VIRTUAL REALITY SITUATIONAL LANGUAGE TRAINER FOR SECOND LANGUAGE: DESIGN & EVALUATION

Timo Korkalainen, Juho Pääkylä, Tapani N. Liukkonen, Lauri Järvenpää and Tuomas Mäkilä
Technology Research Center
University of Turku

20014 Turun yliopisto
Finland
Email: {ttkork, jujapa, taneli, lauri.jarvenpaa, tusuma}@utu.fi

Yrjö Lappalainen

University of Tampere
School of Information Sciences
Tampere Research Center for Information and Media
33014 Tampereen yliopisto
Finland
Email: yrjo.lappalainen@uta.fi

Heli Kamppari

Brahea Centre
University of Turku

20014 Turun yliopisto
Finland
Email: helkam@utu.fi

KEYWORDS
L2, education, VR, gamification, UX, learning environment

ABSTRACT

Use of virtual learning environments has been studied for years, but no common guidelines for evaluating them for education exist. The Developing Virtual Learning for Finnish project proposed a set of such guidelines in context of teaching a second language to immigrants. To aid the definition work and test the guidelines, a demonstrative application was created with focus on introducing the students to everyday situations and to the use of spoken language. The main objective of the game design was to create a friendly and comfortable environment, where the users would feel safe to experiment with the new language. To evaluate both the game and the initial guidelines, user experience research was conducted on actual immigrants learning Finnish as a second language. According to the questionnaire results, the game fulfilled the primary objectives and the evaluation criteria provided an insight into the usefulness of the game for learning.

INTRODUCTION

The Developing Virtual Learning for Finnish project set to develop guidelines for evaluating virtual learning experiences. In order to define and test guidelines, a demonstrative application was developed. The aim of the application was to study how to simulate simple real world situations in a virtual setting in order to let the students learning Finnish as second language on the levels A2 to B1 of the Common European Framework of Reference for Languages (CEFR) to improve their ability to cope with the lingual challenges of daily life. Afterwards user testing was conducted to evaluate what the members of the target audience thought about such an approach to learning.

The background chapter summarizes the educational context and goals of the application and discloses contemporary approaches to evaluating gamified learning experiences. The chapter on game implementation describes how the application was developed and why certain design approaches were selected. Chapters Research Method and User Experience Testing Results outline the testing procedures and the results, while the final chapter summarizes the key points found in the study and based on them presents views on the future development of virtual reality based learning of a second language.

BACKGROUND

The use of virtual worlds as part of teaching has been both researched and practiced for several years. One of the common approaches is to use open virtual worlds, such as Second Life, to encourage cooperation and communication between learners and teachers from different parts of the real world. (Lappalainen, 2015, p. 42) However, virtual worlds offer another approach: simulation of real world situations in a safe and private environment. The students can comfortably experiment with different approaches to the same situation without the fear of being judged for mistakes. This encourages the learning of new language skills and promotes the culture around the language itself. (Kiili, 2004)

Second Language Pedagogy

In this study the focus was on immigrant students learning Finnish as second language. More advanced learners were excluded due to previous studies showing that they would not benefit as much. (Lehtonen et al., 2015, p. 26). For the students in the focus group it is vital to lower the barrier and get initial encouragement for using the language more in their everyday lives, as it is the only way to get comfortable with it in spoken situations and enhance the rate and success of learning.

Traditional methods of teaching a second language are mostly centered on the official written form. This leaves the learners in the blind with casual everyday encounters, where they either do not understand the spoken language used by the natives or use expressions that generate other than desired reaction. Neither tend

the traditional classroom methods to provide a comfortable approach to learn the customs of behavior in the natural face to face encounters. Such moments can cause stress and embarrassment both before and after the situation and thus greatly affect the student's motivation and commitment towards the learning process. (Jauregi, 2012; Canto, 2013)

Virtual reality allows simulating real world situations with no other real human being involved than the players themselves. As all the virtual characters' reactions are controlled programmatically, they express only the emotions desired and never get frustrated no matter how many wrong answers the learner gives. Virtual conversations also make it possible to create interactive characters that comply with the requirements of pedagogical objectives.

Game Design

Designing and creating game is a multidisciplinary task, especially when games are combined with pedagogical goals. It is not enough to just entertain the users, but to also educate them in a way that can be measured according to the standards employed in the traditional ways of teaching. For some students, the interactive nature of games that encourages experimenting with causation, can even be the most effective way of learning. (Gee, 2008; Viinikkala et al., 2014)

While the game still has to entertain enough to keep the players immersed in the story, the students have to recognize the progress they are making with the actual subject of learning. The games also should not present different story paths just to keep the students playing longer, but also to concretize how the different ways of behavior are responded in real life. Thus all aspects of the game should be pre-evaluated on both how they affect the quality of the game experience and how they can advance the learning process. (Ondrejka, 2008)

Vital to educational games is the attitude the players form towards the experience: if they play reluctantly and just because it is part of the classroom work, the learning results suffer. In contrast, when the learning is almost a side effect to the gaming and the players enjoy the experience, they both learn more and the memory trace becomes more profound. (Luckin & Fraser, 2011) Thus the game design needs to be balanced between providing enough pedagogical context and an experience that is memorable by itself.

In order to immerse the player into the virtual world, no additional visual avatar was added to represent the player. Instead the game is viewed from the direct first person perspective of the player. Thus the students are encouraged to feel like being in the situation themselves, and not just controlling an artificial person.

User Experience Research with Educational Games

Many of the traditional software user experience testing methods are also suited for evaluating games. User testing methods can be divided into two categories: 1) attitudinal, for measuring the subjects' attitude towards the application and 2) behavioral, for measuring how the application is used. While many techniques exist for behavioral usability testing, attitudinal testing is mostly conducted using questionnaire methods. (Pagulayan et al., 2007, p. 21 - 27)

In the context of educational games with a specific target group, it is natural to focus the user testing on the same audience. Thus the need for large random sample testing is minimal and results are achieved with a smaller number of selected test subjects. In educational games the emphasis in user testing is also more on whether the players learned the required information, not necessarily on fine tuning the gaming experience. It is also important to measure the attitudinal aspects as they too affect the learning results.

GAME IMPLEMENTATION

The primary objective of the game design was to create an environment, where the players would feel safe and comfortable, allowing them to focus on the content and forget any of the fears the real world situations impose. The game was chosen to use the classical adventure game mechanics with focus on the use of the Finnish language in interactions with the virtual characters. To make the story believable and yet interesting, much emphasis was placed on the authenticity and natural feel of the dialogue. This was also done to ensure that everything the players would learn was accurate and usable in the verbal encounters in the real world.

Story

The story of the game is set inside a restaurant car of a train. The story was written by pedagogy professionals with the help of the game designers and developers. The writers struggled at first with the interactive nature of video games, but after every iteration of the prototype their understanding on the medium grew. An important role in improving the scriptwriting process and allowing easy iteration, was the use of the articy:draft 2 (Nevigo, 2015), an application designed for writing interactive game scripts. It allowed the writers to visualize the flow of the script in a more comprehensible format, as seen in Figure 1.

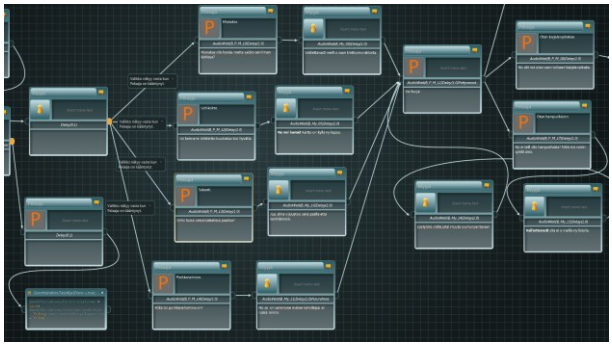

Figure 1: Game Script Visualization (3D Suomi, 2015)

It also supports testing out the discussions in the tool itself and thus eased the process of learning to write interactive game scripts.

A challenge in the script writing was to find the balance between making the dialogue and the player's options both understandable and challenging enough at the same time. Both extremes, too easy or complex dialogue, would cause learner to lose interest. If the players would not understand what to do next, they would again lose interest.

Art Design

In order to help create the wanted safe and comfortable environment, the art design of the game was simple and cartoon like. For example, the restaurant car presented in Figure 2, was closely modelled after the design of a real restaurant car used in Finland.

Figure 2: Restaurant car and conductor in 3D Suomi (3D Suomi, 2015)

Model of the car was simplified, but yet giving clear cues of aspects relating closely to real life elements. All the materials were using bright and friendly colors. This was done to clearly distance the surroundings from the real world. The cartoon like style was continued in the characters which were caricaturized versions of people with different backgrounds. The simple style also helped to keep the players' focus in the important parts of the scene that related to the story.

By design the game environment provides a limited number of objects and persons to interact with and the discussions have a limited number of paths to follow. Additionally the cartoon like style was used to convey neutral visual message to the players with varying cultural backgrounds. The visual style also helped in allocating resources effectively and in improving the cost-effectiveness.

The audio design for the application continued the same simplified style: only quiet yet constant rattling of the train wheels and rain pouring down outside were used to create an atmosphere that would still be enough to distance the player from their actual environment. The studio recorded dialogue was made loud enough to be clearly heard over the ambient sounds. The different dialects gave the characters a personal touch, as none of them would use quite the same type of language.

Technology

Modern game development tools allow fast prototyping and creation of complex virtual reality experiences with less focus on the technology, but on the content itself. The demonstrative game for the project was developed using the cross-platform game engine Unity 4 (Unity Technologies, 2015). The engine was chosen due to it providing necessary features for the project and the developers having prior experience in using Unity in mixed reality applications in the context of learning environments.

An important tool for the development was the plug-in Dialogue System (Pixel Crushers, 2015) for Unity 4. This plug-in has an option to directly import dialogue from articy:draft (Nevigo, 2015), the script writing tool used in the project. This made it easy for the developers to import any changes in the dialogue into the game without additional work, allowing fast iteration.

While the combination of tools used are not the only option, a readily available development platform is a requirement for cost-effective development of educational games. Many modern game engines, such as the Unreal Engine 4 (Epic Games, 2015), are available for productions where the focus must be on the content and not in the technology.

RESEARCH METHOD

As the goal of the project was to define guidelines for evaluating virtual learning experiences, it was seen necessary to form and test some of the proposed guidelines by practically designing, developing and finally conducting user experience testing on a real working demonstrative product. After development and initial testing, a large scale user experience testing was conducted in several of the partner institutions.

Study Setup

User experience testing for the application was conducted in a classroom setting with multiple subjects testing the game on different desktop computers at the same time. Few subjects also tested in pairs in order to find out what kind of a difference that would make to the experience. A teacher was available in the classroom at all times for help, in case someone had technical difficulties. The subjects began the test with the game already running in its initial state and left it running once completed. The subjects were reminded that the test was anonymous and that the testing was about the game and how well it suited the educational purposes, not about their personal performance or knowledge.

Questionnaires

After completing the game the subjects were presented with a questionnaire of 60 questions formed roughly on the basis of the Game Experience Questionnaire (GEQ) (IJsselsteijn, 2007) and System Usability Scale questionnaire (SUS) (Brooke, 1996). The main questionnaire was in Finnish, but additionally the questions and options for answering were available in several languages to make sure all subjects understood everything. Additionally some of the subjects were interviewed after the questionnaire.

The answer options were based on agreeing or disagreeing on a scale from 1 to 7, where 1 was total disagreement and 7 total agreement.

Participants

Altogether 147 completed questionnaires were collected and analyzed. Of all the respondents 58.3% were women and 41.7% men, the majority (53.1%) being from 25 to 34 years old of age. Most (54.4%) of the subjects had some form of a degree and already used Finnish (74.0%) on a daily basis on some level, with English being the second most used language (49.3%). The most common reasons for immigration were family (57.1%) and education (16.3%) related ones.

Almost all of all the respondents (80 % of 112 answers) have been assessed by their teachers on levels either A2.2 or B1.1, which are the median scores in the 9 step scale of the Finnish version (National Board of Education) of the 6 step scale of CEFR - and also form the main focus group of our user experience testing.

Most of the subjects used information technology on a daily basis (6.06), but on the contrary most had not much experience in playing video games (3.46).

USER EXPERIENCE TESTING RESULTS

According to the user experience testing the demonstrative application performed well in general and was especially thanked by the subjects for presenting the everyday situations in an approachable manner. The possibility of comparing the spoken dialogue to the written subtitles was also well received and was seen as one of the key points of the experience. In the interviews one of the subjects especially noted that “my listening skills in Finnish need a lot of work, but my reading comprehension is better, so having the text of the spoken conversation shown on the screen while I could listen to the conversation was very helpful to me”.

The goal of comfortable and safe experience seems to have been achieved as the majority of the subjects (average agreement 5.14, on scale from 1 to 7) reported feeling happy after playing the game. Many also felt the experience had given them courage to act in real life situations (5.10) and especially felt it had been helpful in practicing to understand spoken language (6.17).

The visual style of the game was one of the most dividing topics and while the answers were diverse, most would have opted for a more realistic approach for the characters (4.42). While one of the interviewed subjects called the visuals “primitive”, other told that “they looked funny and made me smile”. Still, most had felt the game was immersive (4.96), and especially that the virtual characters’ dialogue had seemed authentic (5.67).

When asked what they would want to see added to the game, the most common answer among the subjects was “more content”: a longer story, more characters and more things to do. Also, more freedom to choose what to do and in which order, was among the more common answers.

The questionnaire reveals that the game performed well technically and was easy to use (5.42). However, the game also wasn’t seen very challenging (3.65) and most didn’t need help in understanding the language used in the game (2.94). The game mostly seen as a refreshing approach to language education and thought to be a fun way to learn Finnish (5.89).

CONCLUSIONS

The aim of the demonstrative virtual language learning game experience developed within the project was to help in defining the guidelines for evaluating virtual learning environments. The initial questionnaire used to evaluate the application worked well and gave a clear indication that such experiences are effective method for both learning especially spoken second language and getting the students accustomed to everyday situations in the new culture.

Especially the design decisions aimed for creating a safe and friendly virtual environment for the students seems to have succeeded according to the results of the user testing. However, the game was possibly made too easy for the target audience, as it did not provide much challenge for most of the test subjects. This could be solved by having more content and by making the players face increasingly challenging situations as they progress in the game.

As many of the players reported to have been immersed in the game, even as it was played using a traditional desktop computer, it appears the decisions not to visualize the player’s character and not to mimic photorealism, were correct. However, employing writers experienced in creating interactive content would likely have produced a more compelling story.

Virtual learning applications can be developed with limited resources while still allowing an experience that is both good enough for its purpose and most likely feasible commercially. An interesting development for the field is the advancement of affordable virtual reality headsets that allow even more immersive learning experiences than contemporary desktop computers.

Another game changing advancement in virtual learning technology will be the introduction of robust enough speech recognition algorithms that can accurately recognize even non-native speakers. This way the clumsy text based interface can be replaced with all audio user interaction methods that both support learning objectives and allow even higher levels of immersion. While some such applications exist already, like the Danish Simulator platform (Dansksimulatoren, 2015), it will take time before such tools are widely available for little spoken languages like Finnish.

ACKNOWLEDGEMENTS

This article was done as a part of the Developing Virtual Learning for Finnish project funded by European Social Fund. The project was conducted as collaboration between University of Turku's Technology Research Center and Brahea Centre, University of Tampere's School of Information Sciences, Tampere Adult Education Centre, and University of Jyväskylä's Language Centre, together with partners Axxell Ltd., Heuristica Ltd., PragmatIQ Ltd. and Ubiikki Ltd. We thank the VR-Group Ltd for the train car references and likeness.

REFERENCES

Canto, S., Jauregi, K. & van den Bergh, H. (2013). Integrating cross-cultural interaction through video-communication and virtual worlds in foreign language teaching programs: is there an added value? ReCALL: The Journal of EUROCALL, Vol. 25, Iss. 1, pp. 105–121.

Brooke, J. (1996). SUS: a 'quick and dirty' usability scale. In P. W. Jordan, B. Thomas, B. A. Weerdmeester, & A. L. McClelland (Eds.), Usability Evaluation in Industry. London: Taylor and Francis.

Gee, J. P. (2008). "Learning and Games." The Ecology of Games: Connecting Youth, Games, and Learning. Edited by Katie Salen. The John D. and Catherine T. MacArthur Foundation Series on Digital Media and Learning. Cambridge, MA: The MIT Press, 2008, pp. 21–40.

IJsselsteijn, W.A., de Kort, Y.A.W., Poels, K., Jurgelionis, A., and Belotti, F. (2007). Characterising and Measuring User Experiences, ACE 2007 International Conference on Advances in Computer Entertainment Technology, Workshop 'Methods for Evaluating Games - How to measure Usability and User Experience in Games' (Salzburg, Austria, 13-15 June 2007).

Jauregi, K., de Graaff, R., van den Bergh, H. & Kriz, M. (2012). Native non-native speaker interactions through video-web communication, a clue for enhancing motivation. Computer Assisted Language Learning Journal, Vol. 25, Iss. 1, pp. 1–19.

Kiili, K. (2005). Digital game-based learning: Towards an experiential gaming model, The Internet and Higher Education, Vo. 8, Iss. 1, 1st Quarter 2005, pp. 13-24, ISSN 1096-7516

Lappalainen, Y. (2015). Avoimien virtuaaliympäristöjen opetuskäytön mahdollisuuksia. In Y. Lappalainen, M. Poikolainen & H. Trapp H. (Ed.) Tila haltuun! Suosituksia virtuaalisen suomen opiskelun toteuttamiseen. Turun yliopiston Brahea-keskuksen julkaisuja 6. University of Turku, Turku, Finland.

Lehtonen, T., Lakkala, M., Eloranta, J. & Rasila, M. (2015). Pedagoginen perusta kielenoppimisessa. In Y. Lappalainen, M. Poikolainen & H. Trapp H. (Ed.) Tila haltuun! Suosituksia virtuaalisen suomen opiskelun toteuttamiseen. Turun yliopiston Brahea-keskuksen julkaisuja 6. University of Turku, Turku, Finland.

Luckin, R. and Fraser, D. S., (2011). Limitless or pointless? An evaluation of augmented reality technology in the school and home. International Journal of Technology Enhanced Learning, Vol. 3, Iss. 5 (August 2011), pp. 510-524.

Ondrejka, C. (2008). Education Unleashed: Participatory Culture, Education, and Innovation in Second Life. The Ecology of Games: Connecting Youth, Games, and Learning. Edited by Katie Salen. The John D. and Catherine T. MacArthur Foundation Series on Digital Media and Learning. Cambridge, MA: The MIT Press, 2008. pp. 229–252.

Pagulayan, R., Keeker, K., Fuller, T., Wixon, D., Romero, R. & Gunn, D. (2007). User-centered Design in Games, Human-Computer Interaction Handbook. 2nd Edition

Pöyhönen, S., Tarnanen, M., Vehviläinen, E., Virtanen, A. & Pihlaja, L. 2010. Osallisena Suomessa: kehittämissuunnitelma maahanmuuttajien kotoutumisen edistämiseksi. University of Jyväskylä, Jyväskylä. Finland

Storhammar, M.-T. (1993). Ulkomaalaisopettajien opetuspuheen piirteitä. In L. Löfman, L. Kurki-Suonio, S. Pellinen & J. Lehtonen (Ed.) The competent intercultural communicator. AFinLA Yearbook 1993, pp. 79–97. Available at http://www.afinla.fi/sites/afinla.fi/files/1993Storhammar.pdf

Viinikkala, L., Leskinen, O.-P., Heimo, O., Korkalainen, T., Mäkilä, T., Helle, S., Pönni, V., Arimaa, J.-P., Saukko, F., Pääkylä, J., Jokela, S. & Lehtonen, T. (2014). The Luostarinmäki Adventure – An Augmented Reality Game in an Open Air Museum. NODEM 2014 – Engaging Spaces – Interpretation, Design and Digital Strategies.

WEB REFERENCES

Dansksimulatoren (2015). Dansksimulatoren. Available at http://www.dansksimulatoren.dk/

Epic Games (2015). Unreal Engine 4. Available at https://www.unrealengine.com/what-is-unreal-engine-4

National Board of Education (2015). Kielitaidon tasojen kuvausasteikko. Available at http://www.edu.fi/download/119698_taitotasot.pdf

Nevigo (2015). articy:draft 2. Available at http://www.nevigo.com/en/articydraft/overview/

Pixel Crushers (2015). Dialogue System. Available at: http://www.pixelcrushers.com/dialogue-system/

Unity Technologies (2015). Unity. Available at https://unity3d.com/