

Using Virtual Worlds to Support Interaction Design Studio courses

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Abstract

In an interaction design studio students develop interactive products with emphasis on collaboration, creativity and method use. Typically the goals of interaction design studios are to let students acquire the practical skills to apply theories and methods from relevant courses in the context of a real-world problem, and to develop their collaborative and organizational abilities that will be required in their professional work. The paper argues for the potential of VWs to support an Interaction Design Studio by presenting a course that ran through a whole semester with the support of a VW. We have found that the VW design studio can effectively support many interaction design activities like conceptual design, prototyping and evaluation.

Key Words: Virtual Worlds, Education, Interaction Design, Experiential Learning, Design Studio.

1. Introduction

The design studio is rapidly adopted as an approach for teaching and learning in interaction design, following and extending the long tradition of schools in disciplines like industrial product design and architecture. Learning in the design studio emphasizes simple but powerful creative thinking methods that boost creativity, as well as sketching and low-fidelity modelling to help idea expression and exchange.

In interaction design learning, the goal is to design digital artefacts, therefore the process is mediated by quite different tools than those of more traditional design disciplines, including a large number of computer programming tools and many methods drawn (mainly) from the neighbouring fields of HCI (Human-Computer Interaction) and Industrial Product Design. Technology support for design studios (in general) varies, and there are not widely established environments or platforms to support their unique characteristics.

The paper suggests that Virtual Worlds (VWs) have many unique advantages for supporting interaction design studio activities, provided that they are designed as such. We present a postgraduate interaction design studio course that made a combined use of a real and a VW design studio. The student responses and our reflection and experiences have shown that the VW design studio is an engaging and constructive experience; however a number of challenges need to be addressed for wider implementation.

2. Virtual Worlds for Interaction Design Education

VWs have a unique set of affordances for supporting online learning. According to Dalgarno and Lee (2010) the use of educational VWs can lead to enhanced spatial knowledge representation, experiential learning in simulated environments, learners' intrinsic motivation and engagement, and to improved transfer of knowledge and skills to real situations. Additionally, a number of researchers (Dede 1995; Girvan & Savage, 2010) claim that VWs are an ideal medium for constructivist learning activities, in which learners can actively gain knowledge through collaborative experimentation. A key characteristic of VWs that is critical for supporting interaction design courses is their successful use as collaborative mediums: avatar-based representations, synchronous and asynchronous means of collaboration and enhanced social and workspace awareness are some of their features that can be exploited by collaborating communities.

Maher et al (1999) proposed the concept of virtual studios for collaborative design: virtual world models that create a sense of place and are presented like physical design studios. These places may include tools that designers are familiar with and allow them to perform appropriate design activities. The authors further present the approach of "designing within the design", i.e. the design studio being the model of the product or place being designed. This approach has the advantages that designers use a single integrated environment for both private and collaborative activities that they may visually explore the design while being designed and that they may get immediate feedback from their actions leading to further reflection.

There are already a few paradigms in which VWs have been used for design education. Bowman et al (1998) present an immersive environment for designing an animal habitat in which students can modify features such as terrain, visitor viewpoints, visual elements, etc. while being immersed in the environment. It is intended to help inexperienced students apply the theories they learned in a realistic problem context. Gul et al (2009) present a study of design learning in VWs through a collaborative design project that has been set up between two remote student communities using Active Worlds platform. The project involved the design of a two virtual places (a home page and a 3D place in the VW) using a shared whiteboard and the VW.

VWs have been also explored in use by design professionals in many experimental and a few pragmatic situations. Ehsani and Chase (2009) explored the use of VWs as a tool for collaborative design. They present four architectural collaboration projects in Second Life and propose various collaboration modes depending on the level of user participation and on the governance model. In another study, Koutsabasis et al (2012) attempt to determine the value of VWs for collaborative design based on the results of three case studies in architectural,

interior space and user interface design. The results indicate that VVs can effectively support conceptual design activities and can also be employed for review and customer-centered evaluation of conceptual design.

There are also a number of studies that explore the use of VVs in specific activities of the design process. Bardzell et al (2006) propose the use of machinima for presenting and evaluating use case scenarios of designed products. Machinima is a technique for simple and fast video production by recording the activity within VVs, which is quite popular nowadays. It can be used in an interaction design studio as a method of scenario-based design alternative to storyboarding in paper. It can be easily performed if the concept is already present in some visual form in the world, it does not require sketching skills, and the results may have better quality. Functional prototyping of designed products, places or systems can also be performed in a VV. Kim et al (2008) claim that Second Life can be used for immersive prototyping to receive feedback on new ideas and for immersive event simulation to study people's reactions in real-world events. The ability to construct and test functional prototypes is a critical requirement of interaction design studios, as the focus of interaction design is not only on the structure and interface of the designed system, but also on the user experience of interacting with it.

The above mentioned studies focused on specific aspects of educational, collaborative and design activities in VVs that were explicitly or implicitly related to interaction design education. However, there is still a lack of paradigms of long-term use of VVs as an educational platform to support all (or at least most of) the student activities found in interaction design studio courses. In this respect we present our approach for using VVs to support an interaction design studio course.

3. The Virtual World Interaction Design Studio Course

3.1. Context, project and pedagogical approach

The Interaction Design Studio course is offered at the second semester of the MSc program in Design of Interactive and Industrial Products and Systems, at the University of the Aegean, Greece.

The design project given to students was to design a (multi-) touch interactive table or kiosk for a public place like a cafeteria/cinema/theatre, considering alternative installations and types of services, reaching to a functional prototype about form, ergonomics and user interface and interaction. Students had to make careful and justified use of design methods and evaluate the prototype with user groups.

The pedagogical approach was that of Problem-Based Learning (Wood, 2003). In this respect a considerable time of each session was devoted to collaborative work on the identification of areas of further study and the assignment of atomic research and learning tasks for each student by all group members.

3.2. Course activities

The interaction design studio course process was iterative and incremental, blending methods, practice and technology. The main activities conducted during each session of the course were (**Figure 1**): (a) presentation; (b) critique; (c) reflection; and (d) design. In addition, individual, self -directed learning had to be conducted in the form of research (in the field and/or bibliography) during the week that fed through all stages of the course process.

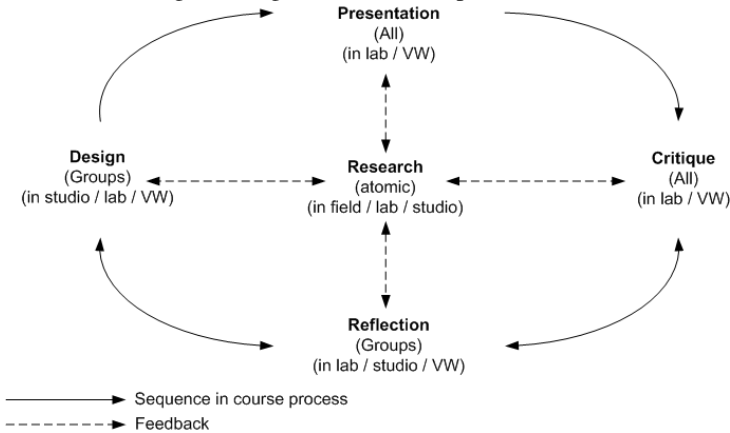


Figure 1: Outline of the iterative activities followed in each design studio.



Figure 2: Presentation in the Virtual World.

Typically the course started with student **presentations**. Most of them were held in the VW studio (**Figure 2**) – this was suitable for students to maintain the corpus of presentations in the digital space as well as for teachers to provide questions and critique with digital annotations as well.

During the **critique** sessions, we followed the tenets of PBL and avoided coaching and correcting students' work but instead we provided questions about the fundamentals of design methods' use in the context of their project. We acted as facilitators and tried to push students to think deeply, and to identify questions that they needed to ask themselves.

The third activity that was taking place during the course time was (group) **reflection**. This was modeled as a simple PBL tutorial process (Wood, 2003), where students elect a chair and a 'scribe' to record the group outcome of the discussion and teachers facilitate the process with posing questions.

The last activity of the studio course was the collaborative **design** of the product of the next week's phase. The design activity included action planning, methods' use and sketching and modelling inside and outside the VW. Furthermore, prototyping and evaluation activities occurred in the VW, where a virtual prototype of the information kiosk for the theatre inside the VW and conducted a usability evaluation with remote users (**Figure 3**).

All in-course activities required atomic **research** (self-directed learning) that occurred during the week interval. Students also had a number of extra meetings without us in their studio, and there were a couple of times that we visited them on their request.



Figure 3: A user approaching the interactive virtual prototype of the info-kiosk.

3.3. The virtual design studio workplaces

We have developed the following digital workplaces to support the interaction design studio activities:

- **Classroom.** There is one single classroom in a central place in the VW to be utilized for class activities. This room is used during the presentation sessions and it is designed as a meeting space with a display screen on one wall and a large table with chairs around it for students and tutors.
- **Private rooms.** Each user has exclusive control of the entrance of their rooms to allow for letting students bring their own resources and privately develop their own concepts before presenting them to the rest of the group.
- **Group collaboration rooms.** One room for each group was used for collaborative design, equipped with interactive tools and furniture (tables, chairs, etc.). The role of these rooms are to support group meetings, to be used as places to collaboratively construct and present sketches and models, to store resources (web pages, papers, etc), to place comments and notes on the project's progress, etc.
- **Prototyping rooms.** There is one room for each group equipped with the appropriate tools to construct a functional virtual prototype of their designed artifact. This prototype can be evaluated by other users that interact with it as avatars.

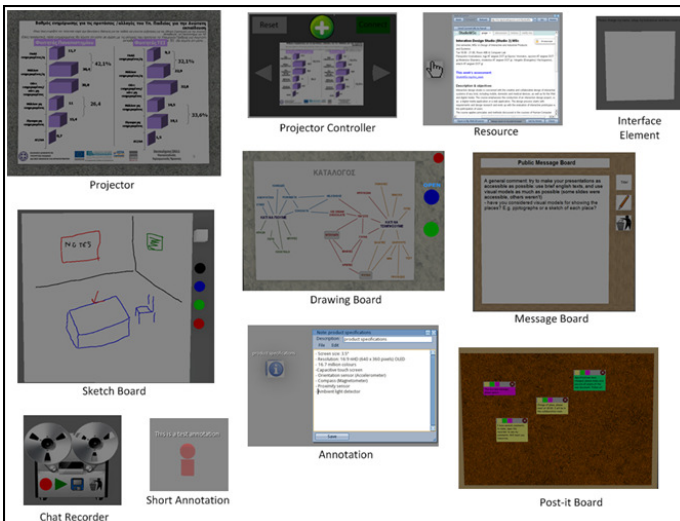


Figure 4. The interactive tools of the VW design studio.

3.5. The virtual design studio tools

We have developed a number of interactive tools (Figure 4) using the Linden Scripting Language (LSL) in order to aid students perform design activities in the VW.

To support group presentations we have built two special tools, the **Projector** and the **Projector Controller**. The first one is used as a display screen with a 'laser pointer' feature (i.e. if one clicks on it a red dot appears in the place) and the second is used to connect to the projector and control a presentation.

Group collaboration is supported with many tools. Students could use the **Annotation** object to store notes or comments and place them in the environment. For simpler one or two-line notes, the **Short Annotation** object was used to display a floating message above it, so other users would not have to click on the object and open the note to read it.

A collaborative text-only whiteboard is supported through the **Message Board** object, which was used for storing ideas, facts or simply group meeting notes. Students could quickly present new concepts to each other using a **Sketch Board**, through which they can directly draw sketches on a white surface. To create more sophisticated and accurate drawings, they could make use of the **Drawing Board** object that displays Google Docs drawings in the VW and lets visitors immediately connect and edit the document. A **Post-it Board** object was also available for students to add text messages on it in the form of colored Post-it notes. Finally, the **Chat Recorder** object allowed students to record chat sessions, play them back, or save them as annotations.

Students also need to store the resources about their research and communicate them to others and for later reference. Given that most resources are available on the Web (e.g. papers, web pages, images, etc), we have added the **Resource** object that displays a short description of the document and it points to and opens the hyperlink in a new browser window when clicked.

Finally, we have designed the **Interface Element** tool for allowing students implement a functional user interface prototype in the VW. Using multiple copies of this object, students can progressively construct windows containing elements such as buttons and images and define their behavior using simple commands. Each working element can have one or more of the following functions: a) operate as a Button, which can send events to other elements (or itself) when clicked, b) operate as a Window, which can contain other elements and it can show or hide based on the event it receives, c) operate as an Image Container, which contains a number of images and it may display the next, previous or any indexed image based on the event it receives.

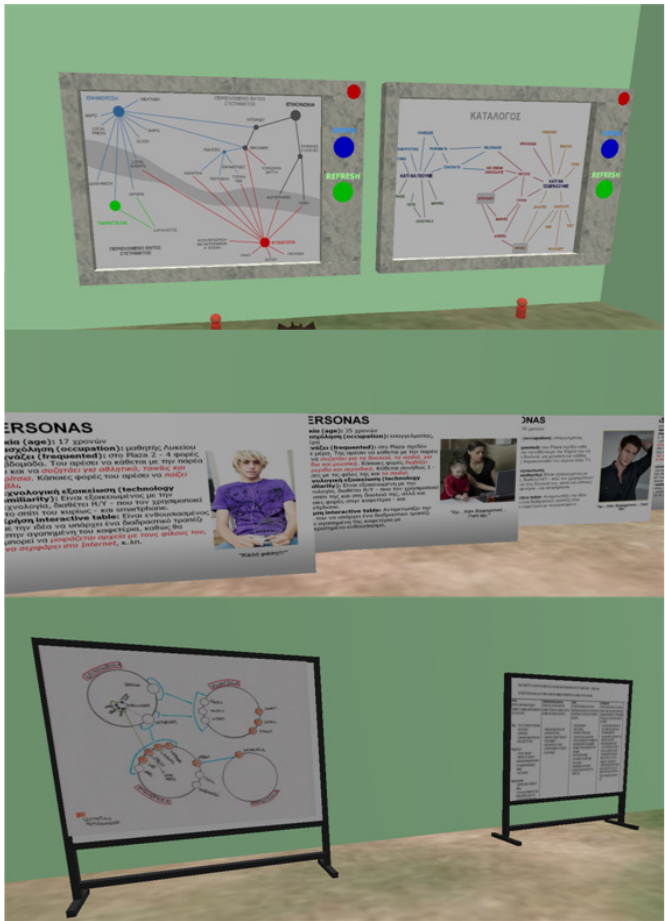


Figure 5: Sketches and models of the design project created in the virtual design studio with the use of the sketch board and drawing board tools.

3.5. Assessment

Formative assessment of the course and students’ performance occurred periodically in every lecture by both teachers and students themselves. The aim of the teachers was to facilitate the PBL process mainly in terms of asking questions about students’ progress and providing resources. Students’ evaluation included comments, questions and ideas on peers during the presentations of their work.

Overall, we were pleased with the process followed throughout the course. The approach enabled students to take responsibility for their own study and follow different routes to their learning and project development. These different routes to

research allowed students and groups to contribute with different methods to the course content corpus.

Students were also very positive about the process recognizing its novelty, and their responses about the use of the VW studio were positive. They reported that VWs can easily be employed for organizing discussions and exchanging ideas, as well as for documentation of knowledge models and the evaluation of proposed solutions. On the other hand, the granularity of solutions cannot develop in detail within this VW, and that they would require other tools for that purpose.

During the lifetime of the course, we have also identified some technical problems like: delays in loading images, usability problems with the use of the diagram board, unclear feedback for some actions in sharing and deleting objects. Some of these problems were addressed during the course lifetime; others are inherent of the platform and require work in further versions.

3.6. The Virtual World Platform

The VW was based entirely on open source software. We used the OpenSimulator platform and MySQL database to set up a standalone VW server and the Freeswitch server to provide voice communication support. Students and tutors could log in to the VW using the Hippo Viewer or any other Second Life-compatible browser. We kept our VW isolated from other regions to provide restricted access for students and tutors only. We decided to use OpenSimulator instead of the most popular Second Life environment, because: (a) we had more freedom to configure the environment, control user access and store the user-generated content for future reference; (b) the activities required images to be uploaded to the VW (e.g. sketches, models, concepts, prototypes) and Second Life charges a price per image upload; (c) most of the features of Second Life are already supported by the OpenSimulator platform.

4. Discussion and conclusions

The paper argues for the potential of VWs to support an Interaction Design Studio by presenting a course that ran through a whole semester with the support of a VW. We have implemented a number of supporting tools, set up the appropriate learning workspaces, and performed formative evaluation of the learning process.

VWs have a number of unique affordances that may be used to support an Interaction Design Studio by offering an experiential, collaborative and constructivist learning environment. During the conceptual design phase students may construct a rough form of their concepts, present them in-world to their group, and embed related documents in a shared workspace. In the detailed design phase students may take advantage of the interaction and animation capabilities of VWs and collaboratively refine both the form and (part of) the functionality of the product. Virtual prototyping can be employed as a prototyping method: the product may be presented in a realistic context and have a simulated interactive behavior.

Finally, in the evaluation phase remote users may test and evaluate the product and send feedback.

We are currently extending and refining our approach in this course by employing additional VW tools, student groups and design problems in the areas of product design, architectural and service design. We expect that in the near future the overall picture of research in constructivist learning in VWs will be that of experiential use of designed VW platforms, in which a new breed of instructional designers will work on the creative introduction of tools and processes that facilitate constructivist learning.

Bibliography

- Wood, DF. (2003). ABC of learning and teaching in medicine: problem based learning. *British Medical Journal*, 326, 328–30.
- Koutsabasis, P. Vosinakis, S. Malisova, K. Paparounas, N. (2012) On the value of Virtual Worlds for collaborative design, *Design Studies*, Available online 10 December 2011, ISSN 0142-694X, 10.1016/j.destud.2011.11.004.
- Dalgarno, Barney, Lee, Mark J. W. (2010). What are the learning affordances of 3-D virtual environments?, *British Journal of Educational Technology*, 41(1), 10-32.
- Dede, C. (1995). The evolution of constructivist learning environments: Immersion in distributed, virtual worlds, *Educational Technology*, 35(5), 46-52.
- Girvan, C, Savage, T. (2010). Identifying an Appropriate Pedagogy for Virtual Worlds: A Communal Constructivism Case Study, *Computers & Education*, 55(1) 342-349.
- Maher, M.L., and Simoff, S.J. (1999). Variations on the virtual design studio. In Proceedings of Fourth International Workshop on CSCW in Design. Compiegne: Université de Technologie de Compiegne.
- Bowman, D.A., Wineman, J., Hodges, L.F., Allison, D., (1998). Designing animal habitats within an immersive VE, *Computer Graphics and Applications*, 18(5), 9-13.
- Gul, L. F., Wang, X., Bulbul, T.T., Cagdas, G., Tong, H. (2009). Global Teamwork: A Study of Design Learning in Collaborative Virtual Environments. In: Proc. Of Undisciplined! Design Research Society Conference 2008.
- Ehsani, E. and Chase, S. C. (2009) Using virtual worlds as collaborative environments for innovation and design: lessons learned and observations from case studies in architectural projects. In Proceedings of the 27th Conference on Education in Computer Aided Architectural Design in Europe, pp. 523-531.
- Bardzell, J., Bardzell, S., Briggs, C., Makice, K., Ryan, W., Weldon, M. (2006). Machinima prototyping: an approach to evaluation. In Proceedings of the 4th Nordic conference on Human-computer interaction: changing roles (NordiCHI '06), , 433-436.

Kim, H.M., Lyons, K., Cunningham, M.A. (2008). Towards a Framework for Evaluating Immersive Business Models: Evaluating Service Innovations in Second Life, Proceedings of the 41st Annual Hawaii International Conference on System Sciences, pp.110.

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