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INTEGRATION OF E-LEARNING 2.0 WITH WEB 2.0

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GUEST EDITOR(S): Xiangyu Wang and Robert Klinc

Xiangyu Wang, Professor
School of Built Environment, Curtin University, Australia
International Scholar, Department of Housing and Interior Design,
Kyung Hee University, Seoul, Korea
Xiangyu.wang@curtin.edu.au

Peter E.D. Love, John Curtin Distinguished Professor
School of Built Environment, Curtin University, Australia
plove@iinet.net.au

Robert Klinc,
University of Ljubljana, Slovenia
rklinc@itc.fgg.uni-lj.si

Mi Jeong Kim, Assistant Professor
Department of Housing and Interior Design, Kyung Hee University, Korea
meijen.mijeong@gmail.com

Peter Rex Davis, Professor
School of Built Environment, Curtin University, Australia
P.Davis@curtin.edu.au

SUMMARY: *A review of studies that have examined the integration of Web 2.0 tools into E-Learning 2.0 within built environment educational programs is undertaken. An analysis of studies undertaken reveals five core themes can be derived: (1) students using Web 2.0 demonstrate the capability for effective learning; (2) Skills learned via Web 2.0 can be transferred to the work and untrained tasks; (3) limited research has compared learning in conventional E-Learning and Web 2.0 environments; (4) E-Learning 2.0 enables social learning process to take place, and (5) the shift from eLearning 1.0 (Web 1.0 based) to E-Learning 2.0 (Web 2.0 based) requires not only a technological shift, but also a fundamental shift in the way knowledge is socially constructed and shared. Future issues and challenges are identified in order to ameliorate the integration of the E-Learning 2.0 experience with Web 2.0 tools.*

KEYWORDS: *E-Learning 2.0, Social Learning, Web 2.0, Education, Built Environment.*

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1. INTRODUCTION

"Do not confine your children to your own learning, for they were born in another time" (Chinese Proverb)

The advent of social media and digital technologies is changing the way in which students learn and interact as they provide a platform for social learning to take place (Bailey, 2005). Social networking and learning are being ameliorated by asynchronous or synchronous Web 2.0 technologies and applications such *YouTube*, *Google Docs*, *Doodle*, *Skype*, *Blogs*, *Wikis*, *Podcasts* (Angulo et al., 2010). Such technologies have provided the impetus for E-Learning 2.0, which assumes that knowledge (as meaning and understanding) is *socially constructed*. The use of Web 2.0 technologies enables learning to take place through conversations about content and grounded interaction about problems and actions (Brown and Alder, 2008; Ham and Schnabel, 2011). From an E-Learning 2.0 perspective, however, conventional e-learning systems rely on Web 1.0 technologies that function as learning management and filing systems that are used to facilitate instructional packets of information that are delivered to students using assignments. As result, students are constrained to passive viewing of controlled learning content. Fundamentally, Web 2.0 allows learners to interact and work collaboratively in a virtual community through social media.

Within Built Environment educational programs, particularly architecture, virtual reality (VR) technology that utilises Web 2.0 are the most popular applications that are used to enhance learning. For example, Ellis et al. (2006) demonstrated favourable reactions from students who were introduced to VR technologies such as Virtualsite. Here digital images, video, sound and interactive panoramic scenes are combined to create on-line virtual construction site tours for students. However, the use of VR as a role-playing tool for educational purposes has been limited. VR simulation environments can be readily broadcasted over the Internet and used to teach large numbers of student (Sampaio et al., 2010). The introduction of virtual worlds such as *Second Life* to design (Nederveen, 2007) and construction education (Ku and Gaikwat, 2009) has the potential to bridge the gap between learning about a subject and 'learning by doing' (Ku and Mahabaleshwarkar, 2011). With respect to educational tasks, the interaction enabled by three dimensional (3D) geometric models can change passive learner attitudes in academic teaching situations.

The theoretical foundations for E-Learning 2.0 are drawn from with *social constructivism;* it is assumed that students learn as they work to understand their experiences and create meaning. In this instance, teachers are knowers who craft a curriculum to support a self-directed, collaborative search for meanings (Siemens, 2005). Social constructivism forms an integral part of the Web 2.0-based social process, as students proactively interact with one another to acquire knowledge (Snowman and Biehler, 2000; Spady, 2001). In collaborative learning situations, students do not simply take knowledge or information, but create something new with the information (Reffat, 2005). Students have multiple perspectives, diverse backgrounds, learning styles, experiences and aspirations and as a result the collaborative learning environment enabled by E-Learning 2.0 provides a plethora of benefits (Cheng, 1998; Dunne, 2001; Kvan and Yunyan, 2005; Mizban and Roberts, 2006; Abdellatif and Calderon, 2007; Fioravanti, 2008; Angulo et al., 2010; Ham and Schnabel, 2011). In the case of architectural students, for example, these benefits include:

- promote different types of collaboration;
- develop team working skills;
- facilitate data sharing, flexible resources and information access anytime, anyplace;
- enhance students' communication skills and help them to exchange their design ideas, drawings, and information;
- facilitate students' work evaluation and feedback;
- enhance students' ability to translate their mental intentions, create new forms of arrangement in their design and increase their creativity;
- improve the richness and diversity of design ideas; and
- eliminate students' isolation by allowing the engagement in group working and help to get design feedback by sharing opinions.

Considering the extant benefits that can be extolled from E-Learning 2.0 and the use of Web 2.0 tools, this paper provides a comprehensive review of research undertaken within built environment education. Future issues and challenges are identified in order to ameliorate the integration of the E-Learning 2.0 experience with Web 2.0 tools.

2. E-LEARNING 2.0 CURRICULUM DEVELOPMENT

Finding effective ways to use emerging technology to enhance learning is always a challenge that educators, academics, policymakers and software developers must work together to solve. Curriculums need to be carefully designed and developed as current Web 2.0 technologies are not specifically developed for educational purposes and are not readily to be used. Gül et al. (2008) conducted a study to analyse various design learning and teaching features in 3D virtual environments (an example of Web 2.0) as constructivist learning platforms, and consider the critical skills and cognitive processes involved when designing and learning in 3D VEs. They found that designing and implementing successful learning environments using 3D virtual worlds require careful integration and adaptation of such factors as Learning Environment Design, Skill Development and Course Development and Moderation.

Matsumoto et al. (2006) developed an Internet-based collaborative design education program based on the "Plan-Do-See cycle" process model using the Design Pinup Board system. The results of implementation and evaluation which were measured with a combination of questionnaire and logged data analysis demonstrated that the process model for interactively learning design collaboration among distributed students was an effective learning mechanism. Rafi et al. (2008) explored the educational potentials of Virtual Reality for curriculum development and presented their experiences over a four year period. The VR curriculum consisted of VR systems, interactions and design theories. It was revealed that problem-based learning and experiential-based design provided a medium for students better understand and learn about the presence of motions, interactivities and stereoscopic visions in virtual environments.

Ku and Mahabaleshwarkar (2011) have propagated the concept of Building **I**nteractive Modeling (B**i**M) for construction education, which complements the capabilities of Building Information Modelling (BIM) with social interaction afforded in *Second Life* to enhance collaborative information and knowledge sharing. Role-playing scenarios were developed in *Second Life* to demonstrate the potential of BiM in construction education. Students within simulation scenarios were able to use an open object library of construction equipment and temporary works. One of the main pedagogical benefits is that students acquire a deeper and more meaningful understand of construction equipment and temporary works by building it themselves. Furthermore, students become contributors to an open learning environment, which not only benefits themselves and immediate peers, but the larger community of construction students. Although the benefits were predominant, one of the downside was the need of learning modelling and scripting skills from students.

3. ELEARNING 2.0 TECHNOLOGICAL ISSUES

There has been very limited research work that has focused on the development of supporting tools for learning about the design process through experience (Engeli and Hirschberg, 1999; Woodbury et al., 2001). For example, Brown et al. (2007) developed an interactive Virtual Campus of the University of Liverpool. It was recognized that it is more appropriate particularly ub the context of architectural learning environment to build virtual learning environments from scratch, considering that the pre-defined building blocks approach offered by environments such as Active World and Second life limit the potential to create environments that are more appealing.

VEs have the potential to provide new kinds of learning experience as they enable users to interact with 3D objects and navigate in a virtual space. Reffat (2005) introduced a new learning approach to architectural design studio within a 3D real-time VE wherein students were able to inhabit, design, construct and evaluate (IDCE) their designs virtually and collaboratively. Furthermore, the collaborative learning situation allowed students' to socially interact with one another. The study demonstrated that the ICDE model of collaborative learning has the potential to provide platform for active exchange of ideas, increase the interest among participants and promote critical thinking.

As an emerging technology, Augmented Reality (AR), an alternative to VR, has started to attract much attention in the entertainment-based education arena. Although Augmented Reality has been explored in various training and education contexts at "proof-of-concept" level, there was rare study to ground the proper use of AR into the pedagogical theory. As an attempt, Chen and Wang (2008) developed a framework for designing and implementing Augmented Reality technologies to improve the pedagogical effectiveness of learning processes in architectural design education. AR can be used to construct an interactive learning environment by merging computer-generated learning materials and stimuli of virtuality into a physical learning space. The framework includes the theoretical process of applying AR in design learning, for example, various cognitive and social-learning processes involved in different learning activities were addressed to design and implement tangible AR technologies for different educational needs. The direct benefit is that tangible AR-based learning can make architecture educators and researchers reconsider how students can learn better.

The student-teacher conversations in the design studios of architectural schools have been associated with the inability of students to grapple with the practical realities (Bailey, 2005). To provide an effective way of facilitating the transfer of "practical knowledge" Bailey (2005) developed a Digital Design Coach, an integrated digital sketching environment to beginning students of architecture, which can recognise sketches and infer an intention under investigation. This proposed system would seem to enhance the relationship of student and teacher by allowing the student to interact with computer augmented sketches, read the questions and issues embedded into the visual sketches, and pursue these issues in the conversations with their tutors.

4. INSTRUCTIONAL DESIGN ISSUES IN E-LEARNING 2.0

Pedagogical design and its supporting instructional design are critical to increase students' learning motivation. Horne and Thompson (2007) investigated the role of 3D modelling and VR on learning and teaching in a school of the built environment. The way it was investigated was to collect and analyse a number of academic experiences to explore the applicability and viability of those technologies into several subjects in built environment. Devised questionnaires were used as the instrument to understand the values and challenges of integrating visualisation technologies into built environment teaching. For example, one questionnaire was devised to investigate tutors' perceptions, opinions and concerns with respect to these technologies. The benefits found in the study are that they enabled tutors to support students' learning, increase student motivation and awareness, and enable the diversity of instructional methods. The study also found that the greatest problem at present is lack of available time for academic tutors and the support staff involved in the integration process.

As a similar study as above, Sampaio et al. (2010) applied 3D modelling and VR to the development of models related to the construction process. The introduction of 3D modelling and VR in school is found to be helpful to students to prepare them to consider these technologies as important supports. The study successfully demonstrated, through the examples, how VR can be used in the elaboration of teaching concepts in the area of construction processes.

Mehdi et al., (2005) developed a VR-based structural analysis program (VSAP) in education and practice at Virginia Tech. Different versions of this system were used as a teaching tool in architectural structures courses. A number of case studies along with results of the surveys and interviews were conducted. The main findings are that the system was used effectively as an experiential teaching and learning tool in classroom settings; students were highly interactive and engaged with a very positive response to the use of the system; and the 3D visualization provided by the system helped students gain an intuitive understanding of building structural behaviour during earthquakes.

5. ELEARNING 2.0 RESEARCH METHODS AND APPROACHES

Merrick et al. (2011) investigates the innovative use of emerging multiuser virtual world technologies for supporting human-human collaboration and human-computer co-creativity in design learning. Three conceptual technology spaces were defined for the purpose of describing the different aspects of virtual worlds: design tools for modelling new artefacts, support for communication, and the ability to incorporate artificial models of cognitive design processes. Four case studies were conducted and examined in the field of collaborative design learning using multiuser virtual worlds. Multiuser virtual worlds permit the synthesis of design computing technologies, collaborative design and artificial models of cognitive design processes. Analysis of these case studies revealed that multiuser virtual worlds supported human-computer interaction, human-human interaction, potentially on a very large scale. More interestingly, it was found that they can also be used to simulate and experiment with new designs and design related systems.

One of the great strengths of problem-based learning has been its integration of the social learning environment into the blended learning experience (Ham and Schnabel, 2011). It becomes important to integrate the various online participatory media such as Web 2.0 in student-centered learning. As an attempt to integrate Web 2.0 into well-established Virtual Design Studio (VDS), Ham and Schnabel (2011) adopted Web 2.0 technologies to enhance learning outcomes in a third-year architectural design studio between Deakin University and the Chinese University of Hong Kong trailed. The studio further developed the VDS by integrating a social learning environment into the blended learning experience. The Web 2.0 technologies used include the social networking site Ning.com, YouTube, Skype and various 3D modelling, video and image processing, and chat software. They were used to deliver lectures, communicate learning goals, disseminate learning resources, submitting, providing feedback and comments to various design works, and assessing of students' outcomes. Their study demonstrated that Web 2.0 technologies can support multi-channel learning through the various online participatory media. It was also found in the study that the social networking of the learners and their sharing of embedded knowledge not only contributes to their own deep learning but also ultimately returns their gained expertise to the social environment

Grasl et al. (2006) evaluated the use of Croquet as an immersive 3D environment to teach generative design at the Vienna University of Technology. They posed problems encountered in the software setup and analysed its strengths and weaknesses in supporting the didactical concept. It is concluded that problems encountered on the technical side were related to the usability and stability of the chosen platform as an early adopter of technological innovation. Different philosophy and incoherent design concerning user interface by developers caused the accessibility problem of the platform for a novice user. On the didactical concept Croquet is a constructive learning environment by enhancing the sensation of collaborative learning and Squeak, an implementation of Smalltalk, an object-oriented programming language was well suited for beginners. Problems in didactical concept were interconnected with Smalltalk/Squeak since it has not reached very broad distribution as a more universal tool. It is clear that programming is an essential element of the didactical concept, thus necessary to enhance the attraction of Squeak to be more incentive for students to learn it. Therefore, allowing for more time to get acquainted with the platform and encouraging incremental steps in programming skills would be advantageous.

Clark and Maher (2005) studied the role of place in a virtual learning environment for digital media design to provide evidence of its effect on the conversations of design students. They created a 3D virtual learning place based on Active Worlds for students in a Website Design course. The virtual learning place has two distinct parts: a classroom-like place surrounded by student galleries. Students can navigate as virtual avatars in 3D space and communicate via synchronous chat within the environment. The conversations and activities of the students in the 3D virtual learning places were recorded and analysed with communication coding scheme. It was found from analyzing the discussion communication that a sense of place can be achieved in a virtual learning environment and that identity and presence place major roles in establishing the context for learning in a place. The use of avatars in the virtual learning place supports the lecturer in the management of learning. Further, it was found that discussions about the location of the students' avatars with respect to the learning material can be a way of focusing attention and providing a context for the discussion in the virtual learning place. Contextual discussions about a location in the virtual learning place supports students in constructing their knowledge by collaborating with their peers and lecturer.

Similarly, Abdellatif and Calderon (2007) demonstrated the effects and the use of *Second Life* as an online 3D graphical-based tool of computer-mediated communication in distance learning in architecture education. Using multiple methods of data collection, mainly based on an electronic observation of the experiment, questioning the participants before and after the experiment, and the analysis of the chat transcripts, they presented descriptive results of the experiment, and discussed its main features. It was implied from the study that *Second Life* has the potential to be an effective on-line environment for communicating design drawings and ideas, due to its high perceptual and spatial qualities and the presence of Avatars. Through the experiment, the modes of communication and interaction within *Second Life* have been proven to be, to some extent, a successful environment for a distance virtual criticism. However, it was identified that *Second Life* also has some limitations such as, the need to use a pointer for describing images, the need to have an aid of a voice or video mode for communication, and the need to consider the high-end technology required to run *Second Life* on students PCs. The participants were in favour of using this environment, as the majority got good feedback and wished to participate in future distance learning situations in *Second Life*.

Angulo et al. (2010) conducted exploratory work in the design, construction, and habitation of a virtual structure (VS) nested within an Internet-based multi-user environment and serving a geographically distributed collective of architecture students and faculty. The results found can be used to make reference to the quality of teaching/learning experience of users and the effectiveness of the interaction among users while working on a common architectural design project. It was found that multi-user virtual worlds encourage students and reviewers to collaborate in a sense of community of learners by providing many tools for the exchanging of information. As a social space for learning, students and reviewers meet and make use of interactive whiteboards, chat, audio and video streaming, blog page links etc. In this context, the level of engagement with the design project might provide opportunities by promoting a level of immersion and motivation for significant learning. This collaborative teaching/learning experience contributes to the knowledge base that will be needed in the design of virtual architecture. As the next step in the improvement of the virtual design studio, the simulation of 3D spaces as designed by students and the visualization/evaluation of the same were proposed to enhance the spatial simulation capabilities that support review and design activities.

Angulo (2007) and Fink, (2003) have found out that after their inaugural formal event and the subsequent informal activities that followed during the semester, the eLearning 2.0 has provided opportunities for significant learning and have the potential to promote collaborative and cooperative activities that allow connections between students, mentors and reviewers, even if they are geographically dispersed, and provide a great sense of self and a sense of community of learners by allowing formal and informal interactions with peers who are in a distant location that otherwise might not meet in a face-to-face setting. It was also found that it promotes the performance of meta-cognitive activities, because the activity of reviewing and critiquing a design project is an integral part of the process of learn-how-to-learn to design.

6. ISSUES AND CHALLENGES

There are many issues and challenges in this area that need to be addressed by current and future research. The following sections elaborated them.

- Effective learning environment design: It is crucial to have effective integration of Web 2.0 technologies within a broader built environment curriculum. The learning environment needs to be carefully designed as most of Web 2.0 platforms are not specifically developed and readily to be used for education. The learning environment design should address teaching and learning supports as well as peer supports and to include them as “in-world” features forming an integral part of the learning environment (Nakapan et al., 2009).
- Skill development: Teaching and learning in Web 2.0 platforms requires technical knowledge and skills of different applications and media interfaces. This means skills have to be developed for teachers, tutors, and students so that they are able to exchange ideas, sharing concepts, knowledge and documents in social learning.
- Curriculum development: An aspect that must be improved is the preparation of didactic materials to support teaching (Sampaio et al., 2010). Design content and technology content should be carefully balanced to match the students’ backgrounds and capabilities as well as to suit the different teaching focus. (Nakapan et al., 2009).
- eLearning 2.0 should not be a replacement but a facilitation: eLearning 2.0 should be the mediator in the relationships of student-student and student-teacher. The paradigm of eLearning 2.0 should be explored as scaffoldings that support student learning to raise the level of meaningful critical dialogue between student-student and student-teacher (Bailey, 2005).

- Simplification of complicated social learning mechanism: The mechanism behind social learning is very complicated and current work usually extracts some essential points and make simple model like as role-playing game or simulation game (Matsumoto et al., 2006). It was also suggested by Yuji (Matsumoto, Kiriki et al., 2006) that the suitable model for such learning environment should be as simple, applicable, leading to interaction, and friendly and light hearted.
- Technical issues: broadband bandwidth is an issue influencing the quality and quantity of real-time data transfer. The poor quality of synchronous tools affected on the flow of information, causing difficulties for students (Schnabel and Kvan, 2002). Other technical issues include incompatibility of software, modelling in 3D worlds, firewalls, and hardware and language communication issues .
- Students' lack of motivation to engage in collaboration and teamwork: Cheng (Cheng, 1998) argues that students showed less desire to collaborate despite the collaborative agenda.
- Culture diversity: students may come from different cultures and countries and they need to accommodate the culture difference and learn together. The different learning styles with different orientations and dimensions behind each culture have to be investigated to make the Web 2.0 to suit most students.
- Interoperability: Web 2.0 represents a class of web technologies that enable social interactions, intelligence, etc. When several Web 2.0 technologies are used together or a Web 2.0 technology work with a third party program (e.g., Second Life works with 3D CAD modeling package), interoperability will become an issue. In order to improve the fidelity and realism of model appearing in Second Life, the models can be created in CAD package first and then imported into Second Life for use (Ku and Gaikwat, 2009).
- Evaluation and progress monitoring: Monitoring the progress of students learning is essential, however, very few studies on using Web 2.0 for ongoing evaluation of student work and interactions were noted.
- Conceptual shift in stakeholders from eLearning 1.0 to eLearning 2.0: The difficulties and barriers encountered to date were not so much concerned with technical issues but more with organisational issues (Horne and Thompson, 2008). The learning process is less dependent on the teacher's formulation of the problem as it becomes possible to tap into global professional and other communities (Ham and Schnabel, 2011). Therefore, one major challenge is to introduce changes to a wider group where existing working practices may need to be modified (Horne and Thompson, 2008).

7. CONCLUSION

This paper reviews the current state-of-the-art of the studies that integrate Web 2.0 technologies and tools into eLearning 2.0 for built environment educational and institutional practices. Five major findings emerge from these studies: (1) students using Web 2.0 demonstrate capable of better learning; (2) Skills learned via Web 2.0 can be transferred to the real work task in most cases and in some cases even generalize to other untrained tasks; (3) in the few studies that have compared learning in real (Web 1.0) v.s. Web 2.0 environments, some advantage for eLearning 2.0 learning has been found in all cases; (4) eLearning 2.0 fosters the idea of placing learners in the center of a more social learning process. (5) Evolution from eLearning 1.0 (Web 1.0 based) to eLearning 2.0 (Web 2.0 based) requires not only a technological shift, but also a conceptual change in all stakeholders.

As future trends, agents should be integrated into Web 2.0. As compared to the scripted behaviour of objects, agents are created by using programming language to provide them with the ability to carry out a complex reasoning and ultimately produce dynamic behavioural complexity. Future work should pay attention to the design of metaphoric interface (compact and familiar) to enhance performance while maintaining interactive and responsive characteristics that improve the user experience. The number of design and construction professionals who are using BIM is rapidly growing and simultaneously the architecture, engineering, and construction (AEC) community is faced with the challenge of remote collaboration as offshore outsourcing continues to grow. AEC education needs to expose students to these emerging practice changes while finding new ways to more effectively address the fundamentals of design and construction. Web 2.0 has the potential to address the communication issues and effectively complement traditional teaching approaches and furthermore integrate with BIM to enhance construction education.

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