EXPERIENCING EDUCATION WITH 3D VIRTUAL WORLDS

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ABSTRACT
In this paper we discuss the potentialities of 3D virtual worlds in education. We argue that assignments in virtual worlds and a constructivist approach go hand in hand. We identify the aspects of virtual worlds (such as ActiveWorlds and SecondLife) that make them useful for education and research, as well as aspects that do not. We found that intertwining real life instructional courses with virtual constructivist courses was very promising in terms of the learning experience. We demonstrate this twofold approach with our course “Virtual Worlds” at the University of Professional Education (Hogeschool) Utrecht.

KEYWORDS
Virtual worlds, education, constructivism, learning

1. INTRODUCTION

In this paper we explain the need for new paradigms when developing courses with new technologies. We illustrate this by positioning education in immersive virtual worlds in terms of the learning paradigm being applied. We explore a few cases of use of virtual worlds in education and identify some good (and bad) practices of using 3D virtual worlds. We then describe the “Virtual Worlds” course as a typical example of intertwining real life (instructional) education with a constructivist learning approach in a virtual world.
2. NEW TECHNOLOGY, NEW PARADIGM

New technology often changes the context of use, the constraints, and the opportunities of application, making existing paradigms obsolete. This results in underutilization of new technology, until new paradigms arise and users become familiar with the new way of interaction.

Literature on education shows that the traditional (instructional) methods can be supplemented or even be replaced by constructivist learning methods when using new technology, such as the upcoming and still evolving eLearning environments and, in the last decade, immersive virtual worlds (Dede 1995; Dickey 2005; Educause Learning Initiative 2006; Antonacci and Modaress 2008).

Eliëns, Feldberg et al. (2007) describe applying the traditional learning paradigm to virtual worlds as “rather naive”: for the virtual VU-campus (VU University Amsterdam 2007) there was “frankly no reason to include what may be considered an outdated paradigm of learning” especially when “there might be more appealing alternatives”. However, other literature claims that there is added value in using virtual worlds preserving the traditional learning paradigm in a virtual classroom setting, mainly in creating a sense of a classroom community and in the fact that students will more easily join in class discussion in virtual life than in real life (Lamont 2007; Martinez, Martinez et al. 2007; Ritzema and Harris 2008).

We will not strictly define constructivist learning, but provide some terms that are often associated with constructivist learning. Constructivist learning is intertwined with collaborative problem solving, knowledge building communities, situated learning, immersive environments, participatory processes, interaction, learning by doing, activity theory, critical learners, and many other aspects. This results in a notion of constructivist learning being the process of creating, sharing, and evaluating knowledge in an immersive collaborative environment through interaction with entities (objects, people, avatars, communities) in that environment.

Immersive 3d virtual worlds enable modeling and simulation, and they facilitate communication between personalized avatars. In some cases intelligent agents can be created for the virtual world. These aspects result in the creation of virtual ‘lives’ and the formation of social networks; in many ways similar to those in reality. This resemblance of reality makes these virtual worlds an immense virtual ‘lab’ for communication studies, social studies, psychology studies (Stanford University 2008), architecture, and medical studies (Kamel Boulos, Hetherington et al. 2007). These and many other examples of educational use of Second Life have been collected by Conklin (2007).

2.1 Why (3D) virtual worlds afford constructivist learning

Course management systems (CMS’) such as Blackboard, Moodle, and WebCT can be considered virtual learning environments (VLEs). These CMS’ provide tools for creating virtual communities and are a central place where students meet, discuss their work, find and organize course materials, and discuss the course content with their lecturers. These virtual learning environments are not as immersive as full 3d “worlds”, and would probably not even be considered a ‘virtual environment’ by the students using them. With immersive we mean Dede’s definition of immersion, being ‘the subjective impression that a user is participating in a ‘world’ comprehensive and realistic enough to induce the willing suspension of disbelief’ (Dede 1995). Though not very immersive, VLEs allow the emergence of knowledge-building communities, promote an interactive style of learning, have opportunities for collaboration and have meaningful engagement across time and space and thus enable constructivist learning (Dickey 2005).

Current VLEs often enable more visual immersion, yet still providing the same tools and assets to education as the traditional CMS’ have. These VLEs enable students to see each other and the lecturer by means of webcams (using for example Acrobat Connect technology (Adobe Systems 2008)). Though still not fully immersive, these applications have a huge advantage over traditional CMS’ in the fact that they allow for non-verbal communication and create a stronger sense of community.

Fully immersive massively multiplayer virtual worlds such as Active Worlds and Second Life have seen a rapid growth over the past decade (especially the last few years). These growing communities in virtual worlds with no preset narrative have spawn interest from, both, (large) companies, researchers, and educational institutes. We will focus on the researchers and educational institutes. In these worlds, learners themselves construct knowledge through interpreting, analyzing, discovering, acting, evaluating and problem solving in an immersive environment, rather than through traditional instruction (Antonacci and Modaress
2008). Especially virtual worlds with no preset narrative, such as Second Life and Active Worlds are considered to be a very usable asset in education (Livingshite and Kemp 2006). These worlds differ from massively multiplayer online role-playing games (mmorpg) in the sense that there is no objective in the virtual world, other than (social) presence. Though we focus on virtual worlds without preset narrative, even virtual worlds that do have a preset objective (i.e. games) do support learning (Steinkuehler 2004) as well as research (the MMORPG World of Warcraft suffered from a corrupted blood epidemic, a situation that now is considered a disease model by some scientists (Gaming Today 2007)).

According to Dede (1995), a virtual world needs at least two essential capabilities for constructivist education, being (1) telepresence (via avatars) and (2) immersion in the virtual world. These capabilities are less prominent in traditional CMS’s than in immersive 3d virtual worlds. We therefore assume that constructivist learning is better supported by immersive 3d virtual worlds, than it is by traditional CMS’s. This is something a lecturer should realize when considering new technologies for a course.

Some key features for education in virtual worlds have been described as a concept called ‘Learnscape’ (Cross, O'Driscoll et al. 2007) defined by seven attributes, relating to learning strategies:

1. Flow - balancing challenge and inactivity for an engaging experience;
2. Repetition - virtual worlds allow for endless repetitions with no extra costs;
3. Experimentation - virtual worlds allow for simulation and modeling;
4. Experience - being part of a collaborative community;
5. Doing - virtual worlds are big practice fields;
6. Observing - learning by observing how others do things;
7. Motivation - the rich context motivates through situated learning.

Although learning is done in the virtual world, the skill and knowledge gained in virtual worlds is as real as it gets. This aspect of virtual learning is being researched to help people with Asperger’s to socialize (Loftus 2005; Kirriemuir 2008).

2.2 Downsides of constructivist learning

It is difficult or sometimes even impossible to define learning goals in a constructivist learning setting (Educause Learning Initiative 2006). This automatically results in difficulty of assessment; with no fixed learning objectives there is no easy way to assess whether objectives have been met. Jonassen and Rohrer-Murphy (1999) argue that: ‘designers committed to designing and implementing CLEs (Constructivist Learning Environments) need an appropriate set of design method for analyzing learning outcomes and designing CLEs that are consistent with the fundamental assumptions of those environments’. They propose the use of an activity-theory based framework to assist in the mentioned tasks, because activity theory closely relates to constructivist theory on collaborative problem solving, experiential learning (Mason 2007) and situated learning (Hayes 2006).

Immersive virtual worlds have another downside as well. Being ‘immersive’, they can be so engaging to students that it distracts them from the actual course (Educause Learning Initiative 2006). A good example was found by Martinez et al. (2007) where a student did not come to the course because he rather spent his time in a virtual bar. We experienced such behavior as well, as we will describe in section 4.1.

3. OBSERVATIONS IN THEORY AND PRACTICE

Multimedia Virtual Worlds are especially useful in constructivist learning, by enabling experiential learning, situated learning, and collaborative problem-solving. From existing examples of education in virtual worlds and from literature, we can conclude the following:

Virtual classrooms in a traditional instructional setting do not fully utilize the possibilities of the immersive virtual world. They do however have added value over non-immersive virtual worlds by creating a 'class'-feeling. Compared to real-world classroom settings, the virtual ones suffer from the engaging context of the classroom (virtual worlds encourage exploration). An advantage of the virtual classroom over real-world classrooms is that students join a discussion more easily through chat, than they would do in real life. Whether this is an advantage is debatable: do students acquire the competence to speak in public?

When transforming a course from real-life into a virtual world, the initial learning objectives of the course will need to be reformulated and assessment should be reconsidered. Virtual worlds afford another type of learning than real life education. The learning objectives of courses in virtual worlds should match the
possibilities of a virtual approach, and assessment should take place in an appropriate way).

Modeling, simulation, and collaboration are effective tools for knowledge creation and knowledge transfer. In general, you can get rid of real world constrains. Practical issues do arise when it comes to ownership and content (co)creation.

Virtual worlds are especially an asset to real life education when students can try out concepts that would be too difficult, too expensive, or too risky in real-life, or when lecturers need to demonstrate things that are difficult, if not impossible, in real-life (such as complex large-scale molecule models).

In our own course “Virtual Worlds” (which will be described below) we combine the best of both worlds. Traditional instructional methods (classroom setting) in real life provide the course framework, a solid knowledge base, and create opportunity to share design knowledge. The virtual world (in our case an Active Worlds world) is used for practical assignments. We found that this complementary approach works very well, collaboration continued naturally in both worlds (virtual and real), resulting in a ‘community of learners’.

4. OUR COURSE ON 3D VIRTUAL WORLDS

The course “Virtual Worlds” is part of the Digital Communication curriculum (third or fourth year of University College) of the University of Professional Education (Hogeschool) Utrecht, the Netherlands. The goal is to teach students to think about virtual worlds in a conceptual way. Because of the curriculum, the course deals with virtual worlds from a communication perspective: the exercises are about possible usage of virtual worlds, advantages and disadvantages.

One half of the course is about theory, the other half is about practice. Contrary to previous years, in the spring 2008 course, students’ practical assignments took place in a shared virtual world (enabling collaboration), situated in Active Worlds. The students were asked to build contributions to an ‘Asterix village’. Assessment and discussion took place in a plenary closing meeting. Active Worlds is a virtual world platform without preset narrative. This enabled students to individually develop and implement interaction concepts (in the current course a house and some activity in or near the house) as well as to collaboratively develop interaction concepts for the entire village.

4.1 Course structure

The course starts with an introduction to design concepts within virtual worlds and on how to design an experience.

In this first part the students practice building a VR application, (a model of a house and its environment for the Asterix-village) in 3D Studio Max. In the second part of the course, theory focuses at the future of virtual worlds when artificial intelligence and photorealistic rendering will increase opportunities for agent intelligence and for interaction within virtual worlds. Another lecture discusses whether rendering photorealistic 3d or other techniques may increase credibility of virtual worlds (Bakker, Meulenberg et al. 2003).

The practical part consists of an assignment to bring their little virtual world concept to life, and to describe an interesting application for the common virtual world, the Asterix village. Examples of applications: illustrating how ancient people constructed their homes; and a “language village” for visiting avatars speaking a foreign language.

In the final weeks students reflect on the benefits of virtual worlds and present their work.

4.2 A virtual world as an educational tool

Building a village collaboratively promised advantages over individual projects. Students had to learn how to implement models in Active Worlds from each other, especially since no tutorial was available. In fact, by working as a group they all succeeded to take this hurdle relatively fast. Their houses and surroundings would never have reached the sophisticated level if they had not been able to learn and copy from each other and from other virtual worlds. In addition, creating a real virtual world as a group is expected to stimulate and motivate students as the result, for each individual, is really a new world to explore.
4.3 Evaluation

Even though our course is not an experiment, we wanted to evaluate our approach. The only possible way in this type of field studies is to listen to stakeholders, both students and teachers, and to assess (student) performance, and to relate this to what is known from prior versions of the course. In doing so we found a series of issues:

- Re-use in groups – meeting each others’ work resulted in re-using it: one student created an animated smoke that was soon featuring the chimneys of many others. The teachers, needing to establish individual students’ credits, easily established who was the original creator of unique features, and successfully discussed the concept of “intellectual property” as a side effect.
- Creativity - creating exciting applications was difficult. Almost all students wanted to ‘let the user explore the time of Asterix’. The teachers needed to actively inspire the students to have them consider more creative applications.
- A shared virtual space – the concept of a co-developed village was successful in allowing students to count on each others presence and feedback
- Performance – all students passed the practical assignments, compared to 33% needing a second assignment in the past.
- Technical problems - conversion from 3D Studio Max was problematic and implementing interactivity reduced the environment’s performance dramatically.
- Compulsory meeting participation – a guest lecture was taught in the virtual world, where “presence” for all students was compulsory. Students’ avatars were indeed in the virtual room but, in stead of participating in discussion, were engaged in activities like dancing the Macarena, labeled by abstract nicknames. A real meeting with a guest lecture would have been very easy to organize and would certainly have been more to the point.
- Active participation - students called their own attitude “active”, spend more time at their assignment then they had planned and considered themselves involved and participating in the learning community. The large majority of the students reported having been positively surprised by the course.

5. CONCLUSIONS AND FUTURE WORK

Current literature about ‘best practices’ and our own findings in our Active Worlds course show the following:

In 3D virtual worlds, it is possible to show (and teach about) some things in a more realistic way than could be done in a real world since one can get rid of real world constraints (Wages, Grünvogel et al. 2004).

In a shared virtual world students can learn from each other and cooperate in creating, which, in addition, is strongly motivating.

Individual assessment is not straight forward as students work in groups. Reuse of each others’ work should in many cases be considered positive learning behavior, though special measures are needed to credit individuals for unique contributions. Discussing this in (real) group sessions works well, as do individual plenary final presentations.

Moving traditional classroom activities s into virtual worlds is not always effective, as in the case of compulsory interactive lectures.

5.1 Future work

The 2008 “Virtual Worlds” course was successful and an improvement to its classical predecessors. Students were more present, more active, and, according to informal evaluation, more satisfied. This success surpassed teachers’ expectations. Teachers even suspect that students gained more conceptual insights in virtual world applications.
It is possible that the similarity between the courses subject and the applied technology was fundamental: a course about virtual worlds with an assignment in a virtual world is a powerful combination. Another success factor might be the choice for an immersive collaborative structure, or the village metaphor.

Before we would dare to generalize our local success, we intend to explore other learning domains, and other collaborative narratives and related world metaphors.

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