PERCEPTIONS OF PHYSICAL VERSUS VIRTUAL DESIGN STUDIO EDUCATION.

Mahmoud Reza Saghafi, Jill Franz, and Philip Crowther

Abstract

While the studio environment has been promoted as an ideal educational setting for project-based disciplines associated with the art and design, few qualitative studies have been undertaken in a comprehensive way, with even fewer giving emphasis to the teachers and students and how they feel about changing their environment. This situation is problematic given the changes and challenges facing higher education, including those associated with new technologies such as online learning. In response, this paper describes a comparative study employing grounded theory to identify and describe teachers' and students' perceptions of the physical design studio (PDS) as well as the virtual design studio (VDS) of architectural students in an Australian university. The findings give significance to aspects of design education activities and their role in the development of integrated hybrid learning environments.

Keywords

Architectural teaching; Blended learning environment; Design studio; Online education.

Introduction

Architecture can be considered as an exemplary model for the application and integration of different modes of learning due to the features of the design studio. Most of the activities that characterise university learning such as critical thinking, research, and professional education are evident in the design studio (Hashimshony and Haina, 2006) making it of relevance to higher education in general (Bose, 2007; Boyer and Mitgang, 1996; Hashimshony and Haina, 2006; Schon, 1987). At the moment however, this learning environment is not compatible with changes in society, higher education, and professional practice (Crowther, 2010). Reviewing the literature shows that the design studio faces similar challenges to higher education as a whole. Therefore, if a model is able to respond to the problems in design studio education, it will be applicable in many other fields of higher education.

This paper is a comparative study exploring the limitations and benefits of physical and virtual design studios. It employs grounded theory to identify and describe teachers' and students'

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perceptions of their learning environments. It is expected that this study could explain the basic factors of studio learning environments to respond to the needs of comparing, analysing, and planning of new settings.

Background

Learning environments in general have been faced with challenges about how to contemporise themselves and respond to the needs of 'digital natives' (Prensky, 2001). Bennett et al. (2008) describe 'digital natives' as active experimental students who have the ability of multi-tasking and who rely on digital tools for gaining information and for communicating with each other. This new generation of learners has changed dramatically. They are no longer compatible with our physical educational system, nor with our educators who are unfamiliar with their students' language (Prensky, 2001). Information technology is now seen as a way of providing students with more flexibility and enabling universities to position themselves more competitively.

Today, learning settings are decreasingly formal timetabled classroom-based and increasingly collaborative and socially peer to peer oriented (Fisher, 2004: 1). Participants share their knowledge and experiences and develop them through discussion and collaboration (Garrison and Vaughan, 2008: 17). Problem based learning, being closely aligned to constructivist theory, is very suitable for; team working, process focused learning, flexible programs, practice based learning, and interdisciplinary courses.

Dutton (1987: 16) compares design studio to a typical classroom and concludes that studios are active places where students are engaged socially and intellectually in various activities such

as drawing, communicating, and model making. Both Ecole Des Beaux-Arts and Bauhaus, as the leaders in architectural pedagogies for hundreds years, focused on the formal and technological aspects of architectural education and had little concern for cultural or social issues (Salama and Wilkinson, 2007: 4). Kurt (2009) concludes that reconsidering the physical design studio in constructivist terms will improve socialization and motivation. For this reason, design education should focus on the process of design rather than the end-product of design with the web-based design studio playing a major role in that education.

Graham (2006: 17-18) claims that face-to-face learning environments benefit from the strength of developing social presence, while at the same time suffer from limited time, lack of in depth discussion, and the participation of all members. Comparably, time and place flexibility, opportunity for participation of all learners, and deeper reflection, are dominant strengths of web-based learning. Wireless access to information at all times results in opening the classroom's walls and making long-life learning possible (Wagner, 2006: 42-44). Web-based learning has shifted the learning environment to a more social, flexible and personal space (Shao, Daley, and Vaughan, 2007: 918-919).

Design education needs face-to-face activities such as peer-learning and cannot be successful in a full online mode (Silva and Lima, 2008), as such, it is believed that VDS will not replace the face-to-face studio setting in the future (Salama and Wilkinson, 2007: 309-310). Virtual universities cannot exist without physical infrastructure, thereby requiring that future universities contain buildings and people enriched by virtual technology

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(Elger and Russell, 2003: 674). Bersin (2004) argues that blended learning is the combination of an ideal teaching program for specific learners, and different learning media such as activities, technologies, or events.

The design studio, by its very nature, offers opportunities to examine the role of virtual learning and how it can be integrated with physical modes and methods. According to Bender (2006: 120) more research about the impact of online environments in architecture education is necessary due to rapid changes in design process, architectural practice, and students' expectations and behaviour. The aim is to incorporate the best features of face-to-face on-campus with online teaching to foster active independent learning and reduce on-campus time (Garnham and Kaleta, 2002). Unfortunately much of this has happened without any research to inform it or explore its potential.

Kingsland and Chen (1996: 2) conclude that students' feelings and motivation towards education may be influenced by the learning approach. Research about learning experience should therefore be concerned with the learners' views and the associated emotional aspects. Emotions have a significant influence on many aspects of the learning experience such as interpretations, actions, motivations, values, goals, and learner-teacher relationship (Austerlitz and Aravot, 2007: 242).

Case Study design

Substantial parts of this paper are extracted from a PhD thesis where a case study was implemented by adopting Grounded Theory methodology in a comparative way. A pilot study was carried out as the first step of the case study. During the second semester of 2009, an online survey was distributed among architecture students and educators of the school to identify their perceptions of design studio as their learning environment. At this stage, volunteers from the online survey were interviewed. Then the data were gathered for analysis and to inform the plan of the main study. A qualitative study was undertaken in the first semester of 2010. In the main study, an architectural design studio was constructed within the third year of the architecture program and a student group was elected to experience both PDS and VDS environments. This paper used the results of the pilot study and the initial analysis of main study data including the surveys.

Participants and data collection

The required data in this study have been collected in two stages. Firstly, a pilot study was undertaken based on a questionnaire involving seven students and two tutors, and interviews with four of them. This then informed the major study involving eleven surveys and twenty two interviews in a case study. The pilot study was a good opportunity to revise the main study questions, tools, and approach, providing higher quality and rigor of outcome. In each stage, online surveys focused on comparing different aspects of learning environments, while semi-open interviews focused on delivering both educators' and students' experiences of the environments.

Twenty seven people participated in the case study, including three educators and twenty four students in two sub-groups. The online survey in the case study consisted of multi choices questions comparing some aspects of PDS and VDS at the end of the semester. Participants were asked to choose between PDS, VDS, or both, for

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each aspect. Participants explained their answers during their final interview through reviewing their survey and commenting on the selected answers. The main purpose of designing the survey was to compare different learning activities, design studio aspects, and participants' feelings in both PDS and VDS through three-choice answers.

Methodology

The collected data were analyzed using grounded theory methodology as outlined by Charmaz (2006). Data was separated, sorted, and synthesized through qualitative coding which occurs by attaching labels to parts of data (Charmaz, 2006: 3). Strauss and Corbin (1990) describe data analysis in a grounded theory approach as the process of separating, conceptualizing, and putting data back together in new way to evolve a different understanding of phenomena and allow a comparison between the elements of different learning environments of the case study.

The process of analysing data

The data for this study were managed and subjected to another level of analysis using NVIVO 8 software. NVIVO was used to facilitate the archiving, coding, and analysing of data as conveyed in Figure 1. The software enabled the formation of free and tree nodes similar to open and axial coding in grounded theory. Categories of nodes were then configured to produce concepts corresponding to selective codes in grounded theory. Following this process, different factors in both PDS and VDS were compared based on their benefits and limitations. They were analysed again to clarify advantages and disadvantages informing the development and evaluation for a subsequent study of a blended
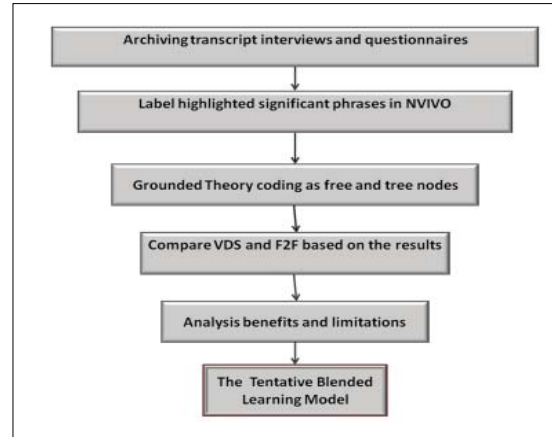
learning environment.

Figure 1:The process of archiving, coding, and analyzing data in six stages (Source: Authors).

Fundamental to this is a process of open, axial, and selective coding. This process involves developing various concepts and identifying links between concepts for capturing the characteristics of the central phenomena in the field of study (Strauss, 1987). Corbin states that the process of coding occurs within a consequential matrix work as a framework. This matrix enriches analysis by classifying the consequences in which setting are located and responded to (Corbin and Strauss, 2008).

Theoretical framework

Effective learning depends on various internal and external conditions (Kearsley and Moore, 1994) including the learning environment that can affect learning in different ways. Karakaya and Pekta (2007: 138) propose that without a

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systematic method, it is impossible to organise, manage, analyse, and synthesise a study in a complex and interdisciplinary field like education; so a framework is needed to facilitate this systematic process. During the coding process, data collected from the case study were structured as tree codes which formed the core of the Theoretical framework.

Figure 2 is the final version of the initial framework offered as a basic tool for use in making decisions about the evaluation, comparison, implementation and analysis of various learning environments for design education (Saghafi, Franz, and Crowther, 2010). In the final framework, pedagogy is allocated to the central position since decisions made in this field can greatly affect the related cells. The nine represented

elements are connected linearly in two directions to form a matrix. Each three elements forming a horizontal line, indicates the elements with close relationship. The first horizontal line shows the social and physical/virtual environments for the community of learning. The second one presents a diverse 'how' for technology, learning pedagogy, and assessment. The third line describes the story of design process from input/content to output/ outcome.

Findings

In this paper design studio education has been considered in physical terms as well as in virtual terms. Specifically it has sought to identify what needs to be considered when seeking to blend physical aspects with virtual aspects. Each section
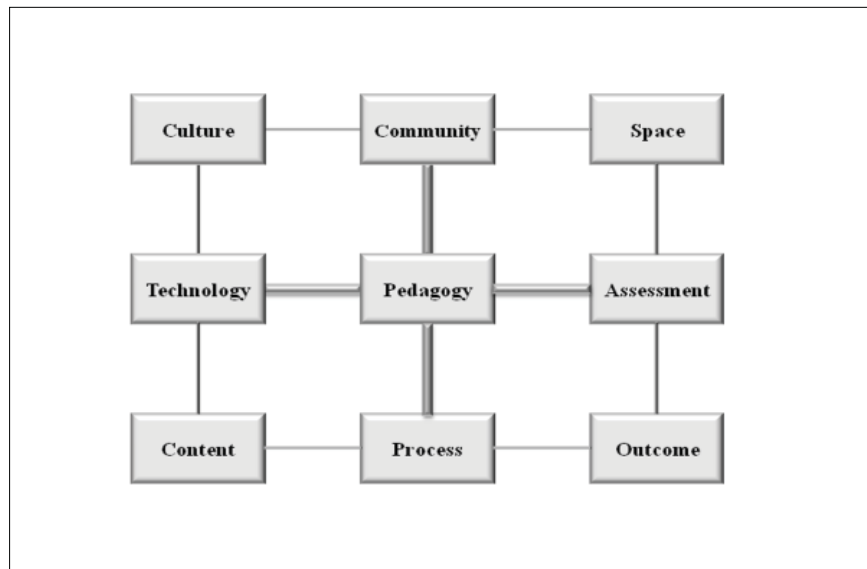

Figure 2: The final theoretical framework in design education (Source: Authors).

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describes the dominant features of each element introduced in the theoretical framework:

1. Culture
Culture can result in different social environments; here focus on collaboration, interaction, and communication. For the participants, greater emphasis is given to the physical design studio for cultural aspects like communication and interaction, but that extent depends on other factors such as the nature of the curriculum and the teaching approaches that in some cases can inhibit communication with tutors and classmates. Even if on campus, outside work is also seen to deter students from interacting and minimising the extent to which they socialise together. There was also significance in students' preference with some preferring to work alone and others in the company of their peers.

2. Community
Although all people in a school form a community other sub-communities exist based on needs and preferences. Students, teachers, and administrators for example have their own communities. Forming communities is facilitated by being able to hear and see others through audio and video. In this regard PDS enables more face-to-face integration with classmates and tutors than VDS and for many students provides a more comfortable, motivating environment. In addition, a VDS can lead to alienation, confusion, and loss of identity.

For the students in the study, their sense of belonging as a student and being a part of learning community were found to be influenced by their study commitments, work activities, and private life responsibilities. As stated by one student:

[...] there is never enough time with teachers. Peers work very hard outside of uni so there is also little contact on campus. If more time was dedicated to studio and less to the culture of outside work that'd be great.

While enhancing flexibility the virtual design studio may also lead to less face-to-face contact, a situation already exacerbated by work demands experienced by students attending studio classes on campus. For many students and tutors, PDS was understood to produce more motivation to participate in the learning activities due to the face-to-face communication and interaction. As a student described; "Being in the studio room with 20 students and a tutor is really helpful, enjoyable, and motivated". For others, such an environment can be distracting and physically uncomfortable if not designed well.

3. Spaces
Learning space refers to the setting where the learning activities occurred, including both physical and virtual environments. To some extent, the study found that preferences for being off or on campus depended on the quality of the relationships between the students as well as the quality of the physical learning environment. It also depends on levels of comfort and the physical design studio was not necessarily perceived as being better than the virtual design studio.

A setting could be too boring, uncomfortable, or too formal to be supportive of expression and creativity. In response to a question asking 'When you are designing, how conscious are you of the world (your environment, other people, etc) in which you are physically located?', one of the students wrote; "Very, if in a boring or uncomfortable environment I cannot work".

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According to an educator; an appropriate learning environment should offer a diverse range of spaces associating with diverse personalities and needs. She continues; saying that a range of lightness and darkness, private and public attitudes, and indoor to outdoor places are examples of this diversity. Flexibility is another advantage to deal with different arrangements and furniture to associate with different activities like temporary exhibitions.

Learning spaces have an important role in design studios since students build up relationship with their environment all the time. A box as a studio cannot inspire in comparison to the place that contains cultural identity, attractive physical attributes, and exhibited works which are publically displayed. Spatial aspects of design studios are also very important functionally and symbolically. Functionally, these spaces need to accommodate various modes of learning and needs of students to invite and support sustained use. Symbolically they need to read as places of exploration and creativity. These characteristics, whether existing in physical or virtual environments, can deal with different students' personalities to inform their ideas.

4. Technology
The technology of education can be divided into hardware and software, such as online platforms, which facilitate the delivery of knowledge. Technology can provide noticeable benefits like access to information from different places and time. If considering design studio without using digital tools, there are many benefits that will be left, including saving time for working with resources, saving costs for publishing information, and presenting resources with more multimedia facilities and higher quality.

This research reinforces the view that the effective communication in design studio depends on simultaneous interaction to be able to respond students' needs and expectations. This process is also achievable through audio and/or video communication platforms - such as Illuminate Live - in synchronous mode (see figure 3; right side).

5. Pedagogy
Pedagogy refers to the teaching style, learning approach, and curriculum; which together should be well designed to increase the effectiveness of learning environments. PDS seems to be more effective for improving skills and peer-learning while VDS is more appropriate for the activities that need to develop over time, such as research and discussion.

For one of the tutors: "I would prefer to tutor in the university environment, where you can draw and model things to explain issues to students, which you can't do easily in a virtual environment". For the students who were interviewed, tutors play an important role regarding motivation, confidence, and making the learning process more enjoyable. Students' reflections indicate that tutors' teaching styles impact greatly on students' perceptions by affecting level and quality of involvement and experience.

6. Assessment
Assessment in design education occurs in various steps, including critique during the design process (formative feedback) and jury review of final presentations - summative feedback. This paper focuses on final presentations as formal assessment, comparing two modes of face-to-face and virtual. In response to the question; "what do you think is the best way to assess design projects?" a lecturer stated;

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Figure 3: Left; physical design studio, QUT, 2010. Right; virtual design studio, QUT, 2010 (Source: Authors).

Exhibition style assessment in the Traditional Design Studio: where both students and staff are requested to evaluate the student work. Being able to see work in a full spread is more appropriate for comparative marking. You are able to step back or look closely at the work. There is also that real time tactility that you won't perceive online.

The need for the assessment has spatial as well as technological implications. Students need ample space for mounting and displaying hard copy works and ample room for groups to view the works. In contrary, web 2 provides reviewing the design process of students' works facilitates focusing on the process rather than on the final product without need to any physical space.

7. Content
This element relates to what is learnt and the knowledge and resources informing the learning. Responding to a question about comparing printed and online content, many participants prefer online materials as they are quick and easy to access. Online materials provide more facilities such as simultaneous access from anywhere, searchable texts, and detailed information. Generally, online materials provide more potential for students, but these "types of books cannot be found in online resources". This could be addressed through the provision of a "studio library". A student believes that 'weaknesses of resources and availability of materials' is the main limitation of design studio.

8. Process
The development of a project is achieved through several design stages and related activities which can be defined as the process. Whatever the definition of 'design process', a comparison of the activities in virtual and physical modes can lead to finding the appropriate environment for each of these stages. However, there are some activities, such as sketching, that are hard to achieve in VDS. As an educator argues, if students attend physically, in-person interaction between tutor and students is possible:

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Sit at the desk now and you do some work and then show me before the end of the class. Being virtually, I can't tell them; okay, do some stuff now and show me at the end of the class. In VDS, it does not work like that.

For some students the decision to come to campus or study from home was determined by how much each world encroaches on their personal life. Some students prefer to design in the campus studio because they feel home to be too cramped. Alternatively, a studio could be helpful for some to generate an idea and obtain feedback then further develop the proposal at home.

I would like to start off with an idea in a studio, get some feedback and then play around with the idea in my own home and once I am happy with it, I would like the opportunity to discuss it more in the studio - but most of the designing I would like to do at home.

Based on the description of design process by the participants; studio can provide an appropriate space which helps students to find possible ideas and focus on their imaginations for their design projects. Since design courses involve imagination, a place plays an important role in inspiring students. In contrast when provided with contact time in class, some students come for five minutes, talk, and then disappear. For many students, most of their design conceptualization and development happens outside the studio at home.

9.Outcome

Outcome refers to the learning aims which are assessed with knowledge gained through the process and the end-product of learning. Design studio outcomes are dependent on various design education parameters. According to the

response of an educator in the questionnaire about factors involved in learning outcome.

Many factors, like quality of learning outcome, depend on tutors' functions. In the first case, delivering tacit knowledge even in PDS, depend on tutors' functionalities. In the second one, it affect on feeling positively.

Therefore, improving design studio elements leads to stronger outcome, while dull settings produce weaker projects. "The essence of the setting in terms of the physical design studio often seeps through the students design work - which is strength if the setting is good or problematic if it is dull". Teaching approach can strengthen the connection between theory, process of design and outcomes; and incorporating other tools such as different media to explore the design process in other ways improving learning outcomes.

Discussion and Implications for a Blended Environment

The previous section conveys several factors which impact on design studio education. Based on participants' opinions, neither PDS nor VDS on their own can respond to all the needs and preferences of students and tutors. Each mode of delivery has special qualities and learners have different learning styles that respond to these in different ways. Therefore, a combination of several media appears to be appropriate (Moore, 2006). This would tend to suggest the need for a blended design studio (BDS) model that optimises the benefits of both modes. The development of such a model however has to be considered in the context of particular universities and the infrastructure, policy and procedures that characterise that university. In this study increasing student numbers has placed considerable

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demand on studio space limiting availability and access for students.

Comparing PDS and VDS learning aspects and perceptions

A comparative study has been made between different aspects of PDS and VDS through different surveys and interviews which present various student learning styles and preferences. The results indicate that there are some aspects in face-to-

face and web-based DS which most participants have similar perceptions of.

Table 1 represents these aspects/feelings and the related contrasting aspects/feelings to show which environment are more effective. The rating system shows a three level rating of 'totally', 'very', and 'equally' for each environment. It was shown that face-to-face (PDS) and web-based (VDS) are totally effective for the aspects of 'scheduled' and

Aspect/Feeling	Totally	Very	Equally	Very	Totally	Con.-aspect/Feeling
Scheduled	f2f				VDS	Self-managed
Inflexible on place	f2f				VDS	Flexible on place
Group approach		f2f		VDS		Individual approach
Peer learning		f2f		VDS		Independent learning
Creativity			Both			Lack of creativity
Delivering implicit knowledge	f2f				VDS	Delivering explicit knowledge
Product focused		f2f		VDS		Process focused
Instant feedback	f2f				VDS	Insightful feedback
Human-interaction	f2f				VDS	Computer mediated
Motivation		f2f		VDS		Lack of motivation
Anxiety		f2f		VDS		Security
Confidence		f2f		VDS		Diffidence
Stress			Both			Relaxation
Enjoyment		f2f		VDS		Lack of enjoyment
Sense of community	f2f				VDS	Aloneness
Clarity		f2f		VDS		Confusion

Table 1: Comparing web-based and face-to-face DS based on participants' perceptions (Source: Authors).

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'self-managed', ' inflexible' and 'flexible on place', 'knowledge delivery' (implicit or explicit), 'instant' and 'insightful feedback', and 'human-centred' and 'computer mediated' interaction. There is no major difference for facilitating 'creativity' between those environments, according to most of the participants' perceptions. For other aspects, face-to-face mode acts as very effective, while web-based learning is appropriate for the contrasting side of the aspects including 'individual approach', 'independent learning', and 'process focused'. Likewise, participants' feelings have been represented about web-based and face-to-face design studios. The findings show that face-to-face mode is the effective environment for feeling a sense of 'motivation',' confidence', 'enjoyment', 'community', and 'clarity'. Similarly, web-based learning has contributed to a sense of 'security'. Also, there is no major difference between these environments for feeling stressed or relaxed.

The results of these investigations show that there is no environment that is preferred by most of the participants for all of the aspects. The wide range of responses to the surveys emphasise students' various learning styles and preferences regarding on/off-campus participation for different aspects.

Optimizing learning through BDS
Responding to the question 'what are the appropriate environments, time modes, and other features for design education activities?' data collected were analysed and classified with the reference to the literature.

Communication and interaction as the cultural aspects of learning environments, will improve in the blended models since these models create more opportunity for communication through different media and modes responding to different personalities. Furthermore, BDS can lead to an appropriate learning environment in terms of developing communication and interaction through providing permanent access to physical and/or virtual design studios.

Taking the whole course online would lead to a lack of involvement in a learning community. However, students' learning experience could be enhanced by blending online within face-to-face education. Therefore, learner's motivation and confidence improves during the development of skills and other abilities (Pieta, 2009: 7). Likewise, this hybrid model, increases positive feelings because of attending in both modes, while it decreases negative feelings due to do not being limited to one mode (or perhaps the ability to make choice about where to attend). Moreover, aloneness and lack of identity are two negative feelings created in an isolated environment like home, but not in a blended one.

Some researchers like Kumar (1997: 31) state that the informal side of university life is the main feature. Informal interaction however is not offered through virtual universities. Also, physical spaces create the university spirit and campus-culture that cannot be found in virtual universities. But, it is possible to find these features in some combination of physical and virtual environments (Hashimshony and Haina, 2006: 9). To have more effective interaction however, a combination of off-campus and on-campus communication is needed (Kvan, 2001: 348-350).

The provision of permanent access to studio spaces is recognized as one of the critical issues contributing to facilities planning difficulties. Ideally it would seem beneficial to create a studio

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space that has 24 hours access for the students and to encourage them to work there whenever they wanted to, thus extending their opportunity to work together and learn from each other. For design studio units, four hours per week seems insufficient especially when staff-student ratios are high. The web-based design studio can be considered as a part of this variety providing wider range for the students who are interest to communicate with different people about certain ideas or concepts through different time and space. So, a wide variety of spaces (and times) may accommodate a variety of personalities and approaches.

In terms of technology, what emerged was the need for platforms to be appropriate for the information they are delivering or the interaction they are supporting. Student satisfaction depends on providing easy navigation as well as experienced tutors who know how to use the technology. Levine and Wake (2000: 6) encourage the students to bring the virtual into the physical in order to improve design ideas and exploit its unique characters. Digital platforms can assist to deliver explicit knowledge whilst tutoring needs to be face-to-face in an ongoing constructive mode.

Pedagogically, whereas PDS is considered more convenient for communication and interaction, VDS is better suited to independent learning and improvement. In a BDS both aspects can be brought together. The tutor's teaching style and role will move from focusing on interaction in PDS to emphasising on student-centred approach in VDS alternately. Sessions which focus on improving skills and production should be achieved in PDS, while VDS should be considered for processes such as developing knowledge and research.

VDS can provide both internal and international collaboration beyond an appropriate curriculum emphasis on team-working. Internal collaboration can be enhanced through group work in the studios with the possibility of the virtual networking encouraging more effective collaboration for those feeling uncomfortable in the physical design studio. Zupancic (2007: 653) concludes that VDS derive from virtual culture, which forms new socio-spatial identity in virtual environment. Therefore, accreditation of different VDS depends on their cultural contexts.

Since both PDS and VDS assessment modes are considered as appropriate for final presentation, BDS can combine digital displaying in the physical exhibition style to capitalise on both advantages. In this case, students' works can pin up on the panels in an appropriate size, while they are presented digitally on a screen to provide for clarity and ease of communication during the presentation.

Internet-based instruction materials generally including visual information rather than audio and text, so implicit knowledge can be conveyed more effectively because of the integration of multiple senses by the variety of formats such as video and computer animation (Bender and Vredevoogd, 2006: 119). This potential can increase students' motivation and creativity. Course description and syllabi can be distributed over the Internet through online resources minimizing excessive copying or the need to place reading materials in the library. BDS can allow for design books in PDS and online resources in VDS.

In the same way, creating, developing, and reflecting during the design process can be better matched with BDS by choosing the proper

mode for the appropriate activates. BDS can divide to synchronous or asynchronous modes of communication, using face-to-face for real time interaction and web-based for reflection with time lag. In fact, real time interaction reinforces self-expression in design work, while lag time providing space for thinking about feedback. And then, considering that learning outcome is the consequence of all other factors, anything that enhances these factors will enhance the outcome; therefore BDS results in higher quality learning outputs.

Conclusion

The initiated activity-based model – the outcome of examining the appropriate features of different activities in design education – began with comparing different aspects of design education based on participants' perceptions. Table 2 presents a blended model based on different learning activities in design studio education. Overall, many of the participants prefer a specific aspect, mode, or environment for certain activities. The first column presents eleven activities, the second shows the appropriate environment, the third is the appropriate time mode, the fourth

Activities	Environment	Time mode	Pace	Type of interaction
Orientation	f2f	Synchronous	Scheduled	Tutor-to-student
Peer learning	f2f	Synchronous	Community-paced	Student-to-student
Lecture	Both	Synchronous	Scheduled	Tutor-to-student
Communication	Both	Synchronous	Scheduled	Student-to-student
Presentation	Both	Synchronous	Scheduled	Student-to-student
Collaboration	Both	Both	Community-paced	Student-to-student
Designing	Both	Both	Community-paced	Student-to-content
Feedback	Both	Both	Community-paced	Tutor-to-student
Assessment	Both	Both	Community-paced	Tutor-to-student
Study the theme	VDS	Asynchronous	Community-paced	Student-to-content
Discussion	VDS	Asynchronous	Community-paced	Student-to-student

Table 2: Comparing design studio activities and their features: the preliminary blended model (Source: Authors).

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refers to the pace of those activities, and the fifth is the main type of interaction for each activity. By reviewing each row, some aspects of each learning activities can be analyzed including appropriate environment, time mode, pace and type of the interaction.

As can be seen, VDS is the appropriate environment for studying the theme and for discussion, PDS for orientation and peer learning, and both environments for other activities. The analysis becomes more complex when considering the appropriate time mode for the same activities and their appropriate environments. For the eight activities which are achievable in both environments, five – orientation, peer learning, lecture, communication, and presentation – should be done in real time, while collaboration, designing, feedback, and assessment can be done in both time modes. However, studying the theme and discussion generally occur in asynchronous mode.

The pace of synchronous activities is scheduled and other learning activities, such as asynchronous community-based activities, benefit from being mainly community-paced. The last column shows the dominant type of interaction in the activities. It has been recognised that designing and study of the theme are mainly based on student-to-content interaction; orientation, lectures, feedback, and assessment are mainly based on tutor-to-students interaction; and other activities benefit from student-to-student as their main mode of interaction.

With this model, some sessions (including orientation in the first week) should occur in PDS to stimulate the development of a sense of community, while some other aspects should be considered for VDS, optimising both off-campus attendance and on-campus attendance. For instance, lecturing is a synchronous activity which can be achieved in both face-to-face and live online modes to provide access from anywhere. Contrary, discussion should be achieved in web-based mode (VDS), asynchronous, community-paced and student-to-student interaction to maximise the effectiveness of learning.

In addition to providing possible combinations of the features for defining a particular application, this initial model can be used for analysing the characteristics of each learning activity in design education. Authors' recent paper (2012) presents the final model of this study.

Acknowledgment

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Mahmoud Reza Saghafi

Mahmoud Reza Saghafi obtained a MArch degree (Architectural Engineering) from the Fine Arts Faculty, University of Tehran in 1997 and since then has been a full-time lecturer at the Art University of Isfahan. As an academic and practitioner his research and practice has been concerned with residential and educational design projects with a specific emphasis on environmental control. For this work he has received a research honour by his university. Currently he is on leave from his university while he undertakes a PhD on learning environment focusing on blended design studio. He is a registered architect and was a member of 'Architecture and Urban Development Committee' at 'Isfahan Science and Research Town'. He can be contacted at mrsaghafi@gmail.com

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Jill Franz

Dr Jill Franz is a Professor and Head of Discipline (Interior Design) in the School of Design, Creative Industries Faculty, Queensland University of Technology (QUT), Australia. She has approximately thirty years in design, design education, and design research, focusing on socially responsible design and the experiential relationship of people and environment. Specifically, she has had extensive involvement in various design practice and research projects to do with developing design interventions to support independent community living for people with disabilities and the development of participatory and consensus approaches to design and design education. Through this research, community-based projects, and a previous work integrated learning (WIL) director role, she has collaborated with a broad

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cross-section of stakeholders including public sector and private sector groups, local business people, academics, professional designers, consultants and end-users. She has also just completed several terms as Executive Editor of the international IDEA Journal. She can be contacted at j.franz@qut.edu.au

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Philip Crowther

Dr Philip Crowther is Head of Architecture at Queensland University of Technology, Australia, where he teaches design in the Masters program. Prior to coordinating the Masters studios, Philip has taught in all years of the course with particular expertise in first year experience and transition scaffolding. He has published many papers on design education and in 2009 won a National ALTC Citation for outstanding contribution to student learning. Philip holds qualifications in both architecture and film, and a postgraduate degree in education. His PhD investigates the theory of designing for disassembly in architectural construction. He is a registered architect and an examiner for the Board of Architects Queensland. Before becoming an academic, Philip was a practicing architect, working on commercial, institutional and domestic project. Philip's current creative research practices include architecture, design competitions, and the dialogue of drawing: explorations of visual communication. He can be contacted at p.crowther@ qut.edu.au