

Language educational space design in High Fidelity

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Abstract

The recent availability of fully immersive three-dimensional virtual worlds, such as High Fidelity and Project Sansar, provide important new opportunities for language education, and are capable of extending those already achieved in existing two-dimensional virtual worlds such as Second Life. A crucial aspect of these virtual language schools is the nature of the educational space or virtual architecture in which these virtual schools are located. Given the more complex user functionality and interactive demands of the three-dimensional platform High Fidelity, this project seeks to explore the potential for the design and development of virtual reality language educational spaces in these new environments, students' responses to these environments, as well as the challenges that face the teacher/designer.

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Attestation of Authorship

I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person except that which appears in the reference, attestation of authorship and acknowledgements, or the components carried out collaboratively. Nor does it contain material which to a substantial extent I have submitted for the qualification for any other degree of another university or other institution of higher learning.

Chapter 1: Introduction

Since the launch of the free online virtual world platform Second Life (SL) in 2003, many scholars and practitioners have sought to examine the potential of virtual worlds for language education (Dickey, 2005). As a result, a number of virtual language schools and learning spaces such as *Virtlantis*, *Cypris Chat* and *Language Lab* have been established in Second Life with varying degrees of success. In 2016, three dimensional virtual reality goggles, such as Oculus Rift and HTC Vive were commercially released. These were accompanied by the launch of a number of new totally immersive three-dimensional online virtual worlds, such as High Fidelity and Project Sansar, especially designed to use these emerging technologies. These new totally immersive worlds provide enormous potential for language teaching and learning, potentially exceeding the affordances of the earlier two-dimensional Second Life. However, because these innovations are relatively new, the possibilities of language education in these emerging three-dimensional worlds have yet to be determined.

Using the new Virtual World High Fidelity and Oculus Rift three-dimensional wearables, this project attempted to examine the design potential and student usability of language learning spaces in the emergent virtual world of High Fidelity, as well as the challenges that the design of such space in this new virtual environment presents to the educator /designer. In order to achieve this, the research project was primarily practice-based and the focus was on the exploratory development of virtual language learning spaces in High Fidelity, however it will also included a user experience design approach, including an observation of user experience, and user interviews. The results of this process, along with reflections on the demands and successes of engaging in the development of virtual education resources for language learning are included in this exegesis, which accompanies the High Fidelity project. The design and build of the virtual language teaching space was a partly collaborative project with another Master of English and New Media Studies (MENMS) candidate, Andi Chen, who was primarily focusing on the design of educational resources in three-dimensional virtual worlds.

The thesis, comprising the development of a learning space in High Fidelity (called KiwiLearning-Space), user evaluation of these developments and the accompanying exegesis, attempts to answer the following questions.

- i) What is the potential for the design and development of language learning educational spaces in the new three dimensional, totally immersive, virtual reality environment of High Fidelity?
- ii) How might potential learners respond to and interact within this virtual educational space?
- iii) What demands and challenges does the design of virtual educational spaces in High Fidelity present for language educator designers?

This exegesis is divided into 7 chapters. Following this introduction, Chapter 2 will provide an overview of the literature on language educational spaces in virtual worlds. This will be followed by a discussion of language learning spaces in Second Life to provide examples of existing practice. Chapter 3 will discuss the methodological underpinnings and resources employed throughout this research. These include a discussion of the notion of reflective practice. Chapter 3 will also discuss the process and tools of the user evaluation approach used to assist the ongoing development of the High Fidelity virtual education space, including the observation protocol, and the accompanying interviews used to evaluate the users' experience of the space. Chapter 4 will first briefly provide a description of the new online platform High Fidelity and its affordances, followed by an initial description of the virtual language educational space built in High Fidelity and how it draws upon concepts discussed in the literature, as well as my own views of virtual learning spaces developed from my explorations in Second Life. Chapter 5 and 6 will provide the results of the two phases of user evaluation, and the changes made to the design of the virtual education space in High Fidelity after each evaluation process. The final Chapter 7 will provide a reflection on the issues, problems and benefits of designing a virtual language education space in the High Fidelity platform and provide implications for future language educators thinking of attempting a similar endeavour.

Chapter 2: Review

A Virtual World (VW) is defined as “an electronic environment that visually mimics complex physical spaces, where people can interact with each other and with virtual objects, and where people are represented by animated characters” (Bainbridge 2007, p. 472). Online virtual world platforms such as *Second Life* and *High Fidelity* have attracted the attention of an increasing number of people interested in interacting with, and creating spaces in, these virtual worlds through their avatars. Some have been interested in the creation of virtual learning spaces, including those for language education (Pfeil & Zaphiris, 2009). These virtual learning spaces, however, are quite different from traditional real-life classrooms, and as a result, they can be quite challenging for some educators and learners.

Education spaces are no longer defined by the physical boundaries of their campus, but by the entire student experience (Watson, 2003) and therefore can include the virtual. In these new virtual spaces learners may have experiences which traditional environments are not able to provide. Lea and Nicholl (2002), for example, state that the virtual education space offers ‘off-campus’, ‘distance’, ‘open’ and ‘flexible’ learning. Virtual learning spaces like *Second Life* can also provide learners with easy access to videos, audio, notecards, blogs, discussion forums and various virtual education scenarios. Such affordances can offer a wider range of interaction among students especially for those engaged in language learning.

A review of the literature suggests that there are four key fundamental outcomes for a virtual learning space design.

Facilitation of student engagement

According to Coates (2005), the concept of student engagement is based on the hypothesis that learning is positively affected by a learner’s participation in goal-directed activities (Coates, 2005). Pascarella (2005) argues that student engagement is an important indicator of learning effectiveness and Astin (1985) states that learners learn by being involved and therefore education is not simply a process of the teachers imparting knowledge, but also necessitates an engagement with learners. Hence, Huba and Freed (2000) state that student engagement is one of the most crucial areas to consider when designing a learning space. In addition, Kearsley (1995) says that a very active engagement is desirable and promotes the efficiency of virtual learning courses. This requirement for

engagement has led to the development of guidelines for designing learning spaces in virtual worlds (Roblyer & Ekhaml, 2000), and Kern (2009) claims that online virtual world platforms, which offer immersive experiences, such as Second Life, can provide virtual representations of actual world spaces that are designed to facilitate student engagement. Several virtual learning spaces also allow students to participate in learning activities which include attractive audio, video and text. Research have demonstrated that learners succeed in virtual learning spaces when they engage in the activities actively (Verneil & Berge, 2000).

Provide sense of a belonging

Dourish (2006) claims that virtual educational spaces should offer students a sense of purpose and belonging, and similarly Rovai (2002) states that a sense of belonging is the most crucial element of virtual learning environments. A virtual learning space should therefore be one where students feel as if they share a common purpose, are warmly welcomed and are engaged in high quality activities. Nistor (2015) suggests that to achieve this goal, students must be offered chances to share their lived experiences and personal backgrounds. He also states that a common mission or goal can help students to feel more connected to others and therefore may be more positive in their online contributions. Northcote (2008) also points out that “a sense of place is needed in online learning communities” (p. 676). Citing Fontaine (2002) she states that rather than conveying simply a sense of remote presence, a sense of place is where educator, learner, community identity and presence are recognized, and incorporated into the online virtual educational space design at a detailed and overall level.

Offer motivation to learners

Motivation is often regarded as having the most influence on an individual’s ability to study, or not study, foreign languages (Baker & MacIntyre, 2003). Virtual worlds provide educators with the potential to create or use learning environments that can simulate immersive spaces and contexts which are interesting and exciting for students and offer similarly motivating learning activities (Dickey, 2005). Deutschmann (2009) states that the motivation offered by this kind of new medium furnish affordances that are not always available in physical educational spaces, particularly those where learners performance are lacking. One study on language acquisition by Peterson (2006) used virtual worlds and found that learners are not only able to more easily communicate with others in foreign language, but able to accomplish various kinds of tasks involving language learning. By designing a virtual space filled with abundant scenarios, learners may become more motivated to learn their target language.

Evaluation of learning spaces in Second Life

Second Life is currently the most popular two-dimensional online virtual environment for the creation and use of virtual learning spaces. In this section, I attempt to identify and evaluate some important elements of these virtual learning spaces. The findings may provide inspiration for designing a language learning space in the three-dimensional platform, High Fidelity.

Flexibility and comfort

Oblinger (2006) claims that flexibility and comfort are crucial elements when designing both physical and virtual learning spaces. In terms of flexibility, spaces should enable users to move easily from one activity to the next (e.g. from a traditional lecture to independent group work) and the flow between activities should be immediate. As seen in the Second Life learning space *Ilha Unisinos* (Figure 1), this might involve the development of an expansive space with various kinds of interactive tools, such as virtual white boards and places for avatars to sit or assemble. Oblinger also states that these spaces should be capable of easy reconfiguration to support various kinds of activities.

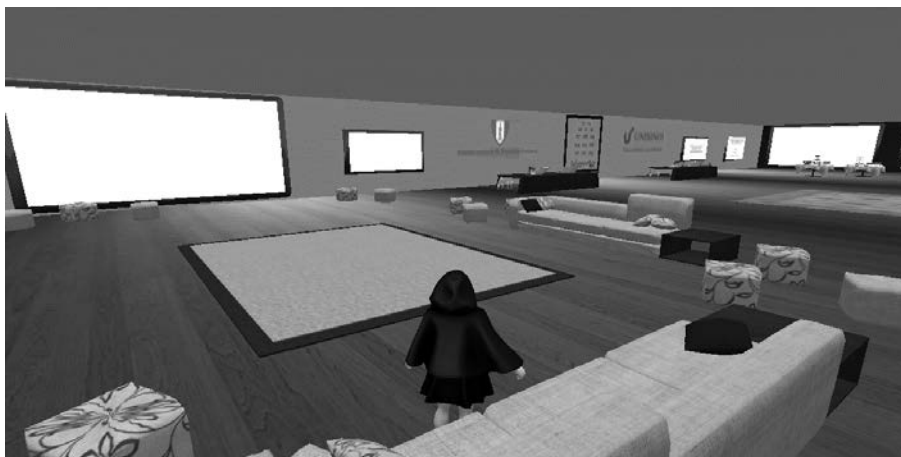


Figure 1: The “Ilha Unisinos” learning space

Nevertheless, flexibility in a learning space is not limited to the ability to access or reconfigure a variety of learning tools and chairs, but also includes the ability to quickly move from one learning environment to the next (Minocha & Reeves, 2010). In Second Life, this is often carried out through the use of teleport devices, which enable avatars to instantly move from space to space (Figure 2).



Figure 2: A teleport point from where learners can be instantly transferred to another destination.

While comfort is generally associated with the physical world, for example, with chairs that allow learners to sit comfortably for long periods, in SL the harmony of colour and space, and the representation of spaces and objects often associated with relaxation in the physical world, can simulate comfort for the participant in a virtual world (Figure 3). As Chism (2005) suggests, discomfort in either the virtual or physical world “makes a compelling distraction to learning” (p. 2.6).



Figure 3: A harmonious outdoor learning space in Second Life named Shimmer Island.

Traditional classroom and outdoor/informal learning spaces

When referring to a learning space, the majority of educators describe it as a place where learning occurs, or where learners are able to interact with other learners (Minocha & Reeves, 2010). While in the physical world such a learning space is still constrained by the traditions of the conventional classroom or lecture theatre, the types of learning spaces found in a virtual world, such as Second

Life are very broad and can include spaces that resemble a more traditional classroom, or a spaces that resemble a dessert island. Figure 4 shows a virtual classroom that mimics a more traditional classroom setting. Like the real life classroom, this traditional design reinforces traditional relationships of authority and formality between students and educators. Design decisions in these traditional spaces are often limited to concerns such as the space between desks, and are dependent on the designer's sense of whether avatars may feel crowded in these space or whether their movement may be difficult (Figure 4).



Figure 4: A more traditional virtual classroom in “Learn It Town”

Learning spaces that are situated in the virtual outdoors, such as those found in Cypris Village (Figure 5) are representative of less stressful physical spaces and aim to create virtual learning spaces which can appear more relaxing to the student user. They also provide areas for exploration, and are potentially easier spaces to navigate for learners who are not familiar with controlling their avatars. ‘Outdoor’ learning spaces also facilitate the development of more informal learning settings, such as circular seating (Figure 6), which can enable interaction among all learners. Additionally, informal learning spaces in a virtual world such as Second Life might take the form of other contexts, such as shops or recreational facilities. These serves as spaces to both learn and play. Figure 7 demonstrates a restaurant in a language learning space called Learn It Town.



Figure 5: An outdoor learning space called “Cypris Village”



Figure 6: Informal seating in an outdoor setting



Figure 7: A pizza restaurant in “Learn It Town”

Visual aesthetics

The visual aesthetics of learning spaces in Second Life are crucial elements in any design. Appropriate visual aesthetics design can attract users' focus (Glore, 2010). Furthermore, studies show that certain visual images have an effect on users' performance (Elliot et al., 2007). They are also closely associated with students' mood and willingness to engage in their learning spaces. Thus, it is significant for educators to think about aesthetic quality when designing a virtual learning space.

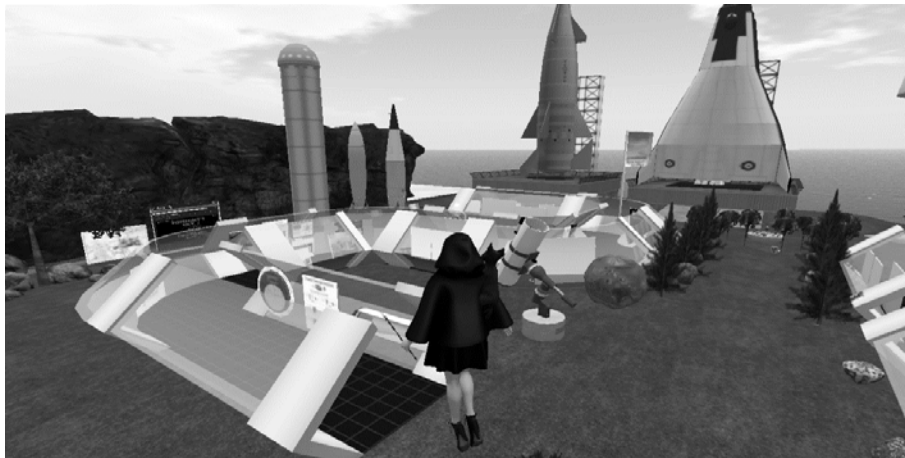


Figure 8: Exhibition corridor in “Spaceport UK”

Lester (2006) has identified several strategies for utilising SL as a virtual learning space. These strategies, which may also be useful for designing and using High Fidelity, are shown below:

- i. Learn about and explore SL as frequently as possible before beginning your design.
- ii. Communicate with other designers and educators who are using SL at present.
- iii. Set a concise goal before beginning your design.
- iv. Record your experience in SL and share the skills you have learnt with others (through online forums, etc.)
- v. Keep track of the potential of the different designs of existing SL learning spaces and think creatively about your own design
- vi. Evaluate feedback from learners' experiences.

Chapter 3: Methods

The next section examines the methodology for the project. Due to the collaborative nature of certain components of this research, the methods section was developed with my collaborator Andi Chen, in consultation with my supervisor.

Research Framework

The research framework was firstly practice-based in that “an original investigation is undertaken in order to gain new knowledge partly by means of practice and the outcomes of that practice” (Candy, 2006, p. 3). For Dirkx (2006), practice-based research emphasises meaning arising within practice, and practitioner construction of knowledge. The study’s questions regarding the potential of language learning educational spaces in the virtual environment of High Fidelity, and the demands and challenges that this process presented for language educator/designers, were established through an ongoing process of practical experimentation and reflection-in-action (Schön, 1983), which focused on the ongoing queries, challenges, and issues that arose as the virtual spaces and resources are developed by the researchers (Dirkx, 2008).

Secondarily, in keeping with contemporary approaches in practice-based research (Yee, 2010), and drawing from user design methods (e.g. Goodman, Kuniavsky, and Moed, 2012, Kuniavsky, 2003), the research also involved the collection of qualitative data through observations of users engagement with the educational space and resources at two stages of development, followed by interviews to ask about the users’ experience of engagement. This answered the second research question focusing on how potential learners respond to and interact with the virtual educational space. User observations can provide information about a practice, or artefact resulting from a practice, regarding the way it is actually engaged with, in contrast to what the researcher or designer might have expected (Kuniavsky, 2003). Interviews with users often follow observations of user experience (Goodman, Kuniavsky, and Moed, 2012). Information from the user observation and interviews also provided the researcher with insights for the ongoing development of the virtual educational space and resources. Importantly, this ensured that the development of the language learning space, and the subsequent reflection on the challenges and demands involved in carrying out this development, corresponded with the expectations of the intended cohort of users.

Finally, given that High Fidelity is a web 2.0 online platform developed for participatory engagement, the research/practice also involved collaborative knowledge creation and production (Yorks, 2007) as the two researchers involved in this project collaborated both online and offline in the development of the educational space and accompanying learning resources in High Fidelity. It is important to note that within the disciplinary context of digital humanities in which this project is broadly located, it is not the focus of the researcher to produce a flawlessly completed and evocative object (Whitson, 2015). Instead, and according to Ratto (2011), the “shared acts of making” and “practice-based engagement” (p. 253) found in the production of objects in fields such as the digital humanities, function to enable critique, reflection and expression on technology and/or society. According to Whitson (2015), such critically focused making often involves a DIY (do-it-yourself) approach, which he states “encourages the return to a hands-on approach to technology that is often connected to computation” (p. 158). The development of the learning space discussed in this exegesis should be considered as such an artifact.

Gathering and processing of data

Practice-based data

The practice-based data arose through the process of reflective practice, that is, the ongoing process of experimentation and reflection that occurred as the researcher worked on developing the virtual educational space in the High Fidelity online platform. As indicated by Schön (1983), much of the reflective knowledge gathered from this data was tacit. However, some aspects of the reflective process was captured in the entries of researchers’ personal reflective blogs. Online blogs are recommend for the purposes of reflective thinking and critique (LaBanca, 2011). They also allow the thesis supervisor to easily access the researchers’ progress and developments at any time in order to provide support and feedback (LaBanca, 2011). Practice-based data and knowledge (tacit or conscious) was fed back into the development of the virtual educational space and learning resources. The practice-based development of the virtual learning space and resources took place in a room at Auckland University of Technology, where the virtual reality equipment was located.

Observation and interview data

Once the development of the virtual language learning space had advanced to a level that facilitated user engagement, the researcher invited participants to experience the space and resources. This occurred twice, the first time in late August, 2017 and the second time in late October, 2017. It also took place in the room at Auckland University of Technology where the virtual reality equipment is

located. Observational data and interview data were collected from these participant user experiences, and this took place in the following way. Prior to the collection of observational data the participants were introduced to, and shown how to use, the virtual reality hardware, informed about the nature of the virtual educational environment, and what they were required to do. They were also informed about the process of observation. Once the participants were engaged in the virtual educational space, observational data was gathered by the researcher as they watched the screen of the computer, which reproduces the participants' engagement in the virtual educational environment. The researcher took notes about the participants' movements and actions in the space, including the way they approached and used the learning resources. Notes were also taken about the participants' engagement with the virtual reality hardware and their level of comfort. Participants were not able to see or be distracted by the observation process, as they were wearing virtual reality headsets. In this observation process, the researcher's aim was to play a neutral role, however at times, they needed to guide or assist the participant if they encountered difficulty.

Once the participant finished engaging with the virtual educational space and resources, they were asked a number of questions about their experience. The interview questions were semi-structured and asked participants about the usability of the space, their comfort when using the space, their likes and dislikes about the design of the space, and their general experiences of engaging in an educational environment through virtual reality. The interviews also took place in a room at Auckland University of Technology where the virtual reality equipment is located. The participants were informed about the interview process during the introduction. They were also told that if they felt any discomfort after their virtual reality experience, the interview could be carried out at another time of their choice. The user experience protocol and the interview questions can be found in Appendix A.

Analysing data

According to Candy (2006) "practice-based research is an original investigation undertaken in order to gain new knowledge partly by means of practice and the outcomes of that practice" (p. 1). She states that claims of originality and contribution to knowledge related to that practice can be shown through outcomes in a number of forms, including digital media. Hence, the reflective process involved in developing the object of the practice, as well as the object of the practice itself (the virtual environment and the language resources collaboratively developed by the researchers), is also a method of analysis (see also Barrett and Bolt, 2007; Nelson, 2013). The use of the online blog enhanced the reflective processes by enabling many of the reflections emerging from practice to be

noted for later retrieval, analysis and discussion with the researchers and supervisor. The qualitative observational notes and interview data were examined for recurring patterns, for example, recurring negative experiences in the participants' use of KiwiLearningSpace. These patterns are indicated in Chapters 5 and 6. Important findings from the qualitative data were reworked into the ongoing design of the virtual educational space and virtual resources.

This project received ethics approval on 31st July, 2017, by the Auckland University of Technology Ethics Committee (Ethics number 17/188).

Chapter 4: The Language Learning Space in High Fidelity

High Fidelity

High Fidelity is an online new media platform where users are able to explore and create virtual spaces. Potential users can be provided with access to use the platform, which supports both Oculus Rift and Vive virtual reality hardware, including goggles, hand controllers and spatial sensors. The main focus of High Fidelity at present is its capacity to easily create a virtual space and experiences where the user, as an avatar, can interact with others. Every virtual space in High Fidelity is essentially a small 3D world, filled with the models built by designers (Russell, 2015) using either external 3D modelling software such as Blender, or added from those available in the internal High Fidelity market. High Fidelity is currently in the Beta stage, that is, it is still in the process of being tested and developed. Users in the virtual space of High Fidelity can learn from, chat with, and engage with other users. Like the real world, the user's avatar can walk around and interact with their virtual environment. However unlike the real world, users can also fly and teleport from place to place. The primary difference between the virtual world Second life and High fidelity besides the latter's three-dimensional nature, is that the space designed by the user, referred to as a *sandbox*, is located on the user's hard drive, rather than an external server.

The virtual language learning space developed for this thesis in High Fidelity is named *KiwiLearningSpace*. This is because it was decided that a space that focused on the learning of New Zealand words and expressions would be a worthwhile space to develop. A fee was paid for this unique name, which also meant that High Fidelity would permit other users to access the space. Some of the virtual models in KiwiLearningSpace were selected from High Fidelity's Market and the others were constructed in Blender. In addition, the High Fidelity platform enables the creation of texts and website links in the virtual space, and audio can also be added. The next section describes some of the central components of *Kiwi Learning Space*.

Spaces in KiwiLearningSpace

The Fish and Chip Shop

In New Zealand, fish and chips is a popular dish and an extremely common take-away food. In the Kiwi Learning Space, a Fish and Chip shop was created to enable students learning NZ English to

engage in a simulation-based scenario which can help them with vocabulary and interactional expressions related to the context of buying fish and chips (Figure 9). It contains models of chips, cola, sauce and a board with a typical service encounter.



Figure 9: Indoor decorations in the Fish & Chips shop

The Teleport Centre

Learners first enter KiwiLearningSpace at the Teleport Centre. The centre contains the different portals which allow users to teleport to different destination. A teleport centre which enables potential learners to quickly teleport to any place in the virtual environment can improve the learning effectiveness of that environment.



Figure 10. Several teleports in the teleport centre

The Clothes Shop

The clothes shop provides different kinds of clothes, hats, and shoes, etc. In this space learners are able to practice the type of service encounter which may happen in a real life clothes shops (Figure 11).



Figure 11. Various kinds of clothes in the clothes shop

The Word Corridors

When a first year student arrives in New Zealand, they are probably confused about the Kiwi words they routinely hear. The word corridors in Figure 12 contains cards which introduce students to some of these words. In KiwiLearningSpace they are presented along both sides of a crossroad.

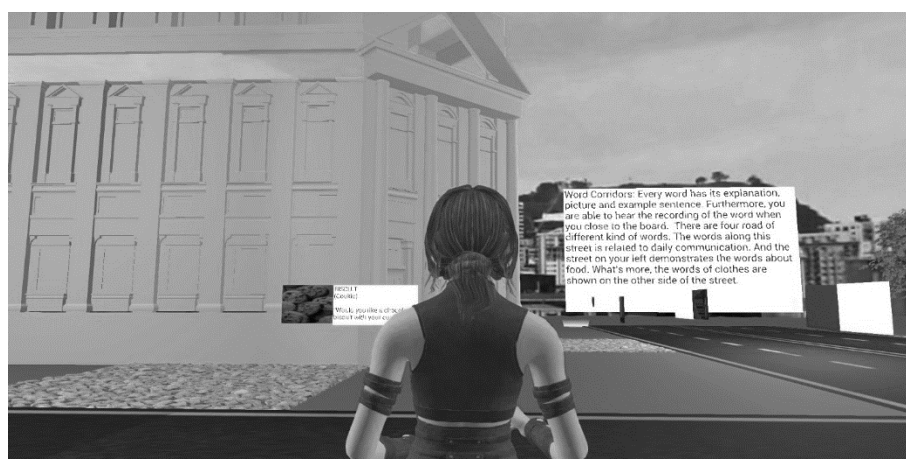


Figure 12: A word card on words corridor

The Cafe

The KiwiLearningSpace cafe resembles the cafe in real life (Figure 13) and includes a counter, coffee cups, tables, and menu. The café includes a textual and audio example of the type of service encounter

typically experienced in a café. Student users can also immerse themselves in the NZ-style coffee culture at this Cafe.



Figure 13. Inner decoration in the café

The Playground

As Figure 14 shows, there are various kinds of recreational facilities in the playground. These provide the student users with the opportunity to relax after their English learning activities.



Figure 14. The recreation facilities in the playground

The Reading Room

The room offers several narratives about New Zealand. Student learners have access to them at any time. It is contained in a building that resembles a physical classroom (Figure 15).



Figure 15. The story boards in the reading room

The Testing Room

After finishing learning in the space, students are able to test themselves in the Testing Room. The test board could be adjusted by learners to a suitable visual angle as seen in Figure 16.



Figure 16. Adjustable test boards in the testing room

Outdoor Learning Space

Unlike traditional classrooms, the outdoor learning classroom provides students with a more relaxing place to learn (Figure 17).



Figure 17. An outdoor classroom

Chapter 5: User Evaluation 1

Observation results

The following are the summary results of the user observation, which involved observing and taking notes on the participants' experience of the virtual educational space and its learning resources. Any important comments made by the observers were also noted. As the observation and interviews were carried out and written up in collaboration with my collaborator on KiwiLearningSpace, Andi Chen, the next sections identifying the findings of the observation of students engaged in using KiwiLearningSpace and post-use Interviews are the same as those in Andi Chen's exegesis. The protocol for the observation can be found in Appendix A.

Observations on participants' initial engagement.

It was observed that most of the participants found it easy and comfortable to wear the Oculus Rift goggles. This was most likely the result of the tutorial provided to participants beforehand. Only one participant found the goggles tight, while two others had to remove their glasses first, with one of these having difficulty viewing the space clearly due to short-sightedness. Oculus Rift does suggest that glasses can be worn under the goggles, but it was found that this was not necessarily the case in practice.

Observations on the participants' movement around the space.

Most participants found it easy to move around and visit the different places in the language educational space. However, as they explored the space, a number complained that their avatars could not walk naturally or fly (flying is a conventional way of moving around in 2D virtual worlds). Instead, they could only teleport from point to point to move through the space. Interestingly, most current 3D totally immersive virtual worlds and games that use virtual reality (VR) headsets, have decided to use the teleport cylinder system as the default method for moving (see Figure 18), primarily because walking and flying in VR typically causes dizziness. High Fidelity in fact does include affordances for walking and flying, but for these modes to be included, adjustments to the settings are required. These were carried out in preparation for the next evaluation stage.

Another way of moving avatars in Virtual Worlds is through pre-established portal points, which allow an avatar to jump immediately from one designated point in the educational space to another.

One participant found it difficult to move onto the portals to enable the teleport. Another participant complained that more instructions were required to identify how to move around the space.



Figure 18: Teleporting cylinder method of moving in VR

Observations on the participants moving in VR o the portals to enable

All of participants were interested in the learning resources found in the various individual learning spaces. One participant tried on many of the clothes in the *Clothes Shop*, and another explored the games in the *Playground*. Another participant liked the audio component of the word corridors and suggested that the continuous audio repetition of the New Zealand words were helpful. This participant also liked the *Quiz*. While they enjoyed the resources, two participants found the virtual Fish and Chip shop space a little boring, and another wanted more words in the word corridor. One participant complained it was difficult to find out where the Reading Rooms and Testing Rooms were located. A number of the participants were expecting to communicate with other avatars in order to practice the words and interactional expressions they learned in the various learning spaces.

Observation of participant difficulties.

It was observed that participants found the lack of instructions regarding where to go and what to do one of the major issues with the learning space. Although a detailed map and general introduction to the different areas and their functions could be found in *The Teleport Centre* (the entry portal for the learning space), further instructions, directions and information were required in the different individual areas. Another area of noticeable difficulty was that participants found it difficult to pick objects up using the Oculus Rift hand controllers. Another participant had problems with the hand controllers in that they repeatedly called out the menu tablet when it wasn't required.

Other observations

Two of participants complained that they felt dizzy after finishing the evaluation. One participant pointed out that there are some bugs in High Fidelity which made interaction with the space difficult. Only one participant repeatedly went to the wrong places because they had difficulty using the rift. Participants stated that they enjoyed listening to the audio of the words.

Interview feedback

The following are the summary results of the post-use survey which asked participants questions about their experiences of KiwiLearningSpace, as well as the use of VR in education more generally.

1. What did you think about the design of the educational space?

Participants positively described the first design of the High Fidelity learning space as functional, practical and an innovative way to be educated. They also commented positively on the learning focus of New Zealand English, and the ability to receive feedback on knowledge learned from the space, through the multi-choice quiz. However, importantly, participants also thought that the space was lacking detailed instructions that would guide the user around the space, and that there was a lack of activities or situations that the users could engage with. One participant also suggested that the design of the space could be more attractive.

2. Was it easy for you to move around the space? Why/why not?

All but two, participants suggested that it was easy for them to move around the virtual space. The signage and reaction time of the hardware was said to have assisted their movements. Of those that found it difficult, however, one stated that their difficulty was due to their inexperience with the Oculus Rift. While most participants found the teleport cylinder approach easy to handle, one stated that they preferred to move directly, rather than use the teleport approach.

3. Did you know where to go and what to do in the space? Why/why not?

Most of the participants stated that they easily established where to go and what to do in KiwiLearningSpace. They cited the labelling, signs and instructions as helpful. However, some excellent suggestions were put forward. One participant stated that signs near the teleports would help identify where to go, and another stated that more detailed instructions in the various specific areas, such as the clothes shop, would be useful.

4. Did you feel comfortable when you are in the space? Why/why not?

All but one participant responded positively about the comfort of KiwiLearningSpace. One of those who responded positively added that it was “relaxing” and “just like real life”, while another said it made them feel like a “superman”. One also liked the familiarity of the Auckland scenery. In contrast, one participant mentioned that the Auckland scenery was not clear enough and needed to be more stereoscopic. The lack of comfort felt by one participant was due to the dizziness they experienced when using the VR goggles.

5. What did you like about the design of this virtual educational space?

When asked about the design of the space, many aspects and areas of KiwiLearningSpace were mentioned by the participants. The responses show that a third of participants liked the design of the word corridor, with one stating that it is “useful for the people who come to NZ for a short time”. Another participant stated that she liked the clothes store, while another found the playground activities interesting. Two comments positively mentioned the graphic quality of the space.

6. What didn't you like about this space?

Again, when asked about their dislikes of KiwiLearningSpace, there were a variety of different opinions. Two participants suggested that the space could include more shops and that the existing shops could be improved. Another said more examples of English conversation needed to be included in the shops; for example, a dialogue about buying clothes in the clothes shop. Furthermore, one participant suggested that the audio for the definition of the words should be added to the space, and in contrast to the responses in the previous question participants claimed that the graphic quality of the space could be improved.

7. How can the educational space design be improved?

Most participants responded that more and better facilities were required to fill KiwiLearningSpace, and that the design of the street, shops and rooms should be detailed. More entertainment was also required in the playground. Furthermore, one of participants usefully suggested that words in the word corridor could be grouped into certain themes or situations.

8. *Was it easy to use the learning materials? Why/why not?*

All, but one participants stated that the learning materials, in particular the word corridor, as easy to use. They liked seeing the words in real-life contexts, viewing the clear explanations and accompanying image, and hearing how to pronounce the word. They also found it easy to move from word to word.

9. *Were the learning materials useful? Why/why not?*

All participants positively described the learning materials. Three said the words are useful for everyday communication in a New Zealand context, for example, they are “useful to communicate with Kiwis and shortened the distance between foreigners and native speakers”. The materials were also seen as helpful for learning new words and improving reading. However, one participant indicated that the words could have been displayed in a more interesting way instead of being cards on street.

10. *What did you learn from the virtual learning materials?*

All most all participants identified learning new words which they viewed as being helpful for their daily interaction with native speakers of English in a New Zealand context. One participant mentioned that the Quizzes helped them to check what they learned, while another suggested their learning primarily involved Kiwi culture.

11. *How can the learning materials be improved?*

A quarter of participants suggested that clearer instructions would help improve the learning materials. Suggestions for instructions included the addition of signs, and arrows on the floor, to direct users to their next destination. As above, two participants stated that grouping the words in the word corridor thematically would help them to be more easily remembered. The number of the words could also be increased, as could the number of images. One participant stated that it would be necessary to constantly upgrade the materials, and that users’ feedback could be collected, to assist with this.

12. *Do you like learning in virtual reality?*

Almost all of the participants stated that they enjoyed learning in VR (e.g. *I love it, easy and fun, informative, exciting, the images are fancy and dynamic*). The view that it would be particular accepted by the young was also expressed. Two students suggested it was an important development for students who live some distance away from the institution (*it will help me to save the bus fee*). One participant stated that their preference for learning was in the real world, while another participant worried that the emphasis on play might obscure the purpose of learning.

13. *Did you enjoy learning in this virtual educational space? Why/why not?*

The participants were very positive about their learning experience in KiwiLearningSpace. One student stated, for example that:

It is useful for foreigners. For example, it can show what Queen St looks like to Chinese when they are in China. It provide realistic teaching and students will be more interested in this mode. It broke the limits of geography.

While another stated that:

Compare to the traditional learning style, the knowledge is easier to be understood and remembered.

As above, others stated that KiwiLearningSpace made the learning process more *enjoyable, interesting* and *fun*, and stimulated the brain more. Two participants mentioned liked the novelty of the KiwiLearningSpace method and its promotion of self-study.

14. *Do you think this kind of virtual self-learning is useful? Why/why not?*

The participants provided a lot of interesting and varied responses for this question. Four explicitly identified it as useful for independent learning, with one participant stating that it is a convenient and dynamic way to self-study. Two pointed out its contemporary significance, for example, *the book is not popular anymore so that VR is easier to learn knowledge and this method becomes an essential trend and an increasing amount of people tend to accept virtual education*. However, one participant worried that students may view it more as a game instead of studying. Another stated that while useful, KiwiLearningSpace required clearer instructions. The only participant who did not find this kind of virtual self-learning useful stated it needed more interactive design.

15. *Would you like to experience learning in this virtual space again? Why/why not?*

All participants stated that they would like to experience learning in KiwiLearningSpace again and provided a variety of reasons. These included the ease of learning (*It's easy to memorize all the learning material through the fun learning environment*), the ability to experience the culture of somewhere that had never been visited in real-life, the convenience, the ability to combine learning with gaming, that it was the *trend*, and the enjoyment. One participant was keen to receive updates and details about KiwiLearningSpace.

Changes made after user evaluation 1

It was observed that some participants claimed that they found it difficult at times knowing what to do and where to go sometimes. Therefore, arrows with information regarding particular destinations were added (Figure 19).



Figure 19: Arrows in the learning space

The sequence in which avatars explore KiwiLearningSpace can be important for some learners. Therefore instructions identifying a possible pathway through the space were placed in the Welcome Centre (see Figure 20).



Figure 20. Introduction in Welcome Centre

Furthermore, as Figure 21 shows, the skybox was changed to one with higher pixels, as it became evident that the participants valued visual aesthetic as a crucial element in the design of KiwiLearningSpace.



Figure 21: The new skybox

In order to build a learning space that characterised New Zealand, models that represented aspects of New Zealand life and culture were added (Figure 22). Such simulated environments might provide learner/users with a potentially stimulating place for language learning.



Figure 22: New Zealand style buildings

In user evaluation 1, several participants responded that the space probably required more learning scenarios. A café was added to address this concern. The cafe involved a Kiwi-style coffee culture including the presentation of various kinds of coffee ordered in New Zealand and a tutorial text and audio to provide users with the potential for learning language.



Figure 23. The new café

Chapter 6: User Evaluation 2

The second user evaluation involved eight new participants, i.e. they were all different from those that participated in the first user evaluation. All participants were learners of the English language and studying in Auckland, New Zealand. As the observation and interviews were carried out and written up in collaboration with my collaborator on KiwiLearningSpace, Andi Chen, the next sections identifying the findings of the observation of students engaged in using KiwiLearningSpace and post-use Interviews are the same as those in Andi Chen's exegesis. The protocol for the observation can be found in Appendix A.

Observations

Observations on participant's' initial engagement, including adjusting to the VR experience, adjusting to the equipment and spatial adjustment.

It was apparent that the majority of participants found the Oculus goggles comfortable, easily adjustable and easy to wear. However, for the five near-sighted participants who wore glasses, the goggles provided some initial difficulties. They found the goggles a bit tight or heavy on top of their glasses, while others, who forgot, or decided not to wear glasses under their goggles found that the virtual world lacked a degree of clarity. All participants had enough space to move their real bodies in the room.

Observations on the participant's movement around the space.

After spending time becoming used to High Fidelity, all participants could freely walk around, fly and teleport. Three participants sat down, rather than stood up to carry out the evaluation.

Observations on the participant's engagement with learning resources.

The new cafe appeared to be the most popular space for four of the eight participants, where one participant listened to the service encounter audio a number of times. Three participants spent most of their time in the word corridor, with one who also used the quiz in the Test Room stating that "it is interesting to learn the word in this way". Another, however, suggested that the pronunciation of the words could be indicated by the inclusion of IPA symbols. Participants also visited the fish and chip shop, the clothes shop and the playground, showing a broad interest in the different learning spaces in KiwiLearningSpace

Observations of participant difficulties.

Although the participants' initial engagement with the VR experience was generally positive, some difficulties were observed as they continued to engage in KiwiLearningSpace. The most common problem was dizziness, with three participants mentioning that they felt dizzy. It was also evident that two participants needed additional time to get used to using the Oculus Touch controllers, in particular one who found it difficult to pick up objects.

Other observations

It was evident that all of the participants, except one, felt a sense of dizziness when exploring the space through the touch controllers. The one participant who did not feel dizzy, stated that they regularly played computer games. This participant was able to explore KiwiLearningSpace more easily than the others.

Survey*1. What did you think about the design of the educational space?*

All participants were positive about the design of KiwiLearningSpace (*really good, useful, brilliant, good, clear, quite good*). However, four stated that it could be further improved with more detailed modelling and a better design. One participant wanted more interactive audio.

2. Was it easy for you to move around the space? Why/why not?

Five of the participants thought it was easy to move around the space. However, as above, the other participants felt that the movement was impeded due to the feeling of dizziness.

3. Did you know where to go and what to do in the space? Why/why not?

This area was significantly improved from the first user evaluation. All participants found it easy to know where to go and what to do in the space (*good structure, clear (x3), simple directions, clear notes to guide where I need to go, useful guide, introduction*)

4. Did you feel comfortable when you are in the space? Why/why not?

Again, this question resulted in six responses referring to the feeling of dizziness. Two participants, however, stated that they felt comfortable in the space. One of these indicated that they had used

virtual reality before. This suggests that overtime users may lose the feeling of dizziness that occurs when virtual reality is first experienced.

5. What did you like about the design of this virtual educational space?

Four of the participant were positive about the design of the virtual space because it resembled the real world, and two commented positively on the design of the skybox. One enjoyed the novelty of the experience, while two commented on ease and enjoyment of learning English or new words in the virtual environment. One participant praised the modelling, i.e. the café and the fish and chip shop.

6. What didn't you like about this space?

With perhaps the exception of the two participants, who mentioned that the modelling could be improved, there was no dominant pattern of criticism. One participant mentioned that the road signs could be clearer, another felt that the words cards floating in the air looked *weird*, and another was critical of the stairs at the welcome centre. One participant responded that there was nothing they did not like about the space.

7. How can the educational space design be improved?

Again, while participants provided some useful advice, there was no pattern of response to this question. One participant usefully suggested that the word corridor audio should initially be played only once, and repeated only if the user wanted. Other suggestions included more entertainment in the playground, more content overall, more modelled buildings instead of images, more pedestrians in the street, and a signal to indicate the completion of the user's mission.

8. Was it easy to use the learning materials? Why/why not?

All participants were very positive about the learning materials in the revised version of KiwiLearningSpace, with five specifically pointing out their simplicity and clarity of use. One participant claimed that the combination of audio and word cards enriched the scenario. However, the lack of interaction with others in the learning environment was raised again.

9. Were the learning materials useful? Why/why not?

Again, every participant thought the learning materials were useful. The main reasons were that they learnt words that could be applied in their everyday lives (x3), they learnt very useful local New Zealand words (x3), and that they simply learnt new words (x1).

10. What did you learn from the virtual learning materials?

As with the previous question, the participants stated that they learnt new words and useful New Zealand phrases that could be used in everyday speech. Interestingly, a couple of participants identified ‘underpants’, ‘knickers’ and ‘sweet-as’, as specific words learnt in KiwiLearningSpace.

11. How can the learning materials be improved?

There were a number of different suggestions for improving the learning materials, but no dominant patterns emerged, with the exception of two participants who thought that International Phonetic Alphabet symbols could be included on the word cards. One participant suggested more conversations; while another thought the word cards could all be located in a single area, rather than spread out across the street. One participant asked for more New Zealand words.

12. Do you like learning in virtual reality?

All participants stated that they enjoyed the virtual reality learning experience, with only one commenting on the issue of dizziness.

13. Did you enjoy learning in this virtual educational space? Why/why not?

All participants enjoyed learning in KiwiLearningSpace. Some commented on the realistic quality of the content and the quality of the word cards and accompanying audio. Another stated that it was fun and would become a future trend for learning.

14. Do you think this kind of virtual self-learning is useful? Why/why not?

All participants thought this kind of virtual self-learning is useful. They thought the gaming aspect helped the acquisition of new knowledge, that it would be useful for distance students, and that it was a new and fun method for learning English. One participant interested commented that it was difficult to take notes while studying in VR.

15. Would you like to experience learning in this virtual space again? Why/why not?

All the participants stated that they would like to experience learning in KiwiLearningSpace again, with a number describing it as a new and interesting experience. Three, however added that they’d like the issue of dizziness to be fixed.

Changes made after user evaluation 2

In the second modification, each of the roads were equipped with large boards containing detailed instructions, as shown in Figure 24. Hence, learners are able to more clearly see the content of each space to help them determine their next destination.

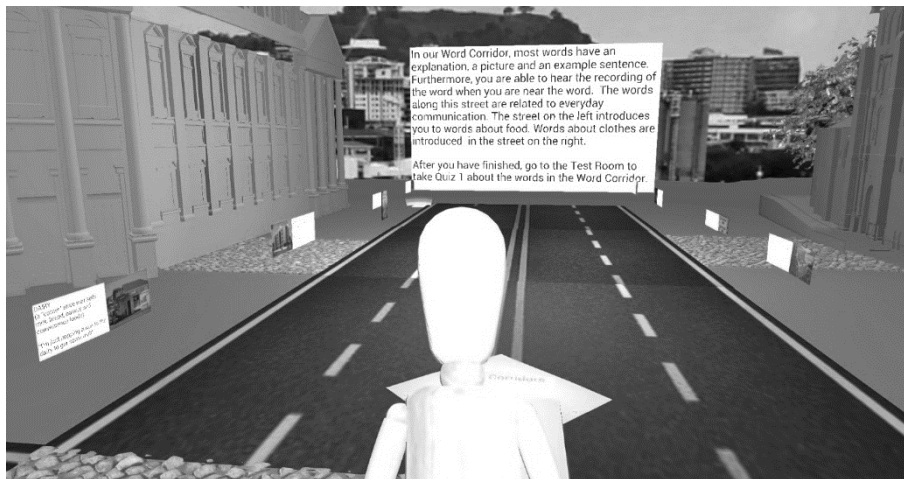


Figure 24: The instruction board.

In order to provide learners with a space where they could move freely and make full use of its affordances, the settings in the café were reorganized. For instance, the menu was placed on the wall to make it easier to read, and the names of the different kinds of coffee orders were placed beside their corresponding visual representations (Figure 25).



Figure 25: Coffee with corresponding names

Furthermore, several participants' suggested that more entertainment could be included in the playground. Therefore, a castle which involved a number of recreations activities was placed besides the original playground (see Figure 26).



Figure 26: The new playground

The quantity and the position of the teleports was changed so that the participants could enjoy increased flexibility and movement when exploring Kiwi learning space. Each of the different learning scenarios was equipped with a teleport, which all connected to the teleport centre (Figure 27).



Figure 27. A teleport near the café

Chairs and cushions were also placed in the clothes shop, reading room and a number of the other learning spaces in order to offer participants an additional sense of comfort (Figure 28).



Figure 28: Seats in Reading Room

Chapter 7: Reflections

Through a reflection on the development of KiwiLearningSpace, this final section provides recommendations and implications for language educators and designers developing a virtual language learning space, and identifies some of the challenges that may occur in this process.

Recommendations

Framework for designing a virtual learning space

The first step for designing a virtual learning space is to learn about the virtual platform to be used and the affordances it can provide as a learning space, relevant to the specific teaching objectives. Once the initial designs are in place, the second step can be to gather learners' feedback, using interviews, questionnaires or other methods. The aim of this second step is to look for aspects of the initial design that could be improved. The final stage involves making modifications in terms of objects, learning spaces, the appearance of buildings, or any other aspects that could facilitate an improved learning context. The following provide other recommendations.

Include clear and elaborate instructions

The participants who took part in Evaluation 1 complained that they found themselves in a strange space without clear directions or any road map. It could be suggested, then, that avatar orientation is of great importance in a virtual learning space, otherwise learners do not know where to go or what to do. In addition, the objective of discovering how one could move from one location to the next is also very challenging, especially for learners who lack of prior game experience (Pfeil & Ang & Zaphiris, 2009). Hence, educator / designers should include clear and elaborate instructions for each stage of the learners experience and place essential road signs, maps, and tools for facilitating teleportation in all relevant areas.

Use simulations that represent real life

Visual realism is usually used to offer familiarity and support for students' present mental models of how to behave or interact (Lakoff & Johnson, 2003). As a result, learners who are involved in language learning spaces that simulate real life tend to engage more fully than those in non-representational spaces. Educators and designers should therefore, incorporate settings of the physical worlds into the virtual learning space during the design process. As KiwiLearningSpace shows, the buildings

along the roads are almost the same as those on the real Queen Street in central Auckland of New Zealand. Many of our participants stated that they appreciated these simulations. After all, learners' comfort is a crucial criteria when designing a learning space, whether physical or virtual.

Consider the location of certain activities

Considering the specific locations of different activities are of importance when designing a learning space. Some learning activities require greater social interaction, while others should be held in more private spaces for individual activities of a more formal nature such as reading or testing. Interactive activities could be conducted in accessible spaces such as the ground-floor spaces of a building or an open platform. More formal activities requiring private spaces could be held in relatively closed spaces like classrooms on the upper floors of virtual buildings.

Challenges

The process of developing a virtual learning space can also involves several challenges. The challenges which both educators and learners may face are discussed as follows:

Technical skills

Technical difficulties provide the major challenge for most educators /designers (Schultze et al., 2008). For instance, in our building process, a large amount of time was spent on learning how to create, upload, and use three-dimensional models, using software such as Blender. This is because in the beta version of High Fidelity, objects could not be easily built in-world, as in Second Life. Moreover, the building process in Blender, was time consuming as the development of 3D modelling skills was required before models suitable for uploading into High Fidelity could be created. Therefore, educators and designers of three-dimensional virtual worlds are likely to spend a large amount of time, not only in designing learning scenarios, but also in making the various kinds of objects and buildings required for these scenarios.

Cost

Dickey (2005) states a major challenge for the developer of a virtual educational space is cost, a point echoed by Schultze et al., (2008), who state that one of the most common concerns for any usage of technology in educational activities is cost. Designing a three-dimensional totally immersive learning

space, such as KiwiLearningSpace requires expensive hardware, meaning that educational institutions must pay large sums for high end computers with powerful graphics card, along with sets of goggles and hand controllers. In some cases, a fee is also required by the platform to maintain the learning space.

Users operation

Learners of virtual spaces also often encounter difficulties when using the technology (Graves, 2008). Some students using KiwiLearningSpace in High Fidelity, for example, encountered issues with navigation, resulting in a degree of confusion and disorientation. Nevertheless, those learners with previous gaming experience claimed that High Fidelity was relatively simple to navigate. Barab et al. (2000) say that users typically spend a large amount of time learning to use the software, in order to become familiar with the virtual learning environment.

Inevitable problems caused by goggles

A large percentage of our participants complained that they felt a little dizzy after exploring the virtual learning space due to the use of the Oculus goggles. Furthermore, the wearing of goggles may not be convenient for short-sighted users due to the limited space between the lenses and the eyes. This issue may be resolved with technological progress.

Implications

Virtual worlds are a technology that is increasingly accepted by educators. A learning space like Second Life has the potential to increase learners' access to the second language they are studying, therefore potentially increasing students' motivation (Wehner & Gump & Downey, 2011). KiwiLearningSpace in High Fidelity provides a chance for second-language learners to hear and use English in a motivating three-dimensional virtual environment. Peterson (2006) has also pointed out that another virtual world, Active Worlds, is a motivated learning space where language learners are not only able to communicate in their target language, but can accomplish various kinds of tasks using their target language. Hence, the development of virtual learning spaces is a good opportunity for language educators and designers to create a more interactive style of learning and teaching.

In our design, we find that the affordances of three-dimensional learning spaces such as flexibility and interactivity using multiple communication modes can be fully utilized. Our method involves

developing the design based on our knowledge and experiences with existing virtual worlds, evaluating it with learners and then enhancing the design according to the feedback.

Conclusion

To sum up, totally immersive three-dimensional virtual learning spaces can provide new opportunities for both educators and learners. The opportunities for designing interactive spaces with avatars open up unique avenues for various learning experiences. This exegesis begins by reviewing the literature on virtual learning space design, as well as several virtual learning space environments in Second Life to provide a background and stimulus for the exploration of the new platform High Fidelity and the development of KiwiLearningSpace. The exegesis then discusses the user evaluation process that was used to help evaluate and improve the development of the KiwiLearningSpace. The exegesis goes on to provide a discussion of the benefits, issues, recommendations and implications that emerged as a result of the design process. As an increasing number of virtual learning platforms and spaces evolve, their effect and potential is still to be discovered and explored.

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Appendix A

Observation Protocol Form

Participant's pseudonym	
Start time of participation	
Observations on participant's' initial engagement. <ul style="list-style-type: none"> • Adjusting to the VR experience • Adjusting to the equipment • Spatial adjustment 	
Observations on the participant's movement around the space.	
Observations on the participant's engagement with learning resources.	
Observations on the participant's use of the touch controllers.	
Observations of participant difficulties.	
Other observations	
Completion time of participation <ul style="list-style-type: none"> • Note whether the participant completed early due to discomfort. 	

Questions

1. What did you think about the design of the educational space?
2. Was it easy for you to move around the space? Why/why not?
3. Did you know where to go and what to do in the space? Why/why not?
4. Did you feel comfortable when you are in the space? Why/why not?
5. What did you like about the design of this virtual educational space?
6. What didn't you like about the design of this virtual educational space?
7. How can the educational space design be improved?
8. Was it easy to use the learning materials? Why/why not?
9. Were the learning materials useful? Why/why not?
10. What did you learn from the virtual learning materials?
11. How can the learning materials be improved?
12. Do you like learning in virtual reality?
13. Did you enjoy learning in this virtual educational space? Why/why not?
14. Do you think this kind of virtual self-learning is useful? Why/why not?
15. Would you like to experience learning in this virtual space again? Why/why not?

