



HYPE OR HELP? TECHNOLOGY-ENHANCED LEARNING IN THE DESIGN CLASSROOM: AN EXPERIMENT IN ONLINE DESIGN COLLABORATION

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While technology-enhanced learning is changing quickly, design courses have been slow to adopt these technologies. However, that gap may be narrowing. Existing case studies in which the functioning of blended, online, and a combination of blended and online design courses are explored reveal a trend toward incorporating social media and internet platforms in collaborative design projects. There is an evolution in pedagogical thinking about how design courses can successfully incorporate up-to-date digital technologies; there are also significant problems when adopting these technologies into studio-based courses. To overcome identified barriers, this study explores the use of a digital platform that supports online collaboration on creative design projects in a blended learning environment. The paper presents insights from 3rd year design students and their experience in using a digital collaborative design platform which allows students to annotate designs and provide in-context feedback for faster iterations in real time. Results are discussed in the context of broadening learning opportunities for design students in a blended learning environment and providing students with an authentic learning experience because it represents technologies that are increasingly part of a professional practice.

Keywords: Blended learning, Design education, Technology-enhanced learning, Online design collaboration, Design curriculum.

Introduction

Design is a discipline that often requires collaboration to arrive at innovative solutions, yet design has been demonstrably slow to adopt digital technology tools in the classroom to enhance collaboration. The early adopters of digital technology that supports learning in design education were often faced with balky internet connections and software platforms not advanced enough to encourage online collaboration. Early experimenters with technology-enhanced learning within design classrooms found students who became frustrated with slow response times from fellow classmates and instructors who were not always comfortable employing technology tools to manage student projects online in a discipline grounded in face-to-face workshop environments.

There has been a shift from these tentative first steps in employing technology to harnessing its power to increase collaboration among design students. The rapid development of internet speeds and software programs that support online communication and collaboration has clearly shifted the focus away from technology's challenges toward how technology can support a particular pedagogical approach specific to design education.

Technology-enhanced learning (TEL), also called technology-enabled learning, is often used as a synonym for e-learning, which can be delivered strictly online or in a blended environment. TEL really means learning *with* technology, which adds a flexible dimension to the design classroom. In this paper, TEL means any kind of technology supported learning whether in the context of a blended learning environment or strictly online.

The search for technology-enhanced solutions that could adapt design's face-to-face learning in a design studio with its dynamic, iterative characteristics has been ongoing since the ambitious Omnium project initiated by Rick Bennett (2009) in 1999. At its peak, the project brought together 120 students, educators and creative practitioners from around the globe and was in 2005 the world's largest international online student design project. Since the Omnium project, design disciplines that have conducted research on technology-enhanced design collaboration include fashion (e.g. Lapolla, 2014), interactive design (e.g. McIntyre, 2007), graphic design (e.g. McDermott & Carena, 2012), digital design (e.g. Park, 2011) and product design engineering (e.g. Sclater, Grierson, Ion & MacGregor, 2001). Recent research focuses mainly on adapting social media platforms to design classrooms to make use of the connectivity of social networks as part of the studio learning environment (Güler, 2015). Researchers have noted positive results from adapting social media platforms into the design learning environment to foster electronic communication. However, the visual iterative design process students need to engage in when developing design concepts has not yet been fully replicated in an online environment.

Online collaboration from a visual perspective has been one of the major impediments why design education has largely not yet replaced blended and face-to-face classroom instruction with fully online programs. Nevertheless, more recent technological advancements have seen digital collaboration tools emerge that support more effortless collaboration amongst creative teams and in an online environment. Professional design teams now have various tools at their fingertips that allow real-time file sharing, visualising work processes and timelines, and some also support the visual aspect of the design creation process in the online environment. This visual aspect refers to displaying, for example, iterations of the project including graphics changes, comments, and storyboards within one digital space, platform or digital whiteboard display.

In this study, one such visual online collaboration tool was trialled with the aim to enhance a blended learning design studio of a third-year undergraduate design subject. The purpose of this technology-enhanced learning approach was twofold: first to test whether the iterative process in a design studio can be maintained online; and second, to provide design students with an authentic learning experience reflective of contemporary professional design practice, which includes mastering project management design software.

The research presented in this paper is part of a larger study which explores the attitudes of undergraduate design students towards the idea of studying their design degree fully online (Fleischmann, 2018). This part of the study is a hands-on exploration of the effectiveness of a commercial freeware product that supports the visual, iterative design process in an online collaborative environment in a blended learning design class.

How Is Design Taught and Learned?

It is helpful to contextualise the way design is taught and learned to lend a perspective to design classroom teaching approaches. Studio-based teaching is a central pedagogy in project-based disciplines such as design (Park, 2011; Saghafi, Franz & Crowther, 2014). Studio-based learning is centered around the pedagogical concept of "learning-by-doing" (Schön, 1983, 1985) and grounded in Kolb's (1984) experiential learning model. In the design studio, learning and teaching is usually structured around fictional or real-world projects with students searching for answers to open-ended problems (Crowther, 2013) through an ongoing dialogue between students and design educators (Park, 2011; Shreeve, 2011). Design students in the (physical) studio usually engage in this kind of project-based learning by combining research and hand-on-activities (Sara, 2006) "rather than the more conventional transmission of knowledge content" (Shao, Daley & Vaughan, 2007, p. 919; Kwan, 2010).

Design learning requires students to engage in an iterative process which requires their reflection on feedback provided by the educator, peers, or at times design industries professionals. When engaging in authentic learning situations, design students are often required to work in teams and collaboratively work through the iterative design process.

Blended versus Online: Can Design be Taught over the Net?

Because of design's collaborative problem-based learning and self-reflective iteration, electronic delivery systems have been tried with varying degrees of success in a number of combinations and design disciplines. Within the various design disciplines, there are two basic approaches currently being used to incorporate electronic platforms: blended and online.

Blended courses are those that incorporate both face-to-face classroom contact either in lectures, studios, or tutorials and the delivery of some parts the course online via an electronic platform such as a Learning Management System (LMS) or social media. The electronic part of blended courses often incorporates discussion forums, file and video sharing, while assessments are often augmented by internet communication tools such as Skype to incorporate professional feedback or encourage collaboration among students in different locations (e.g. Ham & Schnabel, 2011; Fleischmann, 2014).

Online courses combine all the teaching material, discussions, design processes and production into a virtual environment where project submission, peer and instructor feedback or professional critiques are done via the internet. Online courses are often used in distance education where students do not have access to a physical lecture hall or a design studio. Like blended learning, assessment instructions and feedback, discussions and peer interactions are often augmented by internet communication tools such as video conferencing (e.g. Skype, Google hangout) or online collaboration tools integrated into the LMS (e.g. Blackboard Collaborate Ultra).

In general, researchers have found that online collaboration, either on its own or as part of a blended learning approach, works if there is a high degree of student and teacher participation which streamlines feedback (Bender and Vredevoogd 2006). The rise of social media has seen design learning environments being augmented with social media tools such as Facebook (e.g. Morkel, 2011, Schnabel & Ham, 2012), Pinterest (e.g. Lapolla, 2014) or Flickr (e.g. Fleischmann, 2014). While research has highlighted social media integration as beneficial to augment design learning by enabling better communication between team members and idea sharing, social media integration has often fallen short of providing a truly collaborative digital meeting space that supports the iterative process designers need to engage to arrive at their final design idea or product.

Technological advancements, especially cloud storage and faster internet connections, are now making team project software more available to design students, who are already accustomed to using social media platforms outside the classroom (Fleischmann, 2018). More affordable cloud-based communication can now be accessed via file sharing tools (e.g. Dropbox, OneDrive), web-based applications in which documents and spreadsheets can be created and edited online (e.g. Google Docs) and digital workspaces which combine workflow tools and communication tools (e.g. Slack, Wrike)

In various trials, the lack of visually supported communication and collaboration interaction was identified as a major roadblock for students engaging in collaborative teamwork via an online platform. Chen and You (2010) and also Cho and Cho (2014) highlighted, for example, that discussion boards in Learning Management Systems (LMS) are designed mainly for text-based interactions and do not facilitate student feedback on visual content. Cho, Cho and Kozinets (2016) conclude in their research, that students perform better in terms of achievement and confidence in collaborative tasks when they use visually supported collaboration technology.

Technology-Enhanced Learning in the Design Classroom: The Study Context

The design major in the Bachelor of Arts and Creative Media at James Cook University (JCU), Townsville, Australia has been delivered as blended and online modes since 2016. Both modes utilise a

sequence of scripted video lectures post-produced with motion graphic design, images and text overlays highlighting key points of the presentation; the recorded lectures also include embedded videos which add another dynamic visual element to the presentation. The university's video production unit produces a streaming format that is similar to high-quality Massive Open Online Courses. The online lectures go well beyond the common practice of voiced-over screencast PowerPoint presentations.

The lecture videos are available online via the Learning Management System (LMS) Blackboard. Flexibility is behind this approach because design students can access these videos and other content 24/7. For both online and blended delivery modes the learning content, student/instructor communication, assessments and grading are managed through the LMS.

Subjects in the blended design major offer students, next to the online video lectures, two-hour face-to-face tutorials in a collaborative computer space. Here the students conduct tutorial tasks supported by the design instructor. Design students present their ideas and receive feedback from the instructor and other students. The online version of the design major offers students the same weekly tutorial tasks accessed online. External students have the opportunity to upload work to the LMS discussion board to receive feedback from instructor and peers. External students also have the opportunity to participate in collaborative sessions facilitated by the LMS (Blackboard Collaborate Ultra) which includes a real-time video conferencing tool, screen and file sharing, and the use of a virtual whiteboard which, however, is more suited to text-based communication.

Research that monitored the effectiveness of new these technology-enhanced learning approaches showed that design students overwhelmingly support a blended learning approach to their studies rather than online (Fleischmann, 2018). Student feedback highlighted key points in architecting an effective online design course which also apply when using online components to augment a blended learning environment. These include: "an instant feedback mechanism from educators; an opportunity to exchange ideas with educators and peers; an opportunity to receive instant peer feedback ideally; and a progress check on students' learning (projects)" (p. 17). Students also commented on the limitations of social media in facilitating online collaboration. The study (Fleischmann, 2018) suggested the need to explore more engaging and effective online software which, for example, allows students to provide in-context feedback and annotate designs in real time and faster iterations. This is line with findings from Cho, Cho and Kozinets (2016) who suggest that the design studio could be more effectively augmented through visually supported communication and collaboration to allow design students to successfully engage in collaborative teamwork via an online platform. Two platforms that offer a more visual approach to online collaboration for creative teams include ConceptBoard and GoVisually.

Exploring the Effectiveness of Visual Online Collaboration: Research Methods

Design Lab is a 3rd year subject in the design major of the Bachelor of Arts and Creative Media which focuses on applying design thinking to service design problems. The iterative idea development process is particularly crucial as part of the design thinking process where student teams undertake background research to understand the problem; build empathy with stakeholders through observation; synthesize findings from background research, observations and user engagement; brainstorm ideas; build and test prototypes and engage in refinements of ideas with prototype iterations based on user feedback (Fleischmann, Daniel & Visini, 2012).

The Design Lab subject was offered for the first time in a blended learning mode. The subject is built around 13 hours of video lectures delivered online and 26 hours of face-to-face workshops which are delivered in a seven-week block mode. A visual online collaboration tool for creative teams was introduced to augment the face-to-face workshops and extend the learning opportunities for design students beyond the computer lab. The commercial tool selected for this study was ConceptBoard (<https://conceptboard.com/>). ConceptBoard allows members of creative teams to contribute to the project development process via team whiteboards by visualising ideas, sharing drafts and providing feedback on concepts and ideas remotely in one collaborative online workspace (Figure 1 and 2). Conceptboard helps develop projects from initial ideas to their final design stages. Contributions and changes are seen by all

team members in real-time. The platform also supports communication via video-conferencing which is a paid feature. A free plan is also available which provides the basic features of the tool for visual online collaboration. There are limitations with the freeware, such as the number of objects on one concept board, although the number of boards is unlimited. With no budget earmarked for software purchases, the freeware was a workable test platform for gauging the effectiveness of an online collaboration tool. ConceptBoard will be referred to as the “visual online collaboration tool” in this paper.

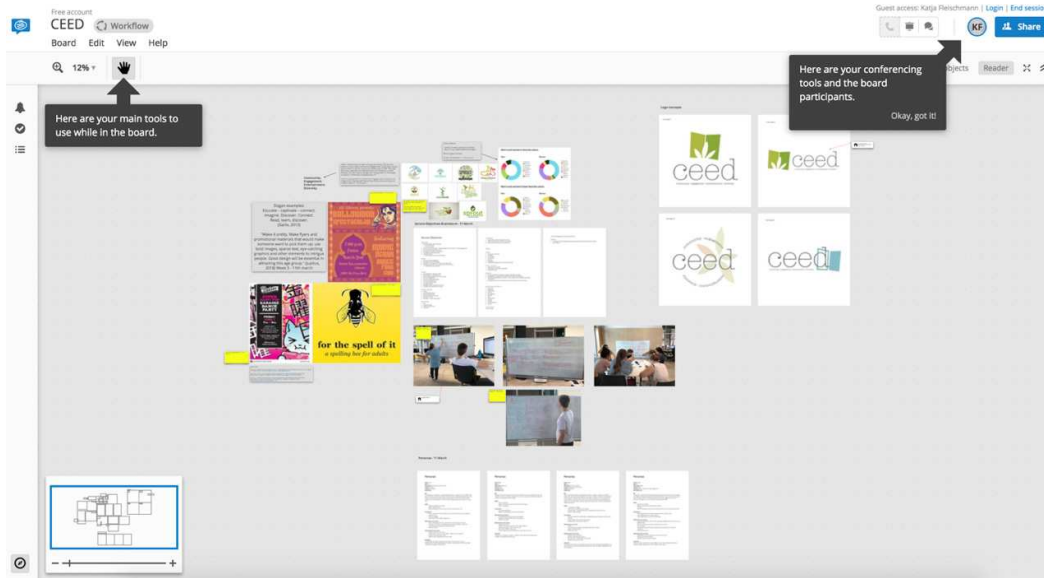


Figure 1. Visual online collaboration tool: detail from board collection of design student team

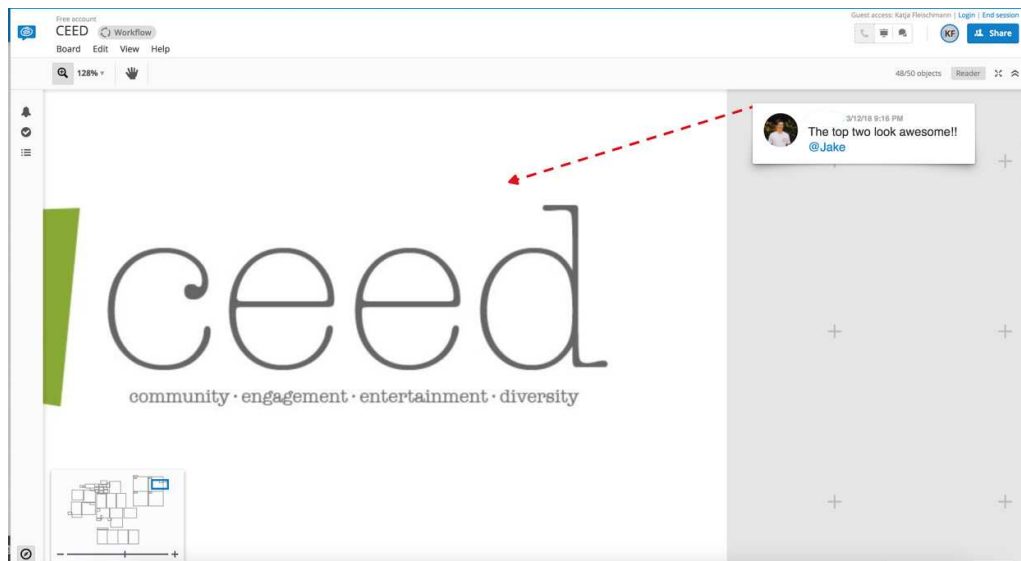


Figure 2. Visual online collaboration tool: team member commented on design idea (detail from board collection)

Sixteen students participated in the subject and formed five teams (four teams of three students and one team of four students). After the completion of the subject, students were invited to participate in an online survey which explored their experiences with the blended learning subject delivery and in particular their perception of the effectiveness of the visual online collaboration tool to augment the blended learning experience. Of the sixteen students who completed the class, twelve participated in the online survey. The survey inquired about the perceived effectiveness of lectures and other learning material being offered online as part of the blended learning component of the subject. Questions in the survey also explored students' perceived benefits and challenges they encounter when using the online tool.

To gain a deeper insight into students' experiences with the visual online tool as part of the team collaboration process, the student teams were invited to participate in a semi-structured in-depth interview. All teams consisting of 16 students participated in the interview. The dialogical nature of the interview allowed a deeper exploration of the work processes applied in each team and how the tool was utilized. Student teams were also asked to imagine having undertaken the same project without the use of the visual online collaboration tool and how the creative process and organization of the project development would have differed.

The interviews provided additional rich data that could be cross-referenced with the survey responses which were based on a small sample size. The interview duration was between 20 and 50 minutes. The interviews were recorded by the researcher and transcribed by a professional service. The qualitative data collected through the survey and in interviews were coded and sorted by emerging themes (e.g. benefits > flexibility).

Visual Online Collaboration Augmenting a Blended Learning Environment: Survey Findings

To contextualise experiences with the visual online collaboration tool, students were asked to state whether they had used the tool before or had experiences with a similar tool. None of the students had used the visual online collaboration tool before nor had they used similar software. Most students had experience in working with Google Docs and were familiar with cloud-based file sharing tools like Dropbox and OneDrive.

Of the eleven students that answered the question whether they "liked" working with the visual online collaboration tool, seven (64%) liked working with the tool while four (36%) did not.

Design students who liked using the visual online collaboration tool gave the following reasons for its usefulness:

- enhanced communication amongst team members,
- keeping track of work progress,
- completing and sharing work, and
- to flexibly work on the project at a time it suited the individual student.

Students commented on its usefulness, for example:

- "we could compile everything the group has done in one place and stops things getting lost in Facebook chats or emails",
- "it gave us a platform to work and communicate together without seeing each other in person. That saved a lot our time travelling to meet up in the group", and
- "it was super usedul during the ideation and concept stages where we were trying to find out what our service would specifically be".

Students who found the tool less useful focused their comments on what they perceived were the usability of the software:

- "functions were awkward to work with and it took some time to find ways to work around the issues", and

- “exporting the content was not a simple process ...and inserting videos took almost a week of problem solving”.

The use of the visual online collaboration tool was supported by other means of communication such as face-to-face meetings, Facebook messenger and email. When asked to estimate the time various communication methods were used during the project creation, of the ten students who responded to this question in the survey, six students reported similar usage distribution in that they used the visual online collaboration tool 30-20%, face-to-face meetings took up 30-20%, Facebook messenger 20-30% and email 10%.

Two students used the online collaboration tool only 10% of the time and had a higher face-to-face time (50%). Two other students were outliers in the opposite direction used the visual online collaboration tool 50-55% of the time and face-to-face meetings took up 20-30% of their time and Facebook messenger 10-20%. It was interesting to observe that all creative design teams used Facebook messenger to additionally manage the online collaboration.

The use of the visual online collaboration tool worked well with a blended learning approach to the subject. Eleven of the twelve students who completed the online survey “liked” that the subject was offered in a blended learning mode. When specifically asked about the use of online lecture videos, student comments highlight the flexibility of online lectures being “available 24/7”; students could “backtrack content”, review at “anytime from anywhere” and “review material multiple times”. Some students also highlighted a key challenge in that they have problems staying focused while watching the lecture videos because they are less engaging than face-to-face content delivery. When asked “How did you like that you could access the lectures online?” half of the cohort reported, “I think it was good”; half opted for “I am still undecided”. No student selected “I did not like it”.

Follow-Up Interviews Support Online Collaboration

The interviews corroborated findings from the survey and provided useful insights into benefits and challenges design teams experienced developing and managing their creative design project using the visual online collaboration tool. When interviewing the five design teams, it became clear that four teams were in favour of working with the visual online collaboration tool and one team felt that they would have achieved the same project results when managing the work process by using Adobe Illustrator (a graphics software used by all teams to visualise ideas) and Dropbox; the team did not see any advantage of the real-time interaction through the visual online collaboration tool. However, it was clear that within this team, opinions were divided about the tool’s advantages: two team members thought that face-to-face interactions align more with the work process of creative people: “Like we are visual students so I think we’re much more like tangible people and we need to be able to write things down, do a quick sketch and straight away communicate”; a third student on this team thought that the idea of the visual online communication tool is good because she would not need to travel to meet the other team members.

The four teams made up of 13 students that saw major benefits in using the visual online collaboration tool. The benefits across the teams included:

- check on the project progress and contributions of each team member,
- work simultaneously on the boards and have content updated in real time
- easy to collaborate,
- receive immediate feedback, and
- enhance collaboration and communication.

The following comments from design students illustrate above benefits and provide insight into their learning experience:

“It was super helpful in the beginning, ... in getting everyone putting research up on it and being able to talk to everyone about ideas and stuff without actually having to be there in person because

it was like, ‘I just thought of something’. You quickly research it and tracked things down and uploaded the info and diagrams on it and you don’t have to wait for a meeting to exchange ideas, drive the project and get feedback and you don’t have to send e-mails or something, so that was nice.”

“The other good thing that I noticed is like [Susi] would put in her app design and I can just do an arrow and a sticker note and say, ‘Don’t like this’ or ‘I like this.’ It’s easier to point to what bit I’m talking about without having to be with her. In other projects when not having the [visual online communication tool] it would be different, she would say that she had sent me the app design on my phone and I’d message back and say, ‘Oh, about the red bit’ and she might write, ‘What red bit?’ and it could be very confusing...”

In general, the interviews revealed that the visual online collaboration tool experienced its greatest degree of support in the early phases of the design process; for example, when uploading and discussing research; developing visual ideas and critiquing them in an iterative process. It was less successful in supporting prototyping and presenting final ideas.

The major advantage for design students is the visual nature or visual working style of the tool and how it complements the creative thought process. Various teams commented favourably on the visual approach of the tool and how it mirrors the creative process:

“We can see what we’re up to and what needs to be done rather than having to send it out in a message like, ‘This is what I’ve done. This is what needs to be done.’ We can kind of see visually, okay this is where we’re at. I kind of liked that we could have the sticky notes and you could comment on things, so you could sort of trace your thoughts as you go along.”

“Simple, good visual, you can see what everyone is working on, it’s easy enough to leave notes....and it was easy to collaborate. We could get our ideas across in a simple manner.”

The interviews also provided a deeper understanding of the one team not “liking” and not being able to utilise the tool to its full potential. This particular team appeared to have mistaken the visual online collaboration tool solely as a creative design tool, as the following comment illustrates:

“It feels different to [Adobe] Illustrator, ...and it needs a lot of work to be something like a high-quality graphics program ...Basically it’s a whiteboard; that’s what it is.”

This confusion about the overall capabilities of the visual online collaboration tool—particularly regarding its collaboration and communication features—may have contributed to expressed disappointment about its perceived shortcomings by this team. In addition, this particular team felt that using the visual online collaboration tool created a steep learning curve “because none of us had used it before...and it is quite fidgety, and the learning curve was rough” while other students described it as, “It’s pretty simple like anyone could pick it up”.

The flexibility of self-paced learning in any location is one of the major drivers for students to enrol in blended or online classes. Design students are no different. This major trend has also been highlighted in the interviews by several design students, and supported findings in the survey as the following quote from an interview illustrates:

“I mostly like working from home. It’s just where I work best; my workflow is best there and it does help me feel as if I am in the same room with the other members because I can pretty much on the fly communicate; point things out with notes, so it did help me in that way.”

Other interviewees mentioned the saving of travel time and being more productive as a result of it.

Hype or Help? – Outlook and Conclusion

Although design has traditionally been a studio-based discipline which relies on extensive face-to-face teaching, rapidly advancing technology is changing the way design can be delivered. The goal of this study was to trial a cloud-based visual online collaboration tool, ConceptBoard, in a blended learning design subject for third year students. The 16 students who participated in the study all had previous experience communicating online via Facebook, cloud-based file sharing, an LMS or other social media platforms but none had worked with bespoke visually oriented online collaboration tools. The study goal was to augment the blended learning environment to broaden students learning opportunities through the use of a visual online collaboration tool that would support the iterative creative design process of students working outside the classroom in an online team situation. Design students who met for face-to-face workshops and teamwork, viewed lectures online with technology that provided flexibility. The course required the students to use the visual online collaboration tool to develop and communicate their service design project ideas with team members.

At the end of the subject, students were asked to complete an online survey about their experience with the visual online collaboration tool which was followed up with face-to-face interviews to add a qualitative depth to their survey responses. In interviews, students from four of the five teams were particularly engaged by the tool's visual approach to collaboration and the ability to immediately post and receive comments in real time. Four of the five teams used the software features intuitively after watching the company's how-to video tutorials. Members of one team, however, said they were confused about using the features of the visual online collaboration tool and what its overall purpose was.

Although a small number of students found the software's functionality difficult to master, the majority of the student responses in both the survey and the subsequent interviews were positive regarding using the tool. The tool's visual approach and ability to quickly post peer-to-peer comments in real time were highlighted as key advantages in both the survey and follow-up interviews. Students appreciated the project management organisation of the tool which made it possible to visually track the project evolution. The feedback from students also indicated that the visual online collaboration tool can instil confidence in collaborative teamwork, which is demanded by today's design profession.

Students liked the visual online collaboration tool's flexibility and accessibility, particularly the autonomy of working from home which for some students also saved on travel time. More importantly, students felt connected to the project and their fellow team members in a strictly online environment. It is clear from this study that the visual online collaboration tool was successful in augmenting the face-to-face component of the subject and that its use broadened learning opportunities for students.

The study also highlighted, as shown in previous research, that there is no uniform uptake of software tools and that varying learning curves have to be addressed by design educators. For the next iteration of this subject, the learning curve could be shortened by a face-to-face introduction to the software which should mitigate student misgivings about the tool's functionality and purpose.

The tool supported research conclusions (Fleischman, 2018) that highlighted the need for any design-based education technology to allow students to easily collaborate, communicate and get quick feedback from peers and instructors. The relatively smooth integration of the visual online collaboration tool in a design classroom where no students had used cloud-based design-specific collaboration software indicates that such tools can be valuable in design pedagogy. The research also indicates that this type of visual online collaboration tool would be ideal for students studying externally in a purely online delivery of the subject. More research on the use of cloud-based visual online collaboration tools needs to be conducted to validate its usefulness in an online delivery mode. There is no question, however, that introducing design student teams to collaborative online tools is a valuable preparation for contemporary design practices, which often rely on project management software to tie together remote creative teams in the iterative visualisation process. Whether the design subject is blended or online, mastering projects in a digital environment is an authentic experience and one that is widely used in contemporary professional design practice.

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