Design on the MUVE: Synergizing Online Design Education with Multi-User Virtual Environments (MUVE)

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ABSTRACT
The world is becoming increasingly virtual. Since the invention of the World Wide Web, information and human interaction has been transferring to the web at a rapid rate. Education is one of the many institutions that is taking advantage of accessing large numbers of people globally through computers. While this can be a simpler task for disciplines focusing on lecture-based learning, it has been a challenge for the field of design. Transferring its studio-based education structure, where students draw, build, collaborate, test and iterate their work, requires using technologies outside of the common ones in information-based disciplines. This literature review analyses the current tools used in online design education and an alternative technology, called multi-user virtual environments (MUVE). Addressing MUVE's technological features, limitations and use in education, this paper proposes that a synergy between MUVE and online design education would be mutually beneficial.

INTRODUCTION
Designing is the act or process of creating some end result or artifact (Boradkar, 2010). It is a field that requires both creative thinking and critical problem solving (Boradkar, 2010) in complex situations while considering clients, goals, collaborators, aesthetics, logistics, safety, resources and feasibility of the project (Boradkar, 2010; Schön, 1983**)**. Today, the complexity in professional design projects requires collaboration of a team of individuals with diverse cultures, experiences, ideas, skills, knowledge and ways of thinking to maximize creative output (Badke-Schaub, 2010).

Design education must prepare the students for these complex settings and the design proficiencies they need in a professional setting (Broadfoot, 2003). Adapting and finding solutions within these complicated situations cannot be taught solely by lecture and requires practice (Waks, 2001). To handle such practically complex situations, traditional design education is characterized by its holistic approach for teaching students through a design studio approach (Broadfoot, 2003; Logan 2007; Schön, 1983; Waks 2001).

Studio-based learning, often practiced face-to-face, causes a challenge for teaching design online. Based on the extensive literature on design education, design studio proficiencies, online design education, and MUVE research, this paper highlights the benefits of possible synergy between online design education and MUVE as an educational environment. By becoming aware of MUVE's strengths and limitations, design instructors can use MUVE in their teaching to effectively prepare online students in practicing the necessary design proficiencies they need. Additionally, design instructors can enhance online learning by providing unique use and custom designs of the technology. Based on this literature review, this paper proposes that the synergy between online design education and MUVE can lead to a beneficial relationship between online learning and design education.

DESIGN STUDIO PROFICIENCIES
In design studios, students work within groups or individually to resolve a given design task supervised by their instructors (Broadfoot, 2003; Logan 2007). During the dynamic problem solving process (Broadfoot, 2003), students 'learn by doing' and 'reflection in action'. Students learn about the process and at the same time reflect on the process as it is executed (Broadfoot, 2003; Logan 2007; Schön, 1983). By doing so, design students work together to advance their collaboration proficiencies (Broadfoot, 2003), context proficiencies (Kvan, 2001; Schön, 1983), and iteration proficiencies (Gould, 1985). These proficiencies are soft skills, personality traits and behaviours that are professionally favourable (Schulz, 2008), the abilities students must foster to successfully compete in the market (Broadfoot, 2003). Exposure to design complexities and obtaining design soft skills are essential within a professional setting and can only be learned by actively doing and reflecting, they cannot be taught by lectures alone (Broadfoot, 2003). Below are the three aforementioned design studio soft skill categories students develop throughout their design studio work.

Collaboration Proficiencies: The complexity in professional design work requires the collaboration of many different people (Badke-Schaub, 2010). Simply placing people in teams does not mean they will work together effectively (Kvan, 2001; Schön, 1983). Aside from personality differences, the cultural and professional diversity within a group can lead to conflicting opinions, views and goals about the project (Badke-Schaub, 2010). To optimize team experience and output, it is important for design students to practice, understand and experience the dynamics and conflicts that take place in a team (Kvan, 2001). Only by doing so can students learn to mitigate the harmful conflicts and maximize the benefits of working in a diverse group (Haats, 2011).

Context Proficiencies: Being a field about problem solving (Boradkar, 2010), designers must be aware of the context for which they are solving a problem (Gordon, 2011). This requires extensive knowledge, keen observation of the environment, and understanding of the people for whom their design will be useful (Greci, 2013). While designers can assess abundant information about users, the experience and understanding gained from interacting within the context generates a more effective output (Gordon, 2011; Kvan, 2001). To optimize understanding of the context, students must improve their observational, listening, empathetic and analytical skills (Greci, 2013). These are required for finding information about the context as well as identifying the most significant ones and applying such information to their design work (Kvan, 2001).

Iteration Proficiencies: Iteration is fundamental to good design (Gould, 1985; Mantei, 1988). Rarely do designers create the best result in their first try (Gould, 1985). Designers tend to reach the best solution possible and save costs when iteration is applied properly (Mantei, 1988). Through collaboration, context research and testing, a lot of information is gathered on what to do with one's design. However, not everyone knows what they want or how to articulate it, and not all feedback can be applied (Gould, 1985). Henry Ford says that if he "asked the people what they wanted, they would have said faster horses." This demonstrates the significance of a designer in identifying how to iterate their work throughout their collaborations, context understandings and prototype testing (Gould, 1985).

As the theme in design studios is to 'learn by doing' and 'reflection by action' (Broadfoot, 2003), the students must learn the iterative process by doing, reflecting and redoing (Gould, 1985). In design studios, with the guidance of their instructor, students learn through successes and mistakes to perform the iteration process correctly. Design students must realize the significance of designing for an audience, develop the proficiencies for empathizing and understanding their context, and practice iteration towards their learning in the design process (Kvan, 2001; Schön, 1983).

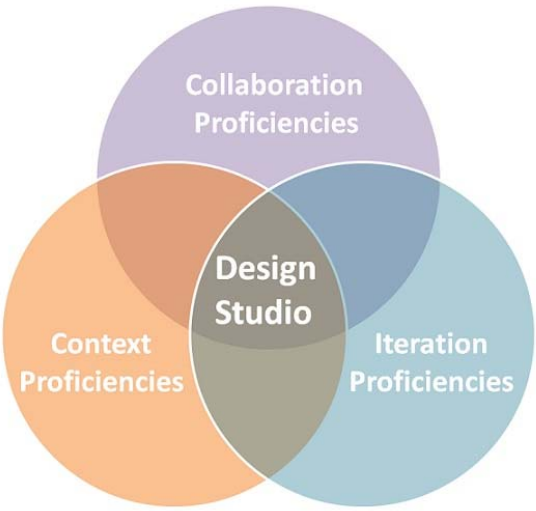

Figure 1. Illustration summarizing of the proficiencies students acquire in design studios.

As shown in Figure 1, while all these proficiencies vary, they all interact with one another and share a similarity in being practically acquired skills. However, since the audience for each design field is different (Buxton, 2010; Datta, 2007) the techniques and desirable outcomes from each type of design are also different. Design education must teach the students the requirements, techniques, expectations, and presentation skills in their design area (Buxton, 2010; Datta, 2007). As noted earlier, these design-specific skills cannot be taught merely by knowledge transfer and require an environment where the students can explore, repeat, and reflect to improve their work (Felder, 1988).

Practical proficiencies that cannot be taught via knowledge transfer require the student to explore, repeat, reflect and improve (Kvan, 2001; Schön, 1983). Doing so in the correct manner requires an educational environment in which they can practice these proficiencies, hone their skills with the guidance of an expert instructor, and be best prepared for the complex workforce.

SHIFT TO ONLINE DESIGN EDUCATION

The invention of World Wide Web in 1992 made online education easily accessible around the globe, flexible in learning pace, and integrative with novel multimedia (Harasim, 2000). Since then, disciplines have aspired to teach online but faced challenges in adapting to the unique technologies (Park, 2008).

Researchers have shown that active and engaging online education can promote creative thinking, problem solving (Broadfoot 2003; Waks 2001; Park, 2011), and enhance collaborative task-based productivity while overcoming the remote and financial restrictions of face-to-face learning for some students (Elliott, 2003; Liegel, 2004). Furthermore, learning in an online setting provides the students with the potential to work with experts and cultures anywhere in the world at any time (Brown, 2005; Vrasidas, 2003; Harasim, 2000) without exorbitant travel costs (Kvan, 2001). While journals may offer minimal understanding of other cultures, the real-time interaction with international students and teachers is substantially better (Kvan, 2001).

The cost effectiveness, convenience, and global accessibility are also very useful for design education. Given the benefits of collaborating with a diverse group (Badke-Schaub, 2010) online education can bring together people from all over the world for design students to practice working together (Harasim, 2000) without the high travel costs.

Given all these advantages, design is also shifting to online learning (Park, 2008). However, rather than utilizing the tools for new forms of communication, interaction and learning, many online educators commonly digitize their existing content, such as with educational videos (Barnes, 2007; Janet, 2009; Kirkup, 2005). This method is not effective for design education (Kvan, 2001). The studio-based nature of design education poses a unique challenge for its adaptation to online learning (Park, 2008). Regardless of all the benefits of online design learning, without satisfactory design studio features, design education cannot be conducted effectively in an online setting. As noted earlier, in an effective online design course, students' must practice their collaboration, context sensitivity, creative thinking, reflections, research, iterations, and problem solving soft skills within a studio-based setting (Broadfoot 2003; Waks 2001). Only by doing so can their online learning experience best prepare them for the complex nature of a professional design setting (Broadfoot, 2003; Park, 2008).

ONLINE DESIGN STUDIO TECHNOLOGY OPTIONS

To practice online design studios for learning the three design proficiencies, four technology categories are found in the literature. These four technology categories are computer-aided design (CAD) software, augmented reality devices, SMART boards, and MUVE platforms.

1. Computer - Aided Design (CAD) tools allow students to create 2-dimentional drawings or 3D models of their concepts while communicating only though voice, video, chat and screenshare features (Lau, 2013; Li, 2005). These programs, demonstrated in Figure 2, are easy to access, allow real-time collaboration and synchronous design iteration (Lau, 2013). CAD is a useful technology for design students to learn because most design corporations also use some type of CAD (Brown, 2005).

Figure 2. Example of a collaborative CAD program, Fusion 360, which allows teams to jointly work on a cloud-based model together in real-time (Hayes, 2013).

Initially, CAD appears to be a sufficient tool for its digitalized lecture content and traditional communication tools, such as Webcams, forums, social networking and text chatting. In practice, CAD lacks student engagement (Cormier, 2009) and non-verbal communication (Nam, 2009), such as gaze and gestures, greatly affecting tele-collaboration (Vertegaal, 1999; Buxton, 1992; Ishii, 1998).Student engagement refers to the time and effort the student spends on their academic study and activity (Kuh, 2003). The engagement of the students positively relates to the depth and amount of information they learn, their problem solving and analysis abilities, and quality of output from their activities. Smith et al. (2009) state that key aspects of design education entail the participant's engagement and active participation. For effective collaboration and studio practice in online design learning, student engagement is essential (Park, 2011; Janet, 2009).

In online learning technologies, enabling student engagement relies primarily on the tools that maximize student's telepresence, or sense of connecting to others via technologies as if they are not remotely separated (Moldenhauer, 2010; Nam, 2009; Savin-Baden, 2010). Increasing a student's sense of telepresence in an online course increases their engagement, participation (Slater, 1986), sense of belonging in a community (Lau, 2013; Moldenhauer, 2010), interaction, learning, (Moldenhauer, 2010; Rowell, 2009; Savin-Baden, 2010; Slater, 1986), contribution (Cormier, 2009), course performance (Hara, 2003; Rovai, 2005) and professional performance (Savin-Baden, 2010). Overall, maximizing engagement in online design education provides the students with the space to perform their best within the course and their professions.

As essential as telepresence and engagement is, much computer software, including instructional videos and CAD, used in online design education fails to maximize the student’s telepresence (Cormier, 2009; Lau, 2013; Savin-Baden, 2010; Park, 2011).

2. Augmented reality devices are worn by users to give them a sense of existence to something that is not really in the physical world (Savin-Baden, 2010). For example, Nam and Sakong (2009) conducted and experiment using augmented reality devices to enhance collaborative object workspace at distance. By using virtual shadows and synch-turntables shown in Figure 3, design students were able to synchronously manipulate the object shown in Figure 3 (A) and be aware of their partner's actions and gestures. The results show an increased sense of working together in a shared space with their partner, comprehension of their partner's gestures and actions (Nam, 2009).

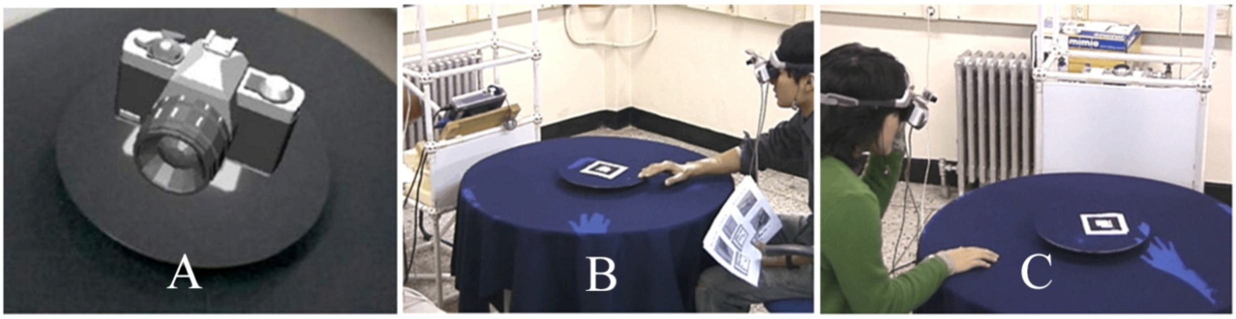

Figure 3. Images demonstrate (A) the virtual camera object the students can see with their augmented reality at the center of the turntable and (B) and (C) are simultaneous views from each participant showing the shadow of the other (Nam, 2009).

3. SMART boards are interactive whiteboards that can detect touch and gestures, that allow the space on top of the board to be shared with others who are also using SMART boards (Everitt, 2003). Researching on effective remote collaboration, Everitt et al. (2003) had six designers use SMART boards who were enthusiastic about the shared workspace and found the features to increase telepresence compared to whiteboard and videoconferencing. Figure 4 demonstrates the interactive feature of the SMART board where (A) and (B) images are from two different SMART boards used by geographically separated teams. (A) shows the digital views of the post-it notes from the (B) board. (A) moves the electronic version of the "Cats" post-it note which appears simultaneously on board (B). Additionally, (C) demonstrates the shadow outline of the remote collaborator from the other board to increase tele-presence.

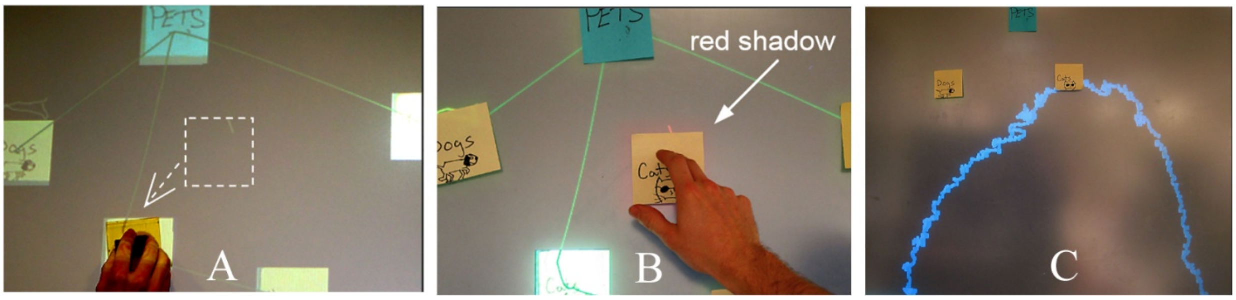

Figure 4. SMART board collaborative synchronous features (Everitt, 2003).

Both augmented reality devices and SMART boards tools are engaging and intuitive to apply in a design studio setting allowing students to visually express their designs and collaborate (Everitt, 2003; Nam, 2009; Savin-Baden, 2010). The primary challenge with using these in online design education is their high cost (Everitt, 2003). They are not affordable or accessible for the broad student population (Lau, 2013) and especially for the student population that prefers online learning because of its lower fees (Kvan, 2001). Since most higher education students interested in online learning own computers (Lau, 2013), online educators have turned to using online computer software for teaching design proficiencies (Kvan, 2001).

The tools mentioned in this section all lack an important part of conducting an online studio in design education (Janet, 2009; Park, 2008). The augmented reality and SMART technologies demonstrate that for design to take full advantage of the cost-effectiveness and global collaboration of online education, online tools used must be accessible to a broad range of students (Brown, 2005; Janet, 2009; Park, 2011). While CAD satisfies these requirements, it does not encourage student engagement (Cormier, 2009). Therefore, new online teaching methods must be adopted if design education seeks to use the benefits of online learning without the cost of sacrificing the necessary experience of design studios to the students (Kvan, 2001; Broadfoot 2003; Waks 2001; Park, 2008; Park, 2011; Harasim, 2000). As an alternative solution for online design learning to explore, this paper proposes the use of fourth option: multi-user virtual environments (MUVE).

4. **Multi-User Virtual Environment (MUVE)** platforms are computer software that enable multiple users, represented by avatars, to navigate and collaborate in a 3D virtual world in real-time (Bessière, 2009; Warburton, 2009; White, 2010). Popular examples of MUVE software in education are Second Life, Immersive Terf, AvayaLive Engage and River City (Bessière, 2009). MUVE comes with a large variety of features within a single software application that collectively provide key features needed for online design education: easy accessibility, design visualization tools, communication tools, and student engagement.

The features of MUVE and the key requirements they meet are listed below:

1. Running on a cloud server and not requiring any additional tools (Greci, 2013), MUVE has broad accessibility for anyone with Internet access to join around the world at a low expense (Warburton, 2009).
2. Using a shared online virtual 3D space, MUVE enables multiple users to simultaneously participate and experience the same dynamic events at the same time. Improving the student's sense of presence and engagement within the environment, community and collaborative activity (Warburton, 2009).
3. 3D avatars that represent the user allow the participants to project their own identities into the virtual space (Meadows, 2008). This projection increases their sense of being within the environment and thus increasing the user's sense of presence and engagement in the space (Meadows, 2008; Slater 1986).
4. Audio communication, text chatting, webcam streaming, screen-sharing and avatar gestures allow for multisensory and versatile ways of communication between collaborators (Warburton, 2009).
5. The 3D world and avatars can be customized by the users, allowing both features to be presented as needed. This allows the students to not only make 3D models of objects as they do in CAD, but provides the ability to customize the appearance of the space and avatars to create a virtual context (Warburton, 2009). This custom created virtual context increases the sense of presence of students for a specific topic (Slater 1986).
6. Having real world similarities, such as topography, movement and physics, provides the illusion of being in a 'real' space and makes the interactions within the environment more intuitive for users while also improving their sense of presence (Warburton, 2009; Meadows, 2008).
7. Using websites collaboratively within the MUVE platform provides access to many online collaborative drawing features (Warburton, 2009).
8. Video recording functions can be used by designers to reflect on their actions and better learn from their experience by remembering and watching their progress from a 3rd perspective (Meadows, 2008).

Combining all the aforementioned features into one package with advanced visual representations, MUVE is a popular and effective tool for collaborative simulations for people to effectively transfer their knowledge, skills and behaviours into the real world. Other fields have used MUVE in psychological therapy for phobias and trauma (Fullerton, 2004), changing dietary behaviours (Johnston, 2012), patient interaction in medical care (Greci, 2013), professional collaboration and critical thinking skill and behavioural development (Tichon, 2006) and process comprehension in the workplace, such as in mining, aviation, nursing, and pediatrics (Tichon, 2006). The following three studies demonstrate the potential for using MUVE for students to practice the three design studio proficiency categories: collaboration, context and iteration proficiencies.

COLLABORATIVE PROFICIENCIES IN MUVE

Shrine Education Experience (SEE) was a project that involved students from all over the world in learning about archaeological findings within a custom designed MUVE, as shown in Figure 5 (Di Blas & Hazan, 2003; Di Blas & Paolini, 2003). This massive project had cooperative activities in which approximately 1400 students from Europe and Israel aged 12-19 worked together and played collaborative "cultural games" to learn about history, religion, anthropology and collaborate with one another (Di Blas & Hazan, 2003). The results of the studies showed a great majority of the students enjoyed learning and were motivated to participate, experienced how many different fields can converge to solve one issue, fascinated in interacting and collaborating with peers in distant countries with very different perspectives (Politis, 2008) and reflected on the significance of their learning relative to their own culture, everyday lives, and behaviours (Di Blas & Paolini, 2003). Throughout the study, students gained vital cross-cultural and interdisciplinary collaboration experiences (Di Blas & Paolini, 2003).

Figure 5. The Virtual rendition of the Israel Museum's Shrine in the background with the students from around the world controlling their avatars (Di Blas & Hazan, 2003).

CONTEXT PROFICIENCIES IN MUVE

To better understand and empathize local issues by engaging in Boston's Chinatown neighbourhood, Gordon and Schirra (2011) created a *Participatory Chinatown* environment in MUVE, shown in Figure 6, for urban planning students. The task for the students was to explore the virtual space, interact with the characters in the environment, discuss their observations with peers, and propose possible future designs for Chinatown. The study results show that the immersive, role-playing experience gave the students a strong sense of connection with the local community and a deeper understanding of their lifestyles and issues. Furthermore, the students who took the initiative to create discussion groups generated a deeper understanding of the context and provided more effective solutions for the town (Gordon, 2011).

Figure 6. (A) Participatory Chinatown modeled after Boston Chinatown where (B) a student playing as the avatar in the center.

DESIGN ITERATION IN MUVE

The OpenHabitat project was a 15 month study in which Art and Design university students engaged in collaborative design and experiential learning using MUVE (Warburton, 2009). Their activities took advantage of an unlimited 3D canvas to build physically or financially impossible things in the real world, for example building 3D realistic and surrealistic trees as shown in Figure 7.

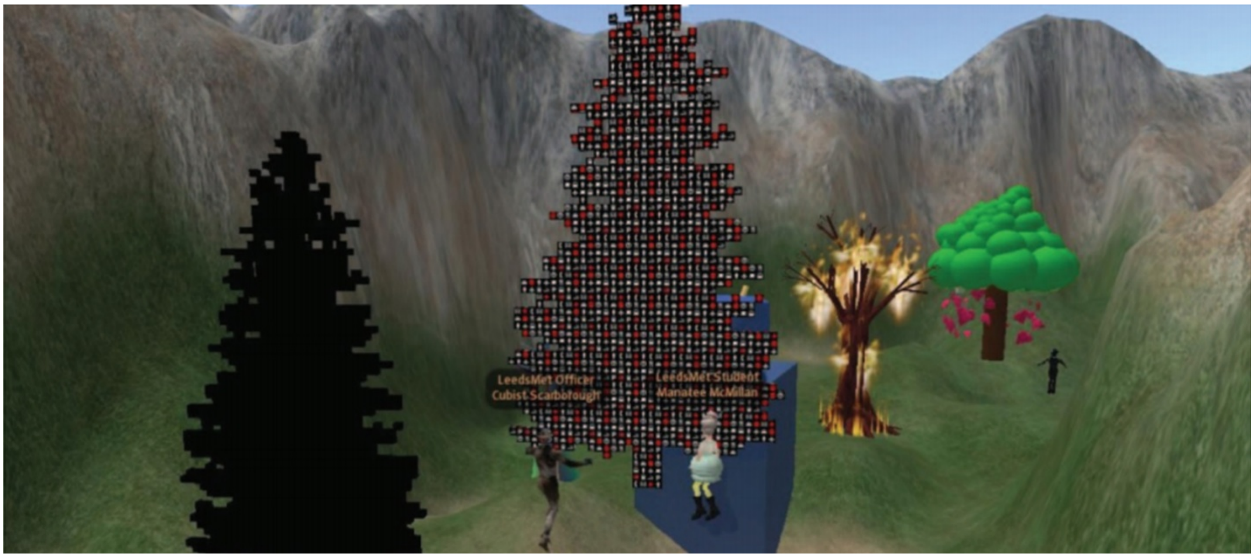

Figure 7. Four of the art and design trees during the pilot (Warburton, 2009).

After the initial orientations, students found the functions easy to use and were amazed at the boundless building capacity and the simplicity of the task, compared to real life. Having their models in a space where many can see them, made the students more attentive to their designs (White, 2010). The results of the study show that the students felt avatars represented the people well (Warburton, 2009), and had a strong sense of presence and belonging to a community (White, 2010). Their ability to work within a common space also encouraged working together through constructive dialogue, supporting one another's creative endeavour and the cross-pollination of design ideas. Although the study does not directly address design iterations, it addresses some of the key interactions for iteration: collaborative design, presenting work, observing other's designs, and giving and receiving constructive feedback (Gould, 1985). With the assistance of a design mentor, the students can learn to analyze these information and apply them to their work appropriately.

These three examples demonstrate the effective use of MUVE for developing design studio proficiencies. Fostering the strengths of these teaching methods in the design field could create an online design education environment for students to gain similar experiences, soft skills and preparation for the professional field.

MUVE LIMITATIONS

To best utilize a technology, knowing its limitations is just as important as its strengths (Park, 2008). Prior to the implementation of MUVE within any course, it is essential to initially be aware of its limitations. Doing so sets the parameters and expectations that users should have when they design their courses, activities, and simulations (White, 2010).

Most of the critics believe that even if online learning technologies improved significantly, it would still not be a learning system capable of substituting for face-to-face experiences (Ho, 2002; Park, 2008; Quinsee, 2004). For example, having limited gestures and facial expressions decreases effective non-verbal communication, empathy towards the avatars and engagement in the simulation (Arya, 2010; Volkova, 2011). Bucy (2003) notes that a bulk of research conducted on the efficacy of online courses only compare online learning to traditional course outcomes. This causes is a bias and neglects the inherent problems in face-to-face interactions that can disrupt effective collaboration (Vrasidas, 2003), which MUVE overcomes, such as balancing the status and power among the users (Greenhalgh, 1995; White, 2010) and removing judgment of people's true appearances (Vrasidas, 2003). Thus, it is important to understand the capability of the technology to avoid unrealistic expectations.

The second most common limitation is the learning curve for students using MUVE (Bessière, 2009; Warburton, 2009). While for some users the controls and functions in MUVE may come naturally, especially for those who play video games, it can be a challenge for others. Some students have mentioned that they found their initial experience overwhelming, with feelings of confusion and anxiety (Conrad, 2002, Rovai, 2005). As a consequence, students cannot concentrate on the task, lose quality communication, manage group conflicts, and perform effectively (Nowlan, 2011). It is essential for students to initially become familiar with using the technology and for educators to provide an initial tutorial phase within the course (Zembylas, 2008)

More pertinent to design is the lack of physical interaction with the objects (Bessière, 2009). Designers who will be creating the object in real life care substantially about the feel of the design and the ability to interact with the design. This is also an issue for instructors when judging and providing feedback to the students (Kvan, 2001). Another consequence is the misinterpretation of the virtual object compared to its real life form (Pickup, 2011). It has been proven that size of the avatar relative to the viewer's actual body can change the user's expectations about the objects in the environment.

A poor session in MUVE can make the participants feel their experience was less eventful and isolated than many other online social media, including forums and text chat. (Cormier 2009). Objects, simulations, content, teaching materials, and learning activities have to be customized when using the virtual world to merge the technology with the curriculum. Educators are encouraged to have a good understanding of the technology's capabilities and limitations before engaging in its use to avoid disappointment, miscommunication and student confusion between the expectations of the instructor and the student's resources within the technology (Vrasidas, 2003; Zembylas, 2008).

DISCUSSION

By utilizing these tools, learning from past successful MUVE projects and becoming aware of the technological limitations in MUVE, educators can enhance online design education to become more engaging for the students. There are many areas of study to conduct when researching the benefits of using MUVE for enhancing design studio proficiencies. For collaboration, effective teamwork over distance opens the possibilities for students to experience cross-cultural design with partners located anywhere in the world. For context, simulations and role-playing can be large contributing factor to design education. Students can practice their sensitivity to the context of their future designs by being tasked to explore the space, communicate and empathize with the clients, and pick-up important cues that they can apply to their designs. For iteration, students can learn to iterate their designs together by giving each other feedbacks. Taking advantage of becoming avatars, face-to-face criticism can be avoided for students to be more comfortable providing each other with constructive feedback. Thus, students could learn to criticize, ask questions, take criticism, analyze people's feedbacks, and modify their designs appropriately with the guidance of an expert.

Furthermore, being an inherently creative, user-centered and hands-on field, design has the potential to bring a wide range of novelty to the ways that MUVE can be used. Design instructors are already proficient in and used to teaching innovation, user-friendly and intuitive designs (Broadfoot, 2003), creating unique active and collaborative projects (Waks, 2001). Designers who are also skilled at 3D modeling are capable of making the virtual world more user friendly, intuitive, and unique. Teachers who are creative in their studio teaching and class activities can create more imaginative projects to engage and educate students. Online design education projects have the potential to provide novel ways of using the technology that many other fields can take example from. Non-design fields not accustomed to these unique and active learning methods inherent in design studios could learn new teaching techniques and activities they can apply to their teachings on MUVE. The potential integration the research conducted on MUVE technology into design education could additionally benefit non-design fields in using the virtual world in unique and interactive ways. Therefore, synergy between design and MUVE technology and researching on effective use of virtual worlds in online design studios could assist the learning of online students all around the world.

Implementing these features in a curriculum requires teachers who have the willingness to become well versed with this novel technology and be creative in their teaching methods. This can be a challenge for many, but those who put in the effort can provide the opportunity for students who have financial or lifestyle limitations to participate in an active, innovative, engaging, multi-cultural, and interdisciplinary design experience.

CONCUSION

The growth of online education is imminent. Even practical fields, like design, are becoming taught at distance. The majority of the current technology used in online design education is not sufficient to provide effective studio experiences for design education. The functions within MUVE make it accessible, user-friendly, engaging, and collaborative, while providing designers with visualization tools to present their work. Using MUVE within their curriculum, design instructors have the potential to provide their students with the opportunity to develop their collaborative, context and iterative proficiencies. These soft skills are essential for design students to survive in a competitive, diverse and complex professional design environment. In addition to benefiting design students, non-design disciplines may also benefit from the innovative MUVE activities that design instructors developed. The synergy between online education with MUVE technology and design can lead to a mutually beneficial relationship and advance the world of education.

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