helpful	17	61
I am still undecided, sometimes I liked it and sometimes not	4	14
I posted my work but did not receive feedback	3	11
I did not post any work because I don't like to expose my work this way	3	11
I did not like it so much because I did not receive much helpful feedback	1	3
I would prefer a different way of receiving feedback	0	0
Other, please explain	0	0
Totals	28	100

While a majority (61%) of students found receiving feedback via the discussion board as helpful, no student would have preferred to receive feedback in a different way. This result, when taken in the context of instructor remarks about student reluctance to share their work online, suggests that some students may not feel comfortable receiving advice or constructive criticism, regardless of the medium. Table 2 presents student perspectives on giving feedback in an online forum and reflects the same uncertainties.

Table 2

Student Feedback on Effectiveness of Giving Feedback on Creative Work of Peers

You were also asked to give feedback on the design work of your peers via the discussion board, how did you like giving feedback?		
	Number of students	%
I think it was good; giving feedback was also helpful	16	58
I am still undecided, sometimes I liked it and sometimes not	4	14
I did not like it so much; it is hard to give feedback on the work of others	4	14
I did not give any feedback	4	14
Other, please explain	0	0
Totals	28	100

Giving and receiving public critiques of one's creative work can be an uncomfortable proposition for many people, particularly students who are in their first year of study. Students can feel ashamed and embarrassed if their work is criticized openly. However, as some students noted, the art of providing and receiving feedback is an "essential life skill" as one student commented, not just a necessity to succeed in the design profession.

The following comment reflects the view held by more than half the students in favour of online crits.

> I think giving feedback is very important. Firstly, it makes the student apply the principles they have learnt to someone else's work. It also helps to guide a student in the delivery of feedback in a positive way. If the feedback is not correct, then the tutor can step in and it becomes a learning experience for both students.

Some students gave constructive recommendations to increase student participation in online discussion critiques: One suggested making the "about me" poster a subject requirement to encourage participation and the other suggested making student discussion board feedback mandatory because "the feedback from other students is just as useful as the ones from the instructors."

Conclusion

Like many design educators, the author was skeptical that design subjects could be delivered fully online. That skepticism arises from design's traditional studio-based culture and project work which requires an iterative process based on face-to-face feedback and a dialogical approach to teaching and learning. This study attempted to pinpoint which aspects of a studio environment could be translated into a successful online learning experience. Twenty-eight first-year students interacted with fellow students and design instructors via a Learning Management System, Blackboard, which hosted all the learning content. Lynda.com was used for off-the-shelf tutorials on use of design software, which the large majority of students stated were "helpful".

The majority of students also liked the fully online learning experience and design instructors were satisfied with the learning outcomes. Positive student remarks centred on the flexibility of online delivery, which gave students the opportunity to create their own study schedule and learn and complete assignments at their own pace. Students experienced the subject as well organized and presented which helped students to focus on their learning– confirming a point raised by Afacan (2015) and also Power and Kannara (2016) who found that well-designed modules are critical to the success of student-centric virtual studios.

A small number of students criticized what they felt were a lack of clarity in assignment explanations, as well as difficulty uploading their assignments to the university server.

The two design instructors involved in teaching the subjects had to adapt their teaching style to an online platform. Although generally positive in their remarks and satisfied with the quality of work produced, one missed the facial and body language feedback experienced in face-to-face lectures which indicate student comprehension of subject materials or lack thereof. Another instructor indicated that some students had a difficult time understanding the iterative design process in presenting design projects.

The online critique process was critical to the success of the subjects and really focused the question of the efficacy of online learning in design education. A discussion board, which was integrated into the Learning Management System, Blackboard, was used to critique student project work. It was found that most students were comfortable with the online critique process, while a minority did not use it to its fullest capacity. Students who chose to be active participants in the online critique (receiving and also giving feedback), said it was helpful to their learning process. These students showed a good understanding how the online critique guided their learning and "provides an opportunity to articulate the often tacit understanding and evaluation of design processes" (Shreeve, 2011, p. 119).

But there were a small number of students who opted out of the process. These students were shy about sharing their work and some found it difficult to critique their peers. The instructors also found it challenging to engage these students into active participation–which provides a point for further research on how to increase student participation in the online critiquing process. Students themselves suggested making participation in discussion boards part of the assessment. Given that the majority of students who participated in the subjects came straight from high school, knowing the process of design learning cannot be assumed. A more in-depth introduction to the iterative design process and the role of feedback could be trialed as a strategy to increase understanding and active participation in the online critique.

Another key component of the online delivery involved recording the lectures that would normally be given in front of a class. The majority of students found the lectures to be the right length and thought they were "engaging" and liked the "uplifting way" design educators presented the information. This positive feedback confirms that time spent on organizing the learning content in digestible learning units, highlighting key concepts by using graphics/keywords, and presenting with a positive attitude in front of a camera, helped to maximize student engagement–as suggested by Brame (2016). Creating video lectures that resonate with students takes time and money, which are in short supply in many regional

universities. Further research into online design subjects should consider return-on-investment based on student enrollments.

Digital technology is reshaping the way higher education subjects are taught, including design disciplines. There is a scarcity of literature exploring practical ways to develop online design courses largely because of the way design is taught and learned. This study indicates that a fully online design classroom can work for this introductory design subject based on projects that can be created digitally with design software. However, it may not be suitable for a course like product design, which requires the creation of a physical object. There is no question that in certain contexts, online design education is possible and does produce positive results from student and teacher perspectives.

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