Virtual Reality: Its Transformative Potential

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Abstract This chapter explores the role(s) that virtual reality can play in using new information technologies to transform the classroom. In some ways, virtual reality represents the frontier of Internet-infused learning because of its potential to open up new spaces of learning even while maintaining the traditional classroom as the outer shell of the educational process. Students can sit at their desk in a four-walled environment while exploring new and different worlds with limitless possibilities. But virtual reality in education is also fraught with pitfalls and dangers for almost identical reasons, as students can experience autonomy and freedom in ways that are completely new to how we conceptualise learning environments. In this chapter, we describe the use of virtual reality in a college-level class. The teaching team used the desktop virtual reality platform 'Second Life' as a central part of the curriculum over the course of a fourteen-week semester. Every week the class would receive a lecture on the class topic and then sit in the classroom and enter the world created through Second Life dubbed 'Wisdom Shores' and engage in activity related to the topic. A critical issue was understanding the space (Second Life)–place (classroom) dialectic and how it plays out in the learning process.

Introduction

One of the more important implications of the information revolution, especially the Internet, is the emergence of what Illich (1973) referred to as convivial tools. Illich criticised the rituals of traditional schooling as manipulative tool(s) used to promote larger social agendas. Individual engagement (enabling immediate and relevant problem-solving) was not possible using what had become a universal approach to schooling. In actuality, schooling moved students away from the idea that they

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could independently use tools to engage, solve problems, live and subsist with others. In *DeSchooling Society* (1971), Illich's first and most famous work on the split between individual agency through tools and social manipulation based on controlled tool use, he suggested computers as a possibility for a new generation of convivial tools that could offer important counterpoints to the control of traditional schooling. Illich's ideas coming at the beginning of the information revolution were necessarily simplistic, and he soured on the possibilities of using computers to escape manipulation a few decades later, but we argue his ideas of computers as tools for exploration through individual and community engagement were prescient if premature.

The first generation of Internet applications was often times anything but convivial, based on linear, one-way communication (what O'Reilly 2007 refers to as web 1.0). Computer applications seemed to be moving in the opposite direction that Illich and many early pioneers in computers/networking envisioned for the new technology. But in the last decade there has been a renaissance of the types of computer and network applications that can serve as tools for open-ended activity/experience, based on exploration and developing communities for problem-solving—these include applications such as blogs, wikis, (sometimes) social network sites and short messaging services. Perhaps no application offers greater possibilities for tools of engagement, exploration and democratic problem-solving communities than virtual reality, or more particularly what we will refer to in this chapter as virtual worlds (e.g. Second Life). Virtual worlds offer users opportunities for engaging in open-ended learning in school settings while leaving behind the manipulative nature of schooling. The classroom still has titular social approval because activities remain under the aegis of teachers as socially approved interlocutors, but students are capable of travelling to a new type of reality where traditional (many times manipulative) socio-educational tools hold relatively little sway. This can happen while students sit at their desk in a traditional classroom under the gaze of the teacher. These virtual worlds belong to students as problem solvers at least as much as they do to the school. They provide a context for what Dewey (1916) referred to as vital experience while still maintaining contact with the traditional classroom. The key for the teacher is setting up a permeable boundary between the corporal reality of the classroom and the reality of the virtual world, making it safe for students to cross over at will, recognising new options for autonomy and exploration when in the virtual world along with social histories and responsibilities of their corporal worlds, understanding how the two influence each other and in many cases recreate each other through vital experience; in other words, it is key to establish a place–space dialectic (Glassman and Burbidge 2014). Researchers have been examining the roles that virtual reality/worlds might play in education (e.g. Dalgarno et al. 2011; De Lucia et al. 2009; Dickey 2005) as well as core developmental issues such as identity (e.g. Kafai et al. 2010). This chapter looks to go perhaps a step further in exploring the ramifications of integrating virtual worlds as a teaching tool that is a major component of the curriculum.

Democratic Education and Constructivism

As early as the beginning of the twentieth century, Dewey (1916) questioned the value of hierarchical, linear educational processes where teachers controlled what was learned and how it was learned while students were passive recipients of socially approved knowledge. He believed the central goal of education was teaching students to be engaged in vital experience—the empirically based investigation of immediate and relevant problems that students saw as critical to their needs, the merging of the desire to know with the active, logical experimentation in the world that brings knowing. Dewey believed that education should reflect life as lived (and life as lived should reflect education, over the lifetime), with everything else more or less window dressing. The desire to know cannot be separated from the need to know, and the need to know cannot be separated from interest. Critical to Dewey's perspective is the idea that we do not really solve problems through vital experience by ourselves. Humans are social creatures, and their greatest attribute, the ability to learn and gain greater understanding through experimentation, is ensconced in the sociability (Glassman 2016). Like learning, problem-solving is not a passive process where we go into a room somewhere and use our special knowledge to come up with a solution based on prior knowledge. Each problem is unique so therefore each solution is unique, tied to the context of the problem and the individuals attempting to solve it. Humans benefit from multiple perspectives and multiple histories when they attempt to solve unique problems. Democratic problem-solving is not, however, natural to the human condition but a process we must continuously reach for, sometimes through more individualistic/selfish inclinations. Individuals must learn to work together in an environment of mutual respect and concern with other interest-driven individuals over and over again so that it becomes part of their nature, the first choice in any activity. The concepts of learning—that is learning to be a problem solver—and citizenship—being a productive open member of a shared community—are deeply intertwined in the Deweyan framework.

Despite the obvious qualities of Dewey's approach, it has taken hold in only limited educational contexts. For the democratic education Dewey proposed to work, the teacher must be willing to transfer much of the responsibility for learning and ownership of the topic to the students. It is the students who for the most part drive the educational processes and not the teacher, who hovers in the background as facilitator and general guide. This also requires ceding a great deal of institutional control not only on the part of the teacher but the educational establishment as well. In Dewey's democratic classroom, the school or the teacher does not determine what is important to learn, that is left to the students themselves. Student interest is the critical component of the educational experience. If there is no organic interest on the part of the students, they are not going to work together, to put solving the problem at hand ahead of their own individual needs no matter what the teacher does. And without this interest-driven community experience, the students have little chance of learning to become democratic problem solvers through their activities.

There are a number of reasons why Dewey's ideas on education have been so difficult to implement (Glassman and Kang 2011), some of them philosophical (many believe for instance is the trained individual as expert and not the group that function best in problem-solving scenarios), some of them are political (many do not believe in the efficacy of the participatory culture Dewey promoted). But at a practical level, the types of tools necessary for true democratic education oftentimes do not exist in the traditional classroom or are not accepted as legitimate by educational institutions. Illich would suggest that schools are set up as tools of control and manipulation, even if we often do not realise it, and this is deeply ingrained in our cultural attitudes towards schooling. Attempting to implement a democratic classroom in these types of traditional classrooms can lead to chaos for even the most well intentioned of educators. What is needed, we would argue, is a new world, open to the types of democratic educational processes Dewey believes so important, within the context of traditional education (which even Illich might have admitted is difficult to overcome). This would have seemed a strange paradox, even impossible just a few years ago. How can there be multiple worlds in a single social context? Yet virtual worlds do offer this possibility. They give the chance for students to adhere to the demands of schooling while simultaneously experimenting with problem-solving groups where there are few consequences for failure.

Virtual Realities/Worlds in Education: Prior Research

The technological advances of the past decades brought into play many new tools that educators can use in the classroom—some of them manipulative (e.g. MOOCs, management systems) but some convivial, meant primarily for engagement. One convivial tool that has emerged recently is virtual reality (VR) platforms. Mikropoulos and Natsis (2011) broadly define VR as "a mosaic of technologies that support the creation of synthetic, highly interactive three dimensional (3D) spatial environments that represent real or non-real situations" (p. 769).

Sherman and Craig (2003) identify four essential elements of virtual reality: a virtual world, immersion, sensory feedback and interactivity. A virtual world refers to the virtual space and its content that are generated by a computer; immersion can be described as a sensation of personal presence in the environment; sensory feedback is the sensory data the user is provided with in response to the user's actions in the environment; finally, interactivity is the freedom of being an active participant and co-creator in the virtual space and the responses of the space to the user's actions. When all four elements are present to the fullest extent, such virtual environments are defined as fully immersive and interactive (e.g. VRs accessed through a head mounted display). In this chapter, we make the argument that the concepts of virtual space with interactivity should be combined because it is not possible to have human-occupied virtual worlds without some level of interactivity (i.e. from a psychological perspective individuals cannot be completely solipsistic and still be considered as engaging human endeavour). We refer to this combination as virtual worlds.

While virtual realities can have all four elements to varying degrees, we suggest virtual worlds focus primarily on the combination of virtual space and interactivity —immersion and sensory feedback are not particularly useful and can actually be detrimental from an educational perspective (e.g. a distraction, inhibit high-level interactivity). Our view of virtual worlds demands a higher level of agency on the part of the user (they must make conscious decisions about their participation in virtual worlds as opposed being immersed in sensory data which set virtual behaviour trajectories). The hardware is often different for the types of virtual worlds discussed here, using mediating, tool-based technologies that are separate from the user. In the literature, this type of hardware is classified as desktop virtual realities. Desktop VRs (DVRs) are the type of a computer-generated VR that can be controlled through the use of mouse and keyboard or any other controllers and represents the 3D environment on the computer screen (Burns and Ausburn 2007). The emergence of DVRs can be traced back to text-based Multi-User Dungeons (MUDs) and MUDs Object Oriented (MOOs) which, following the fast development of graphic technology and computing and processing power, developed into complex, highly interactive digital spaces that can be accessed using an ordinary desktop PC and Internet connection (Peachey et al. 2010). Game industry popularised so-called non-immersive virtual worlds about three decades ago, but the technology still continues to advance with each year.

In spite of similarities in hardware, virtual world platforms have a number of unique features that differentiate them from games. Particularly, there is no predetermined narrative or a story line, or designer-defined objectives. For instance, in games players are expected to complete (most often) successive levels as determined by the designer(s), to collect specific items identified by designer(s), to defeat an enemy, etc. Many games also allow for (and sometimes build on) user-generated content (Girvan et al. 2013), but this still falls within a designed system. Games are sometimes defined as virtual worlds as well, but in this chapter our definition of virtual worlds is dependent on virtual open spaces which welcome (sometimes high levels of) interactivity but have no predetermined rules and goals. In other words, virtual worlds as convivial tools.

VRs as convivial tools provide a number of possibilities that teachers and students can use for specific educational purposes. They offer avenues for increasing social presence as well as create opportunities for collaboration (Dalgarno and Lee 2010). They can provide an opportunity for new types of vital experiences, especially when normally such experiences are difficult, if not impossible, due to technical, ethical or any other considerations (e.g. practicing costly or complicated surgeries in medicine). They also add an element of playfulness and encourage exploration, which are important for educational purposes (Twining and Footring 2010). Steinkuehler and Squire (2009) identified 7 principles of virtual world cultures that should be addressed by educators as students engage in virtual world exploration outside of school with consequences for their in-school learning (some of these principles are true for modern media and technology in general):

1. Ubiquitous access to information: when information can be accessed in a matter of seconds, the focus should be on teaching criteria of filtering and selecting information rather than transmitting it;
2. Overlapping co-presences: student in the classroom can also be in other virtual spaces, e.g. communicating with friends through chat—such multitasking becomes a usual thing;
3. Collective intelligence: in virtual worlds, collective work is encouraged and often expected—mastery is collective rather than individual;
4. Learners are information producers, not just consumers: virtual worlds allow for user creation of content;
5. Authentic participation: meaningful participatory culture;
6. Learners are designers of messages;
7. High student autonomy: their personal learning goals matter.

Therefore, desktop VRs provide a potential educational space that is (or can be):

- Collaborative
- Encouraging exploration and play
- Student-driven (in content and actions)
- Socially meaningful
- Promoting learner's autonomy

Despite these possibilities, educators tend to use virtual worlds as a tool to support traditional learning and teaching systems, in essence as the same type of manipulative tool that Illich decried in *DeSchooling Society*. Educators look to replicate traditional classrooms in virtual space and use the virtual world as a platform for disseminating information; assign tasks to achieve predetermined academic objectives or stick to the realistic representation of the real world. Even as a manipulative tool, virtual world platforms can increase students' engagement and social interaction, as well as interest and motivation (e.g. De Lucia et al. 2009). Using virtual worlds this way is, however, to miss their radical transformational capabilities, creating educational opportunities once thought impossible by creating a second world where students and teachers are not subject to the same institutional histories, barriers and demands in learning processes. Instead of directly challenging schooling rituals as Illich (1971) suggested, virtual worlds offer possibilities for going around them. In a world where everything is possible, imagination, creativity and means to achieve one's personal vision have almost no constraints. Why build a real classroom in a virtual world simply to lecture students when you can have a class riding dragons, travelling through every part of a gigantic eukaryotic cell or flying a hot air balloon? Even when VR activities do not imitate those of the real world, they are often geared towards a specific educational objective imposed by the teacher and limiting students' autonomy and exploration.

The idea of virtual worlds in education needs to be taken to the next level, where these tools are not used for the sake of replicating traditional instructional approaches, but to enhance and complement as convivial tools that can aid in breaking institutional barriers to create new avenues/funnels for student agency and engaged problem-solving.

The Case of Second Life

We tried to take a step in this direction using a DVR called Second Life (SL) in a college-level course. Second Life is a virtual world platform developed by Linden Lab that was initially developed in 2003. It functions as a multi-user DVR where users ("residents") are represented through avatars. They can interact with objects and other avatars, create many different types of objects, buildings and structures, animate and script them, and participate in economic transactions using the in-world currency (Linden Dollars). It is a world primarily driven by user-generated content.

We implemented SL as a the central learning tool (along with more traditional lectures) in a semester-long undergraduate-level course in a general education programme for pre-service junior and senior high school teachers. The course was focused on adolescent development. SL, as well as other many other forms of virtual reality, is usually used in science instruction or social and art studies incorporating such topics as communication, art and history, where there is a natural affinity on the part of the students and the curriculum for SL activities (but this also limits SL activities to the boundaries of the particular course objectives). One of the goals of this particular intervention was to explore how SL can be used as a tool to change the teaching and learning process in a course that does not naturally lend itself to an SL context (the course itself is not about computer applications, exploring models or building/creating objects).

SL features a private ownership system where residents can buy or rent private islands or parts of regions and set the rules for their private territory. We bought an island for our course that we called Wisdom Shores. This island was developed as a safe space for students to learn. Since it was private, students could perform actions that they would not be able to on other territories, such as building objects. No outsiders (SL users who were not members of the class) were allowed access to the island. Learning was not assessed in traditional ways—there were no testing or grades involved. In other words, the environment was arranged in a way that allowed students/users to make mistakes in the process of learning without real consequences. SL has an infamously steep learning curve, so mistakes were a common part of the learning process during the first few weeks. This is the type of learning environment the classroom (ideally) is supposed to be—a sandbox, a safe playground for testing out situations and ideas that could have undesirable consequences in the real world.

Researchers have claimed that virtual worlds can be playgrounds for identity creation and experimentation (Kafai et al. 2010). This is certainly true of the SL platform that has unique possibilities for creating any imaginable avatar. Using the built-in tools (see Fig. 1), you can change the shape and look of every part of the avatar's body; you can change an avatar's sex in a matter of one click. More advanced options, such as creating or buying hairstyles, tattoos, jewellery, different colours of eyes, makeup, clothing, shoes and many other things, provide an

Fig. 1 Example of SL appearance editing options

opportunity to create (or replicate) any possible look. Moreover, you can create an animal avatar, a monster avatar (such as a vampire), an alien avatar… the possibilities are endless.

The students in the course created their SL identities during the unit focused on exploring issues of identity formation, based on the works of Erikson (1950) and Marcia (1966). The students were asked to create avatar identities in their new virtual world as they were hearing lectures and discussing the larger concept of identity formation. Where traditional classrooms may have asked students to take a test to prove their knowledge of identity formation, SL allowed the students to actually examine the concepts in practice as they developed their avatars over a period of three weeks, blogging weekly about their experiences. While in the traditional classroom the teacher controlled the learning processes, in the virtual world it was the students who became the creators in their own avatar identity formation.

The evolving identities of the avatars were, however, not completely detached from the user's place-based selves, suggesting the importance of recognising the permeable boundaries between corporal world and the virtual world in navigating the educational possibilities of the dialectical relationship between place (students' everyday lives) and space (Wisdom Shores). Many of the students brought their personal views, perspectives and experiences into the creation of their avatar's identity, even if they did not realise it while they were in the process of creating it. For example, the only African American student in the class decided not to change anything about her initial avatar (that every resident picks upon entering the world and can edit afterwards). After analysing her interviews and blog posts, it became

apparent that she was unhappy with the underrepresentation of the African American community in SL choice of avatars and the absence of racial awareness in in-world communication, and her in-world decisions about identity were pushback against this. The avatar became a manifestation of the students' corporal world experiences even though SL is a theoretically new social and emotional landscape that does not carry any outside history (except, of course, the history the users bring with them). The avatars are separate but deeply connected to the users who create them.

At the same time, it is not entirely clear whether students perceived their avatars as students in SL (i.e. many did not seem to be translating their classroom experience and educational histories to the virtual world). The traditional hierarchy of the relationships and power structure of the classroom seemed to change once the students entered the virtual world. The teacher was present through his own in-world avatar, but the students almost never sought out any type of guidance or expertise to complete projects (which was the reason the teacher decided to have an in-world presence in the first place), or even communicated with him. Moreover, they engaged in some teacher-related activities (almost pranks) that they would never do in the real classroom. The instructor had a house on the island where students could come and ask questions. The house walls featured a picture of dragons. One of the students put a huge dragon on the top of the roof to "complement" the interior as well as several small dragons inside the house (see Fig. 2). Some other students, while riding a car, ran over the teacher assistant (they apologised for that). Students did not treat the instructor and TA as the authorities on Wisdom Shores; rather, they treated them as equals and actually became angry whenever the teacher attempted to create a hierarchical learning experience (e.g. teaching about constructivist-based education and asking the students to build a constructivist classroom). The students were still working on the activities given by the teacher; however, they did so on their own without communicating with the instructor; they were rather discontent when interrupted with suggestions or

Fig. 2 Dragon on the instructor's house roof

corrections. In other words, the evidence suggests that the place-based rules of being a student in the traditional classroom were no longer in place for them. They were students in the virtual world, but completely different types of students. What is interesting is that the students remained in their traditional schooling roles when they were in the corporal classroom over the course over the semester. They sat at their desks and listened quietly to lectures, they raised their hands every once in a while to ask non-probing questions, and they almost never challenged the authority of the teacher or the teaching assistants. The difference between the type of students they were in the traditional classroom and in-world actually increased over the course of the semester.

One of the most interesting aspects of the virtual world educational experience is that SL seemed to give (or students took) ownership over the island during their in-world activities. This sense of students' autonomy and ownership grew in time as they advanced in their technical in-world skills and soared the highest after introducing building. Building in SL allows users to create any object that one can imagine (see Fig. 3). If you cannot build something, you can always buy it on the SL Marketplace using the in-world currency. Therefore, even if you just buy and arrange things on the island, you still get the sense of ownership. The students did both. This was especially apparent in the situation when before one of the classes the TA deleted the trial buildings to clear space for further building activities. Students were very upset and angry that their work was deleted. Next time the TA left everything untouched and asked students to delete the buildings as they saw necessary, and there were no objections to this. In other words, through the act of virtually building something on their own, even though the act took place in the settings of a virtual world, students developed ownership of the island as their learning world: they were deciding where to place the objects and what objects would survive and what objects would be excessed. They were deciding what the island will look like, not the teacher.

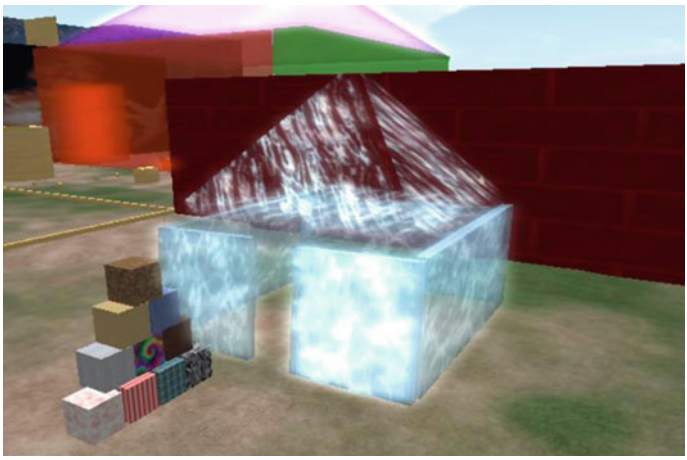

Fig. 3 One of the buildings created by students

From the constructivist and democratic education standpoint, the opportunity to build in-world is one of the most effective pathways to empowering students with agency in their own learning process. Building (which broadly includes manipulating things that one can buy on the Marketplace) causes the sense of ownership over the produced content. This sense of ownership allows students to engage in experimentation and exploration and can lead to deeper processing of information.

In Wisdom Shores, building was done in groups that were formed in-world in the beginning of the course by students themselves. Some students knew each other before starting the course, but most members of the groups did not know who were the avatars in their groups. From the blog post and SL chat analysis, it was clear that the students enjoyed working together, and the communication in groups was always friendly and engaged. It is interesting that the groups seemed to be completely separate from the classroom. The students engaged in active in-world conversations in their group chats during the class and communicated with each other on the blog as well, but in the corporal world they oftentimes did not even know the names of their groupmates.

The groups became the driving force in the process of building. All groups received general directions of the building activity (e.g. build a constructivist classroom) and then discussed what exactly they want to build, why and how they will do it. Group work also made the building process more manageable and faster. All the decisions regarding building were made within groups, and there were no questions directed to the instructor (except a few questions about technical issues).

To summarise, what was happening on Wisdom Shores was collaborative, predominantly autonomous knowledge construction, with students being in charge of the learning process and the instructor gearing the course towards the direction of students' thoughts and perceptions of the learning process. This is the way Dewey and Illich envisioned what education should look like.

Conclusion

Was the use of Virtual Worlds in education successful? This is a difficult question. When SL was successful it was extremely successful. There were times (e.g. during the identity unit) when the student weekly blog posts seemed much more reflective and imbued with higher-order thinking than blog posts in other classes (this particular class was run in parallel with another class using the exact same curriculum and weekly blogging by students). The students also seemed to achieve high levels of autonomy when engaged in virtual world activities—but this did not transfer back to their traditional classroom attitudes. As student autonomy became more advanced, particularly in activities involved building, it became more difficult for the teacher to maintain any type of control over the trajectory of those activities in Wisdom Shores. At times deep in the semester students seemed to become resentful of the teacher's attempt to control in-world activity. One of the students actually wrote a blog post with the title "We don't need no MAN tell us what to do".

The growing open-ended nature of in-world activity did not lead to greater exploration as anticipated. As a matter of fact it seemed to lead to confusion on the part of the students about what the activities on SL meant to them. Observations, interviews and blog posts suggested students were engaging in more democratic style education but perhaps one of the difficulties of being immersed in another world is it is difficult to recognise this. The process-based educative approach combines with the steep learning curve led many students to question the efficacy of the tool.

Wisdom Shores in the end became a place we did not really understand. It took on its own character and meaning. The avatars took on new roles that were more autonomous but also more confused. The experience convinces us that virtual worlds offer possibilities for radical transformation, but it will require a great deal of vital experience to understand it.

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