

VIRTUAL DESIGN STUDIO WITHIN A SOCIAL NETWORK

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SUMMARY: *Online interactions, multimedia, mobile computing and face-to-face learning create blended learning environments to which some Virtual Design Studios (VDS) have reacted. Social Networks (SN), as instruments for communication, have provided a potentially fruitful operative base for VDS. These technologies transfer communication, leadership, democratic interaction, teamwork, social engagement and responsibility away from the design tutors to the participants. The implementation of a Social Network VDS (SNVDS) moved the VDS beyond its conventional realm and enabled students to develop architectural design that is embedded into a community of learners and their expertise both online and offline. Problem-based learning (PBL) becomes an iterative and reflexive process facilitating deep learning. The paper discusses details of the SNVDS, its pedagogical implications to PBL, and presents how the SNVDS is successful in empowering architectural students to collaborate and communicate design proposals that integrate a variety of skills, deep learning, knowledge and construction with a rich learning experience.*

KEYWORDS: *VDS, social networking, social learning, problem-based learning, PBL, Web2.0*

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1. INTRODUCTION

Architectural designs within Virtual Environments (VE) have been widely used as a method of design simulation and presentation. Educational and professional settings employ VE successfully to study, communicate and present architectural design. The rapid development of digital tools during the past decades had profound impacts on the architectural education and the way architects create, converse or appreciate 3D spatial environments (Koutamanis, 1999). Numerous publications illustrate the impact digital media had on architectural design and propose solutions for multi-media design studios and how to make use of VE (Maver, 2002). Dave (1995) investigated distributed design studio. Wenz and Hirschberg (1997) studied collaborative design within remote collaboration, while Hirschberg et al. (1999) analysed pattern of communication within digital design studios. VE often became a presentation tool only to assess design alternatives and final design solutions (Achten et al, 1999). One particular form of design studio emerged in the early nineties that investigated various possibilities digital media and VE can offer to the learning and the exploring of architectural

design. These so called *Virtual Design Studios* (VDS) defined virtuality as acting while physically distant or as acting by employing digital tools (Maher et al., 2000).

VDS are problem-based learning environments that utilise blended learning format, integrating face-to-face contact (in person or via videoconference) with instructive online resources or virtual settings. The effective use of Web 2.0 technologies by learners allows reframing a problem-based learning (PBL) reflecting to this novel context. While existing PBL structures provide scaffolding for problem definition and access to resources and learning objective development, educators can now address additional issues: motivation for interaction, processes for socialisation, and moderation for exchanging information.

The paper is organized in two main parts as follows: we first provide an overview of VDS held over the past decades and present, based on a case study, its progress to one that is embedded into a Social Network (SN) environment. Herby we study in detail the present case study as learning methodology and we present our evaluations in various aspects, such as its engagement, nomadic ubiquity and social intelligence. We then discuss the model of a Social Network VDS (SNVDS) in the context of PBL. Using SN as lens, we present PBL as interaction model within the e-learning framework. Before summing up, we present concluding remarks of how social are SNVDS and that SN can act as enable of design studios.

1.1 The Evolution of the Virtual Design Studio

The VDS established itself as a well-functioning learning environment that allows students in various locations to engage synchronously and asynchronously in design learning. VDS have facilitated collaboration across multiple boundaries and helped re-define the social and cultural contexts of the design studio, whilst providing learning opportunities for students within the context of the internationalization of architecture. In the recent past new technologies, allow the VDS to evolve into new directions – some of which address shortcomings identified in past research. Recently, Web 2.0 technologies, digital native users and universities' investments in e-learning and content management systems have triggered a radical shift of how architectural design is taught by teachers and learning outcomes are produced by students (Ham, 2010).

The VDS established virtuality as acting while physically distant, as acting by employing digital tools, or employing virtual instruments or other virtual components (Maher et al, 2000). Virtual Environments (VE) were established by the choice of design (Achten, 2001), way of communication (Schmitt, 1997) or digital tools (Kurmman, 1995). Later the VDS developed into real immersion within a VE, the medium for design interaction being the immersive VE Design Studio (VeDS) (Schnabel, 2002).

With the advent of Web 2.0 technologies, the next logical step was to develop the VDS was collaboration within a social learning environment (Schnabel & Howe, 2009). Ease of communication, leadership opportunity, democratic interaction, teamwork, and the sense of community are some of the improved aspects that are offered by SN (Owen et al, 2006). Mitchell (1995) also refers to the need for an on-going evolution of the VDS towards a fully integrated studio where the borderlines between realms, professions, tools and mode of communications are dismantled. Subsequently the advancement of VDS moves design education beyond conventional boundaries and curricula, and engages participants socially from diverse professional fields. The Social Network VDS (SNVDS) is subsequently the successor of the VDS and is presented here.

1.2 The Evolution of the Virtual Design Studio at Deakin University

Deakin University has been recognised since its inception for its engagement in off-campus education. Throughout its five campuses in three different cities in metropolitan and regional Victoria, The use of distance education methodologies and materials for both on-campus and off-campus cohorts 'gathered momentum in the early to mid-1990's under the strategic umbrella of flexible teaching and learning' (Palmer and Holt, 1997). Since 2004, Deakin University has sought to further the 'technological imperative' (Holt and Thompson, 1995) through the initiative of Deakin Studies Online (DSO). DSO was introduced to the university in 2004 using *Web CT™* Learning Management System (LMS) software, which was upgraded to the *Blackboard Vista™* platform in 2007 and is currently transitioning to *Desire2Learn™*. This university-wide initiative represents a multi-million dollar investment in IT enhanced education for both on-campus and off-campus tertiary education across four distant campuses with approximately 40,000 students.

University operational policy states that all units throughout the university must have 'an online site' in DSO,

which includes a minimum of unit guide, discussion ‘chat’ forum, faculty notice board and student–staff communication expectations. Basic engagement can be extended to the level of ‘wholly online’ units; with university policy prescribing that all students in all courses must complete a wholly online course before graduation.

A wide array of online learning and teaching initiatives exist across the university. DSO forms the core LMS for these activities, however educators often work outside the University system in order to achieve educational research innovations. Deakin’s educators have engaged in Web 2.0 technologies across a wide variety of educational situations, including the use of Wiki’s (Augur, Raitman and Zhou, 2004), social software (Goold, Augur and Goodman, 2008) and *Second Life*[™] (Warren et al., 2008). Many educators working outside of the core system of DSO have been recognised for their contribution to learning and teaching through university-based and national awards.

The transition to Web 2.0 technologies started with the use of online blogs, which have been employed since 2006 in design studio and construction technology teaching. In 2009, the use of blogs in construction technology units was enhanced through the introduction of student-created videos uploaded to a university server. Further developments in video-based design and construction technology projects have steered towards the use of *YouTube*[™] as the primary submission mechanism and host for student work, linked to online galleries at www.ab.deakin.edu.au/online. Video-based work adds considerable value to the construction technology resources created by students by adding the ability to video interview builders and architects and record construction processes, wherein students become amateur researchers contributing to the body of online construction information (Burry, Prentice and Wood, 1997).

In 2009, the use of Web 2.0 technologies in the design studio was expanded for a third year design studio using an online social networking site *Ning*[™] (see <http://deakin2009.ning.com/>). This site enabled the development of a social network dedicated to the design studio, allowing a novel form of student to student, and student to staff interactions. This initial use of social networks in the design studio further evolved into the SNVDS through the placement of projects offshore, the use of video-conferencing and the engagement with offshore partners into teaching and research.

The experiences gained over the years generated the foundation for a VDS that merges the various realms, working instruments, and communication methods into a novel blended learning environment and the first SNVDS was held in 2010.

1.3 The SNVDS as Pedagogical Learning Environment in Architectural Education

Based on the methodology of a conventional VDS and following Aristotle’s concept of phronesis or practical wisdom (learning to judge when and where to put skill or knowledge into action) and drawing upon the arts to facilitate acquisition of knowledge (Dahlman, 2007), the SNVDS was set up akin to conventional architectural design studios to engage students in a PBL process.

The students’ learning and interactions were conducted in a blended (real and virtual) learning environment that were aided by a freely available Web 2.0 Social Network platforms, modelling-, communication-, and publishing tools. This mixed realm allowed participants to interact in multichannel, varied media forms, with rich text or media content, which enable their peers, experts, facilitators and invited guests to share social communication and generate knowledge (Owen et al., 2006). Our findings are similar to those of Harrison and Donn (2006), who explain how online SN allow the students to preserve and share their own thoughts and conversation about design, decisions and related issues to create a network of intelligence as the designs evolve.

In the following two sections, we will present in detail a case study of a SNVDS that was held at Deakin University and its evaluation in respect of social engagement, students’ nomadic ubiquity, as well as the social intelligence learners gained with that form of design studio.

2. THE SOCIAL NETWORKED DESIGN STUDIO

The architectural design studio presented here is a core third year design unit (SRD364 Architecture 3b) in the Bachelor of Design programme at Deakin University. The studio operates in on-campus mode with a 2011 enrolment of 178 students. The students comprise 140 students studying a Bachelor of Design, 36 students

enrolled in the double degree (Bachelor of Design/ Bachelor of Construction Management) and two students in other categories. The unit is the capstone in design unit for the undergraduate degree and is the unit through which students must demonstrate their prerequisite skills for entry into the Master's Degree programme. The unit outline described the aims and intent of the unit:

'This third year design unit theme is 'Sustainable Architecture in the International Context'. The focus on sustainability (environmental, social and economic) in the unit intends to address the immediate issues of climate change that "we" have allowed to develop to a crisis level. Sustainability, in this context includes economic, social and ecological factors. Architecture, as part of the building industry contributes greatly to resource depletion and ecological degradation. Architectural design has a major impact on the economic and social wellbeing of people.

The unit has been carefully designed to provide authentic challenges in architectural design that give you an opportunity to prove your abilities. This unit will require the integration of everything you have learnt in design, theory, technology and communications units.

Two projects have been devised to challenge your analytical processes, design skills and ability to think and act creatively. One is based in Geelong, and the major project is based in Hong Kong. Through these two projects, we hope that you will be able to gain understandings of the international context of architecture' (SRD364 unit outline 2011)

The SNVDS comprised of one design project, the 'Hong Kong Alternative Carparking Tower' (HKACT). The brief was based on a current international online competition issued by [AC-CA] (Architectural Competition - Concours d'Architecture) {<http://ac-ca.org>}. The competition was framed as a mini-thesis that would 'test students' abilities in design within a context that will operate outside way of their comfort zone' (project outline). The competition brief was as follows ([AC-CA], 2011):

The aim of this International competition is to design an iconic and Alternative Car Park Tower in Hong Kong Central. [...] The architecture of this new building should reflect contemporary design tendencies, standing out for its uniqueness as a car park design, while meshing in with the surrounding Hong Kong urban tissue.

Whereas conventional VDS involved teams of students at two or more institutions in different countries collaborating virtually through shared models and resources, this SNVDS involves no directed remote located or student-to-student interaction. Here, one cohort of students based in Australia undertake a design for a virtual project sited in Hong Kong, in a blended learning environment comprising traditional face-to face delivery by University-based studio staff assisted by Virtual Studio Colleagues located in Hong Kong, China as well as Melbourne. Virtual engagement is achieved through a series of interactions on *Skype*TM and *Facebook*TM (FB) as well as through the students' own social or professional (virtual) contacts via social media, online learning resources, site information, or other sources. The modes of communication employed in the SNVDS are outlined in Figure 1, below.

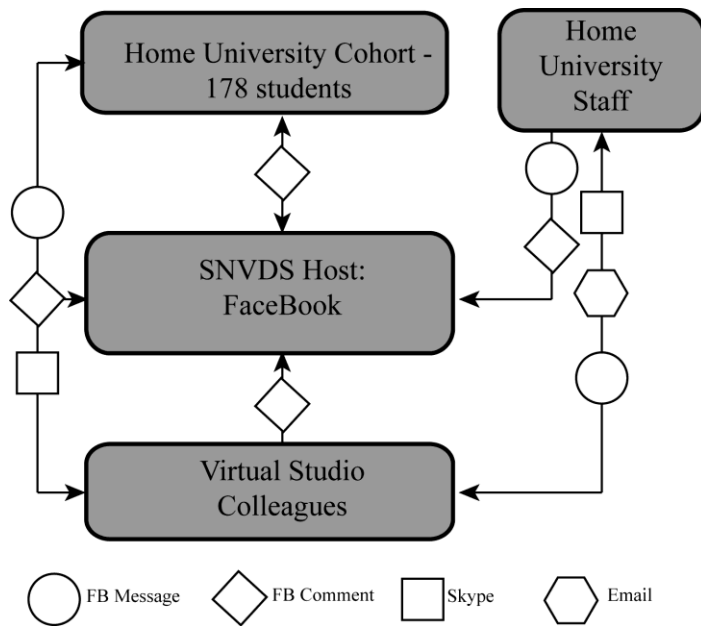


Figure 1: Modes of communication in the SNVDS.

Since Deakin University requires all units to be hosted on their centralised DSO, which operate on *FirstClass Technology™*, the intrinsic limitations of DSO disenable access to resources to external parties and fosters the reinforcement of ‘dis-integrated knowledge silos’ (Ham, 2010); which in turn leads to the minimal use of this technology in a design learning environment. The deficiencies of DSO led to the development of a FB group acting as the principal LMS of the SNVDS. Students were given full read and write access to specific functions of FB: ‘wall’, ‘discussions’ ‘photos’ and ‘videos’ and ‘read-only’ access to ‘events’ and ‘info’. The FB LMS was facilitated by the unit chair, who acted to initiate interaction and engagement through the posting of events and discussion entries relating to the unit and projects (Figure 1).

Skype was used for video and voice interaction between students and virtual studio colleagues through seminars with student groups in lecture theatres and the design studio. Lectures via Skype by Hong Kong- and China-based colleagues provided the dissemination of important information about Hong Kong’s climate, culture, its architecture, building regulations, etc. as well as important information relating to the site that was difficult to access from the Home University. Impromptu video conference sessions occurred within the design studio to allow students formative informal feedback from virtual studio colleagues on individual design works (Figure 2).

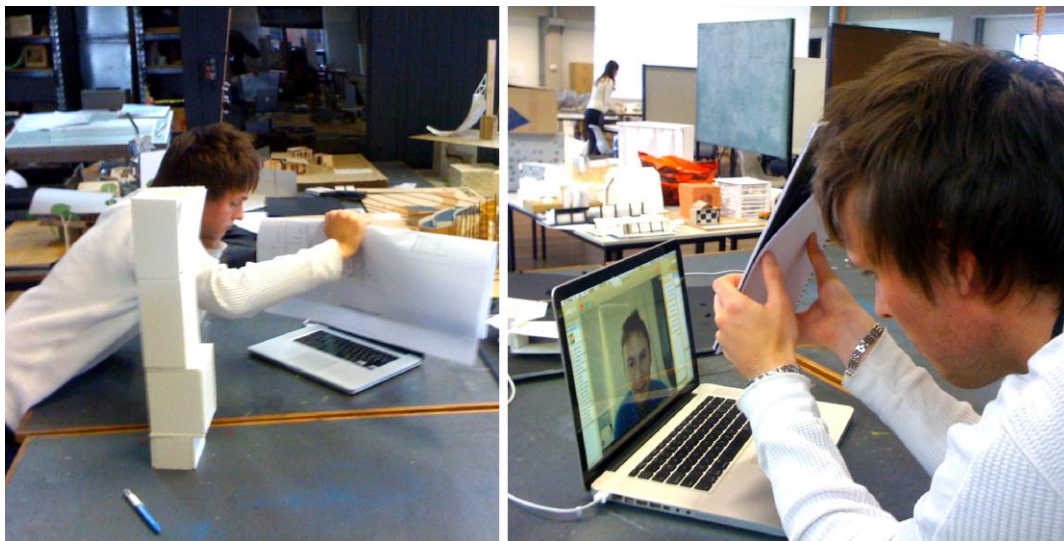


Figure 2: Skype-based virtual feedback session in the design studio

The final review for the SNVDS was conducted as a hybrid virtual-physical session. University-based design staff, students and invited guest critics were joined by virtual studio colleagues based in Hong Kong. The video-based communication medium enhanced by the 50-inch LED TV screen enabled a 'real' presence and augmented active participation in the review. This final session captured how a studio could be enriched and expanded with a blended learning environment that had at its core a social environment and multiple means of communication and engagement (Figure 3).

In the following section, we will present an evacuation of this design studio in the context of SN and the VDS as vehicle for the participants to engage in design and learning activities.



Figure 3: Virtual and physical presence in the final studio review

3. EVALUATING THE SNVDS

Apart from the normal summative unit evaluations, the SNVDS was also evaluated in order to study the impact the social networking and the virtual studio component have on the students learning. There are various ways to analyse a design studio. Since we engaged with the participants online using a SN, we saw it matching to use a similar environment to gather evaluation data of the SNVDS. Subsequently, in October 2011 we offered an online survey to the students enrolled in the SRD364 unit via a link from the course FB group. Matching the nature of SN, students could participate on a self-selecting basis through a posted link to a *SurveyMonkey*TM site. The survey aimed to provide both qualitative and quantitative responses to gather a broad body of complementary information to support the research 'in which the considerations that qualitative researchers raise, and the questions about worth and intent posed by philosophy, are as much a part of the discussion as are measurement and analysis' (Sherman and Webb 1990, p. 11). During the month of October 2011 (immediately after the completion of the SNVDS), sixty-seven students from the cohort of 178 completed the survey, a response rate of 38%. This evaluation of the presented case study acts as preliminary assessment of the social aspects that were facilitated through the specific form of this design studio. In our evaluation, we focus on how the SN and its related instruments influenced the communication, learning and interactions of the participants. Hence the result need to be validated further and the research expanded to test whether the here presented finding can be transferred to other scenarios and cases. In the following, we present our finding relating to: stages of engagement, online parameters of the SN environment, the students' nomadic ubiquity, aspects of social intelligence, and flat hierarchies of the SNVDS

3.1 Stages of Engagement in the SNVDS

The qualitative analysis of survey data and reflection upon the delivery of the unit has defined three phases of students' engagements with FB as LMS and online learning facilitator, each stage lasting around one third of the studio duration. We have named these stages *induction*, *socialisation*, and *maturity*.

3.1.1 Induction

The initial phase of *induction* involved the introduction of the SNVDS concept to the cohort, the lecturer demonstrating the group's potential and modes of engagement being outlined. This stage is where students are inducted into the technologies and philosophies behind the SNVDS. This introduction is met with some apprehensiveness from elements of the cohort, however is wholeheartedly embraced by others. Pros and cons of engagement in SNVDS technologies are weighed up, with students formulating a strategic approach to their current and future engagement. The initial uncertainty felt by some is contained in one student comment:

"I initially questioned the use of Facebook, it seemed to be playing up to a fad to try and make the students excited about design in a different way."

3.1.2 Socialisation

Once students learnt the potential value of the FB group and started receiving relevant and informative information the second stage of *socialisation* begins. Here, the students are socialised into the academic use of FB (outside of their online social environment) and start to gain some value from the social network. Previous assumptions are challenged, however full engagement is still limited. Using social networks in a learning environment that not only serves socialisation needs, but also a learning source needs time to build up trust, connections and content.

3.1.3 Maturity

The third stage of *maturity* is when the students become familiar with the modes of engagement and the value of the group and actively participate in a mature manner, contributing to the group according to their own requirements. One student describes this staged engagement in the FB group:

"I first thought it was a bit unusual to use Facebook as a study medium, however as people started to post up questions and work it was really useful as I would check Facebook more often than I would DSO and as a result was more easily exposed to answers and discussions."

3.2 Analysis of the SNVDS

Students were surveyed at the beginning of the trimester on their use of SN. From the survey group, 82% of respondents described themselves as regular FB users, accessing FB more than once per day prior to the start of the SRD364 unit. From this group, 45% of respondents accessed FB more than once per day. The fact nearly all students already had an active FB account provides evidence of the ubiquity of social networking for the student body (Figure 4).

Answer	Count	Percent	20%	40%	60%	80%
Never used Facebook and did not have an account	3	4.62%	<input type="checkbox"/>			
Minimal user of FaceBook (once per month)	3	4.62%	<input type="checkbox"/>			
Occasional user of FaceBook (once per week)	6	9.23%	<input type="checkbox"/>			
Regular user of FaceBook (once per day)	24	36.92%	<input type="checkbox"/>	<input type="checkbox"/>		
Very regular user of FaceBook (more than once per day)	29	44.62%	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Total	65	100%				
Mean : 4.123	Confidence Interval @ 95% : [3.863 - 4.383]		Standard Deviation : 1.068		Standard Error : 0.132	

Figure 4: Facebook usage prior to the SNVDS: "How often did you use Facebook prior to your participation in the SRD364 design unit (before July 2011)?"

3.2.1 Participation

Although everyone in the cohort joined the FB group and had access to wall posts, links and other information, levels of engagement varied over the trimester and according to individual learning styles, motivations and needs. Engagement in the FB group was noted to increase as the students passed through the stages of induction, socialisation and maturity. Survey data revealed that 88% of respondents logged into the FB site at least once a week. From this sample, 38% logged in passively to read posts made by others, with 12% accessed the group to actively read and write posts. 38% contributed further by initiating and responding to student discussions. Engagement in the FB group, as evidenced by the number and type of posts, increased as the trimester progressed.

A sample of participation in the FB group was taken in Week 9 of the SNVDS with modes of engagement from each participating student coded and tabulated. From the cohort of 178 students, 53 students actively participated in the group by initiating posts and links, commenting on posts and links made by others and 'liking' posts and links made by others. 129 students did not actively participate in the FB group, but may have participated passively, reading comments and posts made by others. Even this minimal level of engagement formed a valuable element of the learning experience. As one student stated, "*I did not post any information but found reading through other's posts to be of assistance.*"

3.2.2 Communication

The Hong Kong-based virtual studio tutor, who initiated three posts relevant to the project, provided valuable feedback to support the students' learning. As the director of learning activities, the studio coordinator was the most active in the group during the survey period. His contribution totalled 54, including 10 comments, 40 replies to student or own comments, 3 links to websites, one reply to a post and one 'like'. His contributions sometimes occurred from 8.30am until 11:00pm at night simply by checking the FB site and answering a question or making a post whilst doing other work or watching television. This factor- of availability of access to staff outside of traditional teaching times- limits the widespread use of FB at this institution. Many design studio staff see this 24-hour potential availability as a trap whereby access becomes a base expectation of engagement.

The cohort included a small group of highly active users. One student initiated nine posts (mostly asking questions clarifying the project), making 28 comments and another student making six comments (mostly of images of his work for feedback) and 28 comments. The most responded to post was a question from a female student related to a specific CAAD issue, which received 26 comments, mostly from male students. One post of an image of a student's work initiated a long discussion surrounding the various philosophies behind the design.

For one student, shyness was an issue that limited involvement in traditional studios:

'we can now communicate to each other better even (when) we don't know them...it's a better way to ask questions as people might feel panic when talking in front of many students'

For another, FB was seen as an alternative to studio attendance:

'I felt it meant less people turned up to studio as everyone just use Facebook. I prefer one-on-one interaction with others than over the internet.'

This oxymoron is typical for blended learning environments (Batson, 2011):

'We find that there was and is no revolution, just a gradual shift in emphasis toward certain kinds of existing learning experiences....Distance education is not, and never should be considered, a replacement of traditional on-the-ground learning.'

3.2.3 Online versus Face-2-Face

Either some students cannot or do not wish to attend campus on a regular basis, particularly lifelong learners, who often have already had the full campus experience. The challenge for educators is to identify not just the learners who will benefit most from an online environment, but in the campus context, what is best done face-to-face when much can be done online just as well and more conveniently for all active or passive participants.

The online social environment operates in parallel with the on-campus studio social environment. Here, differing

personalities, relationships between students, past group work experiences and the stresses of the architecture studio environment are not dissociated with the online SNVDS environment. As such, moderation is required online to monitor the behaviour of participants. In this case, one student was perceived to operate in the FB site outside of his 'role' as a student and into the role of a tutor. As one student commented: *"only 1 thing bothering, there is a student, acting like he's the 2nd moderator of SRD364 FB page."* The SNVDS environment is as much a function of the personalities involved as the technology. Online presence and interactions differ from face to face, because hierarchies, thresholds and etiquettes are not the same (Barkhuus and Tashiro, 2010).

Student perceptions of the FB group were largely positively; however, for some there was a change of perceptions between initiation at the start of trimester and towards the end. Students throughout their seven preceding trimesters had been used to using discussion threads on DSO as a means of communicating, but were now asked to use 'their own' social networking site for University work. For one student:

'Initially, I wasn't too excited as I was used to the DSO discussion thread however now I find it a very great way to communicate at a fast pace'.

For others, *'it seemed unnecessary and stupid when there is another perfectly good system in place'* or they *'don't agree to using social media for school projects, and (were) quite displeased about being forced to do this'.*

A variety of perceptions were provided in the survey, however the majority of comments provided a positive perception of the FB group. As one student summarized:

"Yes! This is a very effective way to gather all the researches (sic) and info together and share it amongst the students. Besides, it enhanced the interaction between lecturer-student where the lecturer can give feedback any time anywhere. This is a very good idea. I LOVE IT!="

3.2.4 Video Conferencing

The greatest value in developing students' understandings of architecture, communication and design skills was from the series of Skype lectures provided by three academics with past or current connections to Hong Kong. The majority (36%) of survey respondents indicated that Skype guest lectures were the most helpful element of social networking for the HKACT project. Skype's *Shared Desktop*-facility allows the delivery of *PowerPoint™* lectures into the lecture theatre from off-site, offering great potential for international into the design studio and other subjects. For students with no physical access to the site and little understanding of the culture, Skype provided the most positive aspect of the SNVDS. For students, the virtual presence of Skype-based lecturers was felt as a physical presence, *'Real time communication channels with specialist personnel are invaluable. Skype in particular proved very good at bringing Hong Kong to the studio'*. These findings are akin to Schnabel's (2002) VeDS where real-time chat communication was used by the participants to communicate not only design issues but also related information that allowed the remote end to grasp a larger understanding of context, culture and environment. The chat protocols showed that these contexts contributed to the design decisions and aided the collaboration between the designers (Schnabel 2002).

For one student,

'Learning process and useful information came mainly from Skype lectures. Guest lecturers were very informative and it is good to have a huge range of diversity of lectures apart from Deakin's lecturers'.

Given the ill-defined nature of the competition brief,

'The Skype lectures gave a different perspective on the brief: the brief ended up feeling too 'utopian' and ideal, whereas the Skype lecturers gave a more real-life view of the site and the city'.

Skype lectures were perceived to be complimentary to engagement in the FB group, with each mode offering different information relevant to the project:

'The Skype lectures were very helpful since I've never been to Hong Kong myself. They gave us great insight on day-to-day life in Hong Kong that was needed for understanding the area of the site. Same goes for the group. It was very helpful to have most people using the group to share relevant information to everyone'.

3.2.5 Learning Management System versus Social Network

Students' responses to the issue of DSO versus FB were variable, with recognition of the value of the FB site for communication and information sharing. There was also recognition of the changed involvement of the unit chair where student posts were responded to quickly beyond the limited face-to-face contact period.

For students, 'seeing posts and the encouragement of instant conversation' created an environment that was 'much more user friendly and easier to communicate freely on'. FB was perceived to be 'more accessible', presumably because of the ability to access FB through Smartphone technology.

Students also recognized the limitations of FB with no ability to share project CAD and other resource files. The noise of communication between students, a feature of the social network that is largely absent in DSO, was also annoying to some students: 'I find that DSO is very specific to a project, as opposed to FB where there were 1000s of post and most were questions and post that i found not to be usefull (sic)'. The ability to thread discussions in DSO 'makes them much easier to keep track of,' and for one student, 'was also another place I had to read the horrible spelling, grammar and punctuation of my fellow students, and even lecturers'. Some students preferred the formality of DSO- and the strict operation of University courses within the University online environment. This was described by one student as being best for 'social and casual unit engagement'.

In a sense, the SNVDS affected the incursion of University life within students' private realm- their own social network site. The FB site meant that 'to access information for more than one subject you have to go to different sites. Also, it is distracting. If I'm trying to do an assignment the last thing I want/need is to be checking FB'.

A hybrid of DSO and FB was proposed to bring together the positive aspects of both systems: 'Integration of Facebook and DSO will be most beneficial'. The change of LMS from Blackboard to Desire2Learn in 2012 will meet some of those changes as suggested by this student.

81% of student survey respondents felt that FB and Social Media had a positive impact on their learning design for the SRD364 unit, with 10.2% indicating that there was no impact on their learning. The majority (49%) felt that there was a 'small positive impact' on their learning (Figure 5). These responses should not reflect the totality of value of the SNVDS for students, as 'reflection-on-action' is an important element of the learning cycle, which occurs some time after the completion of design activities (Schön, 1983).

Answer	Count	Percent	20%	40%	60%	80%
My engagement in Facebook and social media negatively impacted my learning of design in SRD364 in 2011	1	1.59%				
My engagement in Facebook and social media had a small negative impact on my learning of design in SRD364 in 2011	5	7.94%				
My engagement in Facebook and social media had no impact on my learning of design in SRD364 in 2011	6	9.52%				
My engagement in Facebook and social media had a small positive impact on my learning of design in SRD364 in 2011	27	42.86%				
My engagement in Facebook and social media had a substantial positive impact on my learning of design in SRD364 in 2011	24	38.10%				
Total	63	100%				
Mean : 4.079	Confidence Interval @ 95% : [3.839 - 4.319]		Standard Deviation : 0.972		Standard Error : 0.122	

Figure 5: Impact of FB on students' learning: "Which statement best describes the impact of Facebook and social medial for your learning of design in SRD364 in July 2010?"

3.3 Nomadic Ubiquity

University students are often noted as early adopters of technology, 'since they are young and in the process of becoming well educated and since many universities were pioneers in the use of computing, often opening up access to all students' (Barkhuus and Tashiro, 2010). Architecture students in this cohort are approaching a state of 'nomadic ubiquity' (Attali, 2006), where optical fibre, Wi-Fi, 3G and 4G mobile technologies are used in conjunction with a range of nomadic devices such as mobile Smart phones, tablets and laptop computers. Online sources such as FB, MySpace™, Twitter™, Skype and the various Google Apps enable unprecedented

connectivity. This connectivity has unlocked many of the learning outcomes of the SNVDS. Clear parallels can be found how the first VDS unlocked the potential of digital media in design learning (Kvan and Kvan, 1999).

FB is ubiquitous amongst the cohort, and 81% of respondents accessing FB more than once per day. 48% of survey respondents used their laptop to engage in the FB-group, 24% their smartphone and 25% a desktop computer at home. A combination of these devices enables multiple modes of access from the home, in transit and in the design studio itself. This convenience of access and accessibility to the “Nomadic Device Generation”, we called it, was widely received by students as positive. This is reflected in several students’ comments:

“The ability to share work and gain immediate feedback was brilliant. It made the studio a 24/7 event, not just 4 hours on a Thursday afternoon.”

‘everyone always has their phone on them. So it’s a quick way to give and receive feedback to one and another and be reminded of upcoming events’.

The issue of access to tutors is critical in a design studio with 178 students, eight tutors and one coordinator and a weekly two hours lecture and three hours of studio contact times. The studio evaluations of earlier studios have consistently highlighted the lack of quality contact-times with tutors. The SNVDS offers an extension of the design studio outside of the limitations of scheduled classes, which is seen by some to fit in with students ‘work hours’ and nomadic lifestyles – as a student puts it – with its *“ability to wake me up in the night (if I wished it to) is a far better communication platform, able to be delivered straight to my pocket”*.

Clearly, there is great potential for further engagement in nomadic technologies in design education. With almost ubiquitous student access to online learning resources, LMS, various forms of mobile and cloud computing, technology has matured to facilitate a blended learning environment that intersects various physical and virtual realms as well as social and cultural elements. Current research is directed towards the integration of mobile tablet computing and the use of apps into the SNVDS, enabling a further potential for virtualisation of practitioners and academics into the design studio.

3.4 Facilitating Social Engagement

Barkhuus and Tashiro (2010) found that students’ use of FB facilitated a variety of student-to-student interactions, including ‘casual interaction online, leading to casual interaction offline’. In our case, this was extended to include both student-to-student and student-to-staff online and offline interactions. As a student remarks:

“I also ‘met’ other students through FB that led to discussion in design studio sessions that otherwise wouldn’t of (sic) happened without FB.”

The informality of the FB environment made it easier for some to seek information from the online community that would not otherwise have been sought:

“Firstly, we can know and communicate to each other better even when we don’t know them from the first time (sic). Then, it’s a better way to ask questions as people might feel panic when talking in front of many students.”

For some, this informal online learning environment was dominated by ‘chatter’, which distracted from the core learning tasks. One student thought the FB group was *“intrusive and unprofessional”* whilst another *“I don’t agree using social media for school projects, and I was quite displeased about being forced to do this.”* Despite these negative responses being marginal and limited to only a few respondents, it is important to note that a social network as LMS does not fit every learner’s need and style, since the LMS relies on the social abilities of students. Social skills and the ability to interact socially becomes per default a necessary skill that learners have to acquire or have as prerequisite. This is manifested in the responses of the survey, in which the students indicate that their perceptions of the FB group changed over time. Initial negative or neutral attitude, such as *“I thought that everyone would not treat it seriously and just fill it up with rubbish”* changed once socialisation, mature use, and richer learning content posted by group members brought about more meaningful levels of engagement:

“Initially I wasn't too excited as I was used to the DSO discussion thread however now I find it a very great way to communicate at a fast-pace which has been great with SRD [the FB-group]. Especially due to it being a design subject, sharing documents and photos has been much easier.”

One constant issue of studio education at Deakin University is poor attendance at lectures and studio sessions across a wide range of units. Attendance of face-to-face lectures in the SNVDS fell from 80% in the first week to around 30% in the last lecture. Reasons for non-attendance, as outlined by Shannon (2006) generally include perceptions of marginal outcomes from lectures in students' busy lives, personal reasons and university workloads. In this case, the need to just 'get the job done' in the last weeks meant that students may have strategically prioritised actively working on design tasks over attending lectures and some studio sessions. Several survey respondents thought that the FB group contributed to poor attendance, with one student stating that *'I felt it meant less people turned up to studio as everyone just use FB. I prefer one-on-one interaction with others than over the internet.'*

It is proposed that FB acted as a source of engagement in the studio to compensate for students, who perhaps would not have attended anyway. The FB group enables the design studio cohort, with its constituent blend of deep and surface learners- and students, who strategically transition from deep to surface, various modes of engagement that suit different learning styles (Saljo, 1979). As Oblinger and Oblinger (2005) note, the *Network Generation* uses a variety of channels to learn. Face to face is only one of many others that learners use to build up their knowledge.

The SNVDS was widely perceived to have expanded social engagement in the studio (which was limited to 3 hours face-to-face per week): *“It was good to be in contact with other students, when usually we would not talk that much. It is easier to open dialogue with other students via FB.”* This was perceived to be of considerable value for some.

This increased social engagement contributed to 80.1% of respondents reporting that the SNVDS contributed to their learning of design. From this group, 38.1% reported a substantial positive impact on their learning of design. Moderated unit results demonstrated these outcomes across the cohort, with 8% High Distinctions, 27% Distinctions, 37% Credits, 17% Pass and 9% Fail (of which 6% were attributable to late withdrawals).

3.5 From Collective to Social Intelligence

Collective intelligence in architectural design invites anyone to contribute to a design process through crowd sourcing even if the design processes are an individual process. This is especially true in the SNVDS that employed Web 2.0 technologies to encourage everyone to contribute to a competitive design. As Maher et al (2011) state, developing successful collective design starts by understanding how individual and collaborative design are supported with computing technology and then goes beyond collaborative design to structure and organize the design tasks so that students are motivated to participate and contribute by gaining more value for their own design proposal. The social network LMS enabled many passive students to become participants: engaging in discussion forums, creating their own social networks, taking part in polls and building communities and portals of knowledge. This provide opportunities for knowledge to be shared among social groups, extending beyond the conventional studio setting, allowing for opportunities for collective intelligence to rise, and enabled through the social networks, the next step along the social and collaborative interaction, in which knowledge is generated and collected lies the collective social intelligence (Paulini et al, 2011).

The key attribute of the SNVDS is the generation of a social intelligence that relates to both the current design project as well as knowledge in the relevant fields. The SNVDS differs from traditional model of delivery in that the students themselves became the primary contributor to skills, content, and knowledge required for the design project. The ill-defined nature of the competition brief and for that matter any architectural brief (Kvan and Gao, 2004) enabled a wide diversity of responses. The tutor-to-student engagement that dominated the early stages of the project evolved into student-to-student engagement that generated social intelligence of the project.

3.6 Flat Hierarchies

In 1993, Alison King predicted that educators must undertake the transition from being 'the sage on the stage to the guide on the side' (King, 1993). The SNVDS successfully negotiates this transition by flattening the hierarchical structure of the design studio. In the conventional model, educators, experts in 'tacit knowing in

action' (Schön, 1983), are referred to by students for their command of knowledge and expertise in design. In the SNVDS, the FB interface acted to flatten this hierarchical structure and facilitated learning. The competition brief aided in this process, by specifically seeking for an architectural alternative to the conventional typology of multi-story car parks. In this case, the only true experts were Hong Kong-based virtual studio tutors and Skype-based guest lecturers. University-based design studio staffs, although skilled in design, practice and teaching, learnt as much as the students throughout the SNVDS did.

Students themselves thus became important sources of information that was shared with their peers. Tutors became learners too as the trimester progressed and the social interaction on- and offline transitioned from teacher-led to student-led. The amount of shared information is a key attribute to the social intelligence, resulting in *"a positive increase (in learning) because lecturer used FB to share information 10x more than any has ever used DSO."* One student reported that the FB group *"felt more 'alive' and interactive"*, whilst another felt that *"it was definitely a better experience - seeing posts and the encouragement of instant conversation."*

This flat and democratic learning environment created *"much more discussion and thought pattern among students. There was a greater dialogue between peers and teachers overall."*

Students themselves established a number of their own separate FB-groups, following the inspiration of the SNVDS:

"Several students and myself created a group of our own for another unit... it's so much easier than emails etc."

Throughout the course of the studio, the flat hierarchy was maintained throughout all aspects of the studio including desk-critiques and final presentations. Tutors, local or remote, shared the discussions with the students as initiator and listeners and using the smartphones, FB and Skype as real-time discussion contributors. Subsequently, the SN acted as facilitator and bridge between different stakeholders neutralising boundaries and thresholds. Learning in this SNVDS occurred omni-directional (among 'peers'), rather than directional (top-down or vice versa).

4. PROBLEM-BASED LEARNING BASED ON A SOCIAL NETWORK

The previous two sections presented based on a case study some findings in relationship to SN. In this section, we discuss of how the SNVDS fits into the larger framework of PBL. By using SN as lens, we explore how an interaction model within the e-learning framework can reframe PBL. Since most approaches to PBL are sequential following the conventional method of Albanese & Mitchell's (1993) seven steps model, this linear format is limiting and imposes a structure that does not fit with an iterative and reflexive processes facilitating deep learning. Flexible interplay between the seven steps improves the social engagement of students of the 'Net-generation' (Oblinger & Oblinger, 2005), especially where social networking sites are used to replace or augment the PBL tutorial or studio sessions.

Technologies of Web 2.0, by embracing problem-based learning, have utilised blended learning formats, where face-to-face contact is supported by instructive resources such as *WebCT™*, *Blackboard™*, web-blogs or static websites. However, the effectiveness of these platforms for online learning has been limited by typical Web 1.0 approaches to learning (Oblinger & Oblinger, 2005). The Internet, when employed as a filing cabinet for resources or post-box for messages, is too unwieldy to generate the experience of flow that motivates deep learning (Craig, Graesser, Sullins, & Holson, 2004). Further impeding the effective use of Web 2.0 technologies has been design of learning experiences by teachers from the 'Baby-boomer' or 'Gen-X generations', who do not think or learn in the same way as their students (McNeely, 2005). It is thus important that PBL flexibly encompass the thinking and learning styles of both teachers and students. Existing PBL structures provide scaffolding for problem definition and access to resources and learning objective development, which are transferable to online platforms. Subsequently, for successful learning in the present online environments, educators must now constructively address additional issues: motivation for interaction (Craig et al., 2004), processes for socialisation (Dede, 2005) and moderation for exchanging information (Salmon, 2000).

In a non-linear modification of Salmon's (2000) model of e-learning, the learning experience is the context surrounding the process of knowledge construction, which is an interlinking of concepts and actions spanning two broad areas of endeavour: educational/technological scaffolding and social interactivity (Figure 6). Access

to resources and problem development inform the scaffolding while social interaction and information exchange are facilitated by the potential for interactivity of the learning tasks. All components of the process are interlinked. Since all members of the learning community (teachers, students and other relevant stakeholders) contribute to knowledge construction, they are not represented as disparate entities in this model. The traditional steps of PBL are subsumed in the educational scaffolding but are modified to suit the online technology.

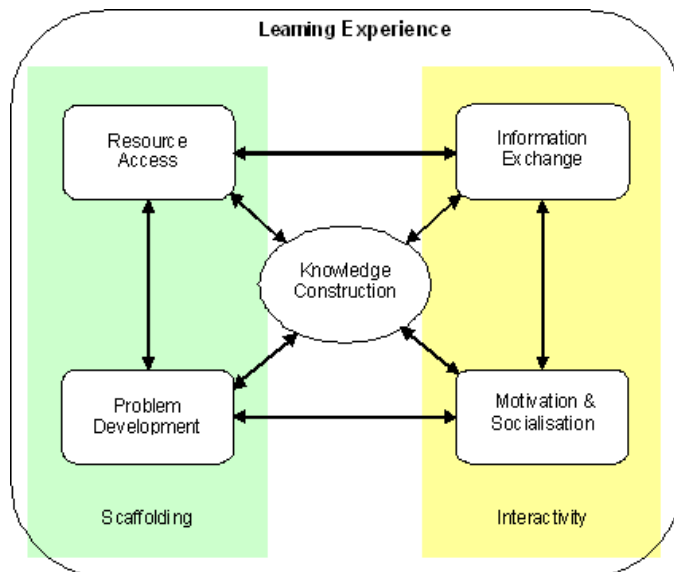


Figure 6: A social interaction model of e-learning by Howe & Schnabel (2011)

4.1 Scaffolding: Technology and Resource Access

Online learning strategies emerged in Architectural education in the last two decades (Kvan, 2001; Achten, 2001; Schmitt, 1997; Kurmann, 1995; Maher, Simoff & Cicognani, 2000; Schnabel, 2002; Ham & Dawson, 2004). SN impact on the quality of engagement and learning outcomes (Schnabel & Howe, 2009) through ease of communication, leadership opportunity, teamwork, and a sense of community (Owen, Grant, Sayers & Facer, 2006). Finally, the finding that design productivity may be better supported by remote settings than co-located ones was raised by Kvan & Gao (2006).

The FB group was made accessible to the students and tutors of the course but also to anyone who was interested in the topic of the studio. Students undertook research relating to their design task and target audience and posted this information as a shared resource for use and discussion by all participants. Significant opportunities were provided for student-staff interaction online, mostly outside studio hours, and contact using other media was also possible (mobile phone, video-chat, etc.). This is a particularly important issue in the context of diminishing resources within the school for seasonal staffing and a staff: student ratio of 1:27. Staff, experts and peers were commenting and posting additional resources to enlarge the students learning further.

4.2 Interactivity: Motivation and Socialisation

Motivation and socialisation were facilitated through site personalisation of the SN website, opportunity for development of flow and diverse learning activities. Respecting personal characters in the learning experience of the students, the SN facilitated flow (Csikszentmihalyi, 1996). Flow is an important component of creative knowledge environments and has been found to facilitate content acquisition, teamwork and positive affect towards subject mastery (Beylefeld & Struwig, 2007). This positive affective experience in turn increases team effort and spontaneous communication. Huang (2003) argued that motivation is enhanced or maintained by flow, achieved when the site is pleasurable as well as functional. The studio FB-site included a 'wall'-discussions, videos, chat, photos and RSS-feeds enhancing motivation because they enable hedonic experiences.

4.3 Information Exchange

While social interaction is necessary for information exchange, it may not be sufficient; the learning activities have to be varied, challenging and meaningful. Information exchange in the program occurred in multiple areas of interaction: with peers, resources, teachers, other stakeholders and the community. Not only does blended learning involve integration of different media for information exchange, it also involves amalgamation of the contributions of all members of the learning community, a process for developing collective intelligence (Levy, 1997). SN provides a mechanism for presenting collective information for individual use as well as aggregating individual insights into a collective decision (Surowiecki, 2005). The PBL experience was situated within the professional realm and the wider online communities, thus providing a transformative environment for blended learning.

4.4 Knowledge Construction

Darling-Hammond et al. (2008) found that deep learning is enhanced when students apply classroom-gathered knowledge to real-world problems: a process requiring sustained engagement and collaboration. Active learning practices have an impact on student performance greater than any other variable, including student background and prior achievement. The current PBL experience addressed three criteria for authentic learning and teaching developed by Newmann & Wehlage (1993): construction of meaning and production of knowledge, disciplined inquiry to construct meaning and production of discourse, products and performances that have value beyond school. To research the problem required higher order thinking combining knowledge from design, culture and construction to generate a successful overall outcome. Students had to research local conditions, collect environmental and cultural data and develop a design concept, which integrated all architectural elements.

In construction of a design, that fits the local requirements and contexts, social interaction intensified with peers, friends and other FB members. Because each member had to find out appropriate information via their SN environment, the students remained motivated and engaged with the PBL program; similar to findings of Schnabel (2002), a process analogous to a typical collaborative scenario in practice, where designers and specialists contribute to an overall scheme in sequential and parallel activities. The learning discussion involved social networking utilising both human resources and design technology, a convergence of social communication and technological environments. An important benefit of this convergence for facilitators is the opportunity to learn with and from the students. Students are often ahead of teachers in mastery of technology (McNeely, 2005). The loosening of the outdated hierarchical education system, reframing teachers as facilitators of social learning, provides the great opportunity for teachers to upgrade their own skills in the process of working with their students.

The SNVDS addresses issues of PBL in a novel context, allowing learners to acquire both skills and knowledge that are embedded into SN environment. It also differs from conventional PBL that the problem is framed in both a social as well as learning context and the constructed knowledge becomes independent of the PBL setting or participants, but relevant to the learners general environment.

5. CONCLUSION

The above presented case study of a SNVDS moved participants from sequestered autonomy into an enriching, deep and most of all authentic learning experience in design, learning, communication and social engagement. It involved students, guests and academic staff in learning about professionalism, communication, collaboration, and cultural awareness. Hereby the SN played a crucial role as facilitator and enabler without being imposing through its technologies or usability.

SN environments redefine and reframe PBL in a creative novel development because they are inter-disciplinary, inter-professional, inter-institutional and inter-national and conventional boundaries are more easily permeated. PBL is no longer a linear sequence of gaining skills and knowledge but embedded into an experience that traverses from social interactivity to a scaffold of social intelligence. Social multi-nodal networking sites (such as Ning, YouTube, Google Docs, Doodle, Facebook, Twitter, Google+, Wiki's, or other mash-up multi-dimensional platforms) were meaningful integrated in learning activities enabling communication of learning goals, disseminating learning resources, creating knowledge and original ideas, providing feedback and aligning with assessment of learning outcomes.

We recognise that a design studio within a SNVDS is potentially problematic (Gero, 1999), suggesting that developments may be needed to facilitate the acquisition of skills and the translation from virtual to physical models and vice versa. Similar to Gibson and Kvan's (2002) findings this suggests that other technologies such as rapid prototyping or automated construction methods may have a significant contribution to make to a design process that engages VDS. Synergies between the different realms, media, technologies, and people can be developed in a collaborative environment that fosters the evolution of new kinds of forms and structures. Further, the above case study despite its size is just one set of data, specific to the setting and participants of the SNVDS. Our evaluation is subsequently more a snapshot of how SN can reframe students' learning and how a VDS can be developed by focusing on SN aspects. Due to the novel nature of the here presented methodologies and technologies our framework might be validated in a longitudinal study

The SNVDS introduces a new way of designing and therefore fits well within existing paradigms (Mitchell, 1994). Wiener (1954) predicted that in future merging of location and culture would drive design, whereby he referred to physical and virtual architecture as an expression of cultural understanding. Both have their own properties, but both deal with the same matter. This can result in a new interpretation of architectural design and vice versa, influencing the definition of architectural design itself (Schnabel, 2009).

5.1 How social is the SNVDS?

The social collective intelligence that contributed to the students learning as well as the various blended interaction channels resulted in a successful design studio that addressed not only the needs of the different learning and design styles of the students, but also their desire to engage socially. The students received their training in architectural design as well as were able to develop a social capital from which they could draw during the course of the studio. At the end, students and tutors jointly selected six design proposals for submission to the competition resulting in one student winning an Honourable Mention {<http://www.ac-ca.org/en/hongkong02mentions>}.

Employing SN in a blended learning environment responds to the need of learners to not only acquiring knowledge or solving problems but also engaging in a social setting that generates exchanges and interacts with skills, information and knowledge. The Nomadic Device Generation engages with knowledge and information differently, as the anonymous quote states: "If the news is that important, it will find me." This is only possible if one connected with social networks that not only engage socially but also intelligently. This engagement is one of the fundamental pillars since the early VDS that "allow students to work collectively with colleagues from different cultures and climates who are thousands of kilometres and in different time zones." (Bradford et al, 1994). Subsequently the Design Studio was elevated by its social aspects and allowed learners to acquire knowledge that other ways they would not have received.

5.2 Social Networks as Enabler of Design Studios

These media-rich platforms certainly do not solve all problems that educators and learner have; the constant change of technologies interfaces, social trends and risk of failure are omnipresent and increase the flow-effect. It adds a certain weight and responsibility to the educator to facilitate the blended learning environments and recognise the different levels of expectation, expertise and experience of the learners. Also not every learning environment matches a SN, akin that face-to-face learning cannot be replaced by online learning. Yet these platforms allow learners to reframe their problems in such a way that these problems can be explored in both social-interaction and knowledge-gain, thus enriching the current praxis of PBL. The SNVDS proved to be effective at tapping into social as well as knowledge capital of participants, guests and FB-onlookers; therefore, the process facilitated students' self-directed learning in problem formulation and research. The SNVDS allowed participants to embrace professionally with their personal respective SN communities to achieve their own and their common higher levels of collective intelligence.

5.3 The Future of Virtual Design Studios

Despite the novel approach, the challenge is still the very same: to facilitate students' learning in such a way that knowledge is gained and deep learning facilitated. To match today's and specially tomorrow's communication essentials, we need to actively engage with activities that reflects the ever evolving needs of learners and their education, by juggling technical, social and human aspects. With the advancement of technologies and different

skill sets of learners, blended learning environments will merge more intensively with design- and communication-realms leading to augmented and mixed reality environments that will shape future VDS. In the final students' presentations, we used an Augmented Reality (AR) setting to blend between virtual and real content, participants and communications. We see a great potential to develop this further into an 'ARVDS'.

5.4 Summary

Firstly, we presented a case study of an architectural design studio based on the VDS methodology held at Deakin University using SN and other media-rich platforms. We studied the influence the social aspect plays in generating design proposals for an architectural competition and how the SN facilitated interaction, communication and learning. We studied the effectiveness of the generated social intelligence and explored the facilitation of students' self-directed learning. Hereby our paper discusses the construction of knowledge via social interaction and how blended learning environments foster motivation and information exchange. The experience gained in this case study has to be tested in other settings and environments before the findings can be conclusive.

Secondly, with the advent of SN, it became apparent that the social aspect of designing and learning plays a crucial role in students' education. Using SN as lens, we investigated how an interaction model within the e-learning framework can reframe PBL. The ease of communication, leadership opportunity, democratic interaction, teamwork, and the sense of community are some of the aspects that are now in the centre of students' design interaction. We presented how the SNVDS not only generated successful and meaningful architectural results but also fostered a PBL environment where students constructed knowledge outside conventional learning outcomes. We presented a non-linear model of e-learning, whereby the learning experience is the context surrounding the process of knowledge construction. The model interlinks concepts and actions by covering educational/technological scaffolding and social interactivity.

The potentials of the SNVDS are obvious and omni-present, yet in the architectural education, they are not explored fully to their own capacities. As Maver (1973) postulates: "Design follows its own paradigms". Therefore, it evolves and re-establishes itself by its own developing expression.

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