

# Formal and Informal Collaborative Learning in 3D Virtual Campuses

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## Abstract

*In this paper, we focus on collaborative learning in 3D virtual campuses, i.e. virtual worlds representing real educational institutions that use the metaphor of a university and provide users with a range of different tools for learning. Analyzing the results of a study conducted across two virtual campuses in Second Life, we discuss how formal and informal learning can be supported in such virtual worlds and how they should be designed to improve student experience. As a result, we provide implications for conducting both formal and informal educational activities in 3D virtual campuses.*

## 1. Introduction

Three-dimensional virtual worlds (3D VWs) offer an opportunity for people to interact in a way that conveys a sense of presence lacking in other media, which is important for the students' emotional involvement and implies a level of engagement that might not be present otherwise [1]. Therefore, the use of 3D virtual worlds for educational purposes has been constantly increasing during the recent years [2]. In this paper we, focus specifically on one type of educational virtual worlds – virtual campuses.

3D Virtual worlds can be used to support both formal and informal learning. Major universities use virtual worlds for formal learning by supplementing both credit and non-credit courses with Second Life classes in art, computer science, education, communication, law, and counseling education. 3D virtual campuses also provide many informal learning opportunities, such as virtual tours, scavenger hunts, role playing, and games, among others. Although Second Life is the major platform for virtual campuses at the moment, it was not purposely designed for learning [3]. As a result, the numerous

virtual campuses within Second Life are often developed in a non-systematic manner. In addition, there are little studies that suggest any guidelines for designing virtual environments for specific types of educational activities [4, 5].

In order to overcome these limitations, we conducted a study across two virtual campuses in Second Life: the first representing the College of Education (COE) at the University of Hawaii at Manoa (UHM) and the second – the Norwegian University of Science and Technology (NTNU). The data were collected during the virtual Summer School organized by two EU projects, TARGET (<http://www.reachyourtarget.org/>) and CoCreat (<http://www.cocreat.eu/>). Additional grounding for the discussion in the paper is supplied by the previous research into the virtual campus design, including the cases of the NTNU [6] and COE, UHM [7].

The COE UHM virtual campus was officially launched in 2011 aiming at developing a virtual community for COE students specifically the distance education students who are dispersed across the Hawaiian Islands. The development of the NTNU virtual campus started in spring 2009, and since then several course exercises, seminars, and other activities were conducted in the environment.

We analyzed 3D virtual campuses in terms of support provided for the formal and informal educational activities. The goal of such analysis is to evaluate virtual campus environments and suggest implications for conducting such activities. The analysis is structured according to a characterization framework where virtual environments are described in terms of *learner*, *place*, and *artifact* [8]. The framework is inspired by the Activity theory, i.e. activities are performed by learners and mediated by artifacts, while both learners and artifacts are contained in a place. Place dimension is in addition characterized in terms of *appearance*, *structure*, and *roles* [8].

## 2. Background

### 2.1. 3D Virtual Campuses

Many different educational environments that define themselves as 'Virtual Campuses' have been developed. Such environments started as online multimedia services for distance learning in the early 90s of the 20th century [9]. In this paper, a virtual campus is understood as a 3D virtual world that uses the university metaphor and provides users with a range of tools for educational activities [10]. Other possible roles of the virtual campuses include dissemination and sharing of educational content, support for educational simulations and demonstrations [11] as well as support for collaborative learning [12]. Virtual campuses can facilitate the development of learning communities, provide perception of awareness, and a sense of presence [4, 13]. In addition, virtual campuses support informal learning and provide a platform for open, distributed, and lifelong education [14-16].

Existing virtual campuses are diverse in their appearance, possibilities, and purposes. Many of them attempt to create a familiar atmosphere for the students. Often, virtual campuses provide a clear association with the real educational institutions they represent, conveying their 'spirit' and atmosphere by different means. These means may include a realistic outlook, informational resources, and possibilities to contact the representatives of the educational institutions [17].

Virtual campuses have been created based on different types of platforms and technological solutions, for example OpenSimulator, Unity, Active Worlds, and Bluxxun. The most widely used platform at the moment is Second Life, despite the decrease of popularity and certain limitations as a learning environment [3, 18].

### 2.2. Formal and informal learning in 3D virtual campuses

Formal learning is characterized as official, curriculum-fixed, and pedagogically designed learning. Another aspect of formal learning is that it is scheduled, organized, controlled and is evaluated or graded. 3D virtual campuses offer many formal learning opportunities for educators and students.

Major universities already using Second Life for formal learning include California State University, Columbia University, Harvard University, Indiana University, Ohio State University, New York University, University of Hertfordshire and University of Sussex, just to mention a few. The presence of institutions working in Second Life varies broadly, from full-scale, highly realistic campuses, less realistic 'digital interpretations' to more individual classes taught in common areas. For example, Northern Illinois University is supplementing

both credit and non-credit courses with Second Life classes in art, computer science, education, and communication [1]. In addition, the Human Services Counseling Program at Regent University incorporated the virtual world of Second Life into an online counseling skills and techniques course [19].

On the other hand, informal learning tends to be unstructured learning that happens when you need it. It is unofficial, uncontrolled, part of everyday life and is often tacit. Similarly, 3D virtual campuses provide many informal learning opportunities, such as virtual tours, scavenger hunts, role playing, and games. Warburton argues that Second Life allow students the opportunity to experience rich interactions, visualization, authentic content and culture, identity play, immersion, simulation, community presence, and content production [20].

## 3. Study settings

In autumn 2011, we conducted an explorative case study within the Cooperation Technology course at the Norwegian University of Science and Technology. The study was conducted with 37 students in 10 groups, 3-4 students in each. The students were required to cooperate in a challenging technological environment and learn through experience. Each group was asked to build an educational module in Second Life, representing a major curriculum topic and present it at a joint session by role playing. Each group was required to keep a blog for sharing and discussing proposals, reflecting and documenting the progress, and for the final discussion. In addition, each student was required to create and keep an individual blog for weekly reflection.

In conjunction with this course, we conducted a virtual Summer School organized by two EU research projects TARGET and CoCreat. The focus of this paper is on two virtual events that were conducted as part of the summer school. These events were designed to demonstrate affordances of virtual worlds and let the participants to experience two types of learning, formal and informal.

The first virtual event was held in the virtual campus of NTNU and designed as a seminar with presentations and questions-answers session. The objective of this event was to demonstrate the affordances of 3D virtual worlds for the formal type of learning. The contents of the presentations were relevant to the course and included topics such as international cooperation, serious games, corporate learning, and collaborative creativity.

The second virtual event was aimed at demonstrating the possibilities of the 3D virtual world technology for informal learning. It was organized as a virtual tour to the COE UHM virtual campus. Our intention was to let the students to critically evaluate the design of the campus specifically with regards to its immersive qualities. The visit was followed up by the return visit from the COE students. They evaluated the constructions created by the

Norwegian students in the course of virtual Summer School.

The data were collected from the students' individual and group blogs, in which they reflected on both virtual events and discussed various related topics. Additional data were gathered from the direct observation in Second Life and chat logs. For data analysis, we use the constant comparative method [21] that was originally developed for the use in grounded theory methodology and is now applied more widely as a method of analysis in qualitative research. It requires the researcher to take one piece of data and compare it to all other pieces of data that are either similar or different. Leong et. al discussed about the application of constant comparative and discourse analyses to virtual worlds research [22].

### 3.1. Cooperation seminar in the virtual campus of NTNU

The formal event was organized as a seminar involving presentation of seven EU-financed projects, as a part of the virtual Summer School. The focus of the school in general and the seminar in particular has been on creative collaboration, technology-enhanced learning, and serious games. The seminar took place in a rather formal lecture setting, with an amphitheater for the public, slide show, and interactive posters providing more information on the presented projects (Fig 1).

The goal of the seminar has been to disseminate the results from TARGET, CoCreat, and other EU projects, such as Mirror, ImReal, and LUDUS, exploring the possibilities for synergies and cooperation, as well as presenting these projects to students and the general public. The seminar involved presenters and the audience from several European countries. The seminar attracted about 35 participants.

The students have been asked to provide feedbacks to the seminar in their blogs, identifying both positive and negative aspects of the virtual seminar. Among the positive aspects, the following items have been mentioned most frequently:

- Geographical independence of the virtual meetings, allowing the attendance of participants from different EU projects and countries
- The novelty and excitement when facing the technology and learning approaches “different from the normal kind of lectures”
- The comfort of use both for the lecturer and the audience (including low threshold for asking questions and the flexibility of giving a talk from own office)

Among the negative aspects, the following items have been mentioned most frequently:

- Technical problems, especially with the sound, diminishing the overall educational experience
- “Boredom”, attention distractions both inside (“unusual surroundings”) and outside the virtual

environment (e.g. accessing social tools) and therefore difficulties with concentrating on the content

In addition, it was noted that while the threshold for giving feedback was mostly higher than at an “ordinary” lecture, there is a clear potential for improvement. A number of students expressed the need for a more interactive environment, taking more advantage of the 3D technology, for example:

*“One possible approach would be geographically distributed slides and the lecturer can wander around from one slide to another and the listeners are force to follow the lecturer. [...] The lecturer can ask different questions and the listeners have to move to the left corner if their answer is yes and to the right corner if they are going to answer with no”.*



Figure 1. Virtual seminar at NTNU

### 3.2. Guided tour to the virtual campus of COE UHM

The central part of the informal event was organized as a guided virtual tour and lasted for about an hour. The students visited the major highlights of the COE UHM virtual campus including the Wist-Everly Hall complex which houses the faculty offices and the college's Office of Student Academic Services (OSAS), the Diamond Head Amphitheater, the Holomua Learning Area, the Get FIT program tree house, the Hale Anuenue dormitory, and a dockside coffee shop (Fig. 2).

The students were informed that the goals for the COE virtual campus are creating places for experimental teaching and research, socializing and collaboration, outreach, culture, and place for entrepreneurship. After the guided tour, students were asked to reflect and provide feedback by discussing a series of questions in their individual blogs, including their overall impression of the COE virtual campus and any evidence(s) of specific design features or characteristics of the COE virtual campus that met these goals. Lastly, students were asked if the COE virtual campus was successful in immersing its visitors with a strong Hawaiian sense of place and if they felt “transported” to Hawaii.

The analysis of the data showed the different types of learning that occurred during the virtual event and that

were reflected in the blogs. We identified eleven major themes (with the number of students discussing them) – general impression (13), campus atmosphere (11), campus infrastructure (10), learning in the campus (5), experimental teaching (7), Hawaiian culture (11), mythology game (3), navigation problems (2), sense of place and immersion (18), places for formal learning (9), and places for informal learning (11). It was clearly evident that the majority of students felt an immersive Hawaiian sense of place on the COE virtual campus. Students who felt otherwise were those who were not convinced by the immersive qualities of a 3D virtual environment, for example:

*“I did not feel ‘transported’ to Hawaii as the whole concept of a 3d-simulation does not appeal very strongly to me, and I usually draw a very clear distinction between real life and a virtual imitation. A Second Life 3D-model is as immersive for me personally as a good drawing of the place would be. There are limits of immersion with every technology.”*



**Figure 2.** Virtual tour to Hawaii

## 4. Discussion

In this section, we present an evaluation of formal and informal virtual events that are described earlier. The evaluation is based on the analysis of the analysis of individual assignments at the Cooperation Technology course students.

### 4.1. Implications for facilitating formal learning in 3D virtual campuses

The analysis of student feedback identified two major challenges for formal learning in the virtual campus: technical problems and the difficulty of sustaining attention. Therefore, based on the results of this study and our previous work with the virtual campus of NTNU [6], the following implications for campus design can be identified:

**4.1.1. Learner.** To keep the audience’s attention and increase the sense of presence and engagement, the presenters and participants engaging in formal events at a virtual campus should have the possibility to use their

avatar more actively, such as moving around and possibly exhibiting body language, visual effects and even changing appearance. This requires corresponding tools and facilities, including layout of the virtual place and inventory items.

**4.1.2. Place.** The appearance of the virtual place for formal events might be kept minimalistic and familiar/similar to real-life lecture rooms to minimize disruption of attention. At the same time, the layout/structure of the virtual place should facilitate better deployment of the 3D space and provide affordance for more flexible moving and grouping of avatars and alternative placement of tools, such as lecture slides and other seminar facilities.

**4.1.3. Artifact.** Addressing underlying technical limitations of the platform is not always feasible. Still, the learning experience during formal virtual events might be enhanced by integrating social tools normally used by the students into the virtual classroom. This will facilitate feedback during the events and focus more of the students’ attention in-world. In addition, special in-world tools for interactivity should be provided, such as tools for quizzes and polling.

The implications above are presented through the example of the NTNU virtual campus, and the list can be further extended for different educational situations and technological solutions. However, this list can serve as a starting point for analyzing various virtual campus designs, evaluating their suitability for formal learning.

### 4.2. Implications for facilitating informal learning in 3D virtual campuses

While the analysis of the data indicates that students’ perceptions of their informal learning experiences were diverse, three major themes emerged: appreciation for the strong Hawaiian sense of place, recognition for the need for social spaces, and frustrations with navigation problems. Therefore, the following implications for campus design were identified and exemplified by the COE UHM virtual campus:

**4.2.1. Learner.** To minimize students’ frustrations with navigation problems, improvements need to be made to the teleportation system as well as reorganizing content into thematic areas. Within the learner dimension, the primary concern is to improve the learners’ possibilities for socializing and community building. COE virtual campus provides such possibilities, e.g. in the Diamond Head Amphitheatre and student projects areas. The COE virtual campus supports avatar customization to the extent it is implemented by Second Life, supporting the sense of identity by the means of special objects available to the COE island members, such as Hawaiian flower leis.

**4.2.2. Place.** The *appearance* of the COE virtual campus was intended to immerse visitors with a strong Hawaiian sense of place and make them feel transported

to Hawaii. A well-known landmark of the Oahu island, Diamond Head Crater, a 'generic' Hawaiian village, and other Hawaiian elements, such as hula dancing animation contribute to creating a special atmosphere of Hawaii, facilitating both activities and special events.

The COE virtual campus was designed to partially resemble the real campus while creating other 'fictitious' places. The island features a replica of the Wist-Everly Hall complex which houses the faculty offices and the college's Office of Student Academic Services (OSAS), the Holomua Learning Area, the Get FIT program tree house, the Hale Anuenue dormitory and a dockside coffee shop, as well as the Diamond Head Amphitheater. Some of the elements have unrealistic features, such as lecturing facilities within the Diamond Head and its placement close to the academic buildings.

The *structure* of COE virtual campus consists of several elements, such as buildings, villages, landscape features, sky platforms, connected by roads and teleportation links. The structure is only to a certain extent influenced by the physical campus contributing to a greater freedom of future development of the campus and the associated community. As mentioned earlier, to reduce navigation problems, there is a need to reorganize content into thematic areas.

The *Roles* of educational virtual worlds may vary, depending on the learning goal and activities that need to be supported. The roles of the COE virtual campus can be described as follows:

- **Demonstration and exhibition:** The COE virtual campus is extensively used as an arena for exhibition of student projects (e.g. "Hawaiian mythology", course assignments) and Hawaiian culture in general. To strengthen this role, it is planned to continue with the further development of the Hawaiian cultural projects. The goal of this project is to educate students and other Second Life residents about important aspects of the Hawaiian culture – Hawaiian mythology relating to the four Hawaiian Gods, Polynesian voyaging, and the Hawaiian art of cultivation of the Kalo plant. It is conducted in a way that is immersive, informative, and entertaining. In addition, the virtual Everly and Wist buildings, being accurate replicas of the physical buildings, act as a demonstration of the physical campus, targeted at visitors outside Hawaii and potential students.

- **Social meeting place and workplace:** This role is quite prominent as the COE virtual campus serves a workplace for students working on various projects as a part of COE courses and a venue for meetings for physically distributed participants. An example is an elective course Computer Authoring – Virtual Reality. In addition, COE virtual campus hosted a virtual graduation ceremony in 2011, involving teachers, students, and their relatives. To support these educational activities, the COE virtual campus has a number of workplaces and meeting places designed in various styles to support an

appropriate atmosphere for different purposes and learning goals. The facilities include sitting areas, slide show tools, building tutorials, with additional facilities planned to support a wider range of educational activities.

- **Information space:** The COE virtual campus can be seen as a place displaying general information about Hawaii and COE, including major COE buildings. Furthermore, some informational resources on Second Life building and student projects are included. To provide additional support to COE students and enhance their access to important informational resources, the college's OSAS plans to begin providing academic advising and counseling services in Second Life.

- **Virtual stage:** The COE virtual campus contains several places that can be seen as virtual stages, such as Diamond Head Amphitheatre and 'hula' stage. The associated facilities include typical Hawaiian clothing elements (such as flower 'lei' and virtual hula skirts). Additional virtual stages are planned to facilitate educational role playing, innovative project presentations, and social events.

**4.2.3. Artifact.** The COE virtual campus provides a number of artifacts for general educational activities such as lecture theatre and some informational signs. There are Second life tutorials and some specially designed Hawaiian-style artifacts. There is a need for more specific tools for supporting course activities and integration with tools and practices used by students and teachers on a daily basis outside Second Life. Therefore, the primary focus in the future COE virtual campus development will be on supporting different modes of learning and providing corresponding tools and facilities for that.

## 5. Conclusions

In this paper, we present a set of implications for conducting formal and informal educational activities in 3D virtual campuses, based on the results of an exploratory case study conducted across two virtual campuses in Second Life.

Applying the suggested implications in practice, it will be of most importance to sustain a balance between formal and informal learning. The flexibility of the 3D virtual world technology enables special possibilities of virtual campuses in this context, such as adjusting for specific formal or informal approaches in both academic and corporate settings.

Although the suggested implications were derived based on the data obtained from a study in Second Life, they could also be extended to apply for virtual campuses, classrooms, offices, conference facilities, and other types of environments developed on different platforms.

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