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How to Use Social VR in Higher Education: Case JYUXR Campus in Finland

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(Abstract if needed)

This chapter focuses on the use of social virtual reality in higher education. The use of virtual reality environments in, particularly, teacher education is still in its early days. We argue that teacher education plays an essential role in the adoption of immersive technologies in schools and societies in general. Based on the first experiences of the University of Jyväskylä's extended reality campus JYUXR in 2020–2021, we argue that despite the many bottlenecks that still exist, social VR has particularly good potential for use in future teacher education given that it already offers affordable, workable and flexible environments for testing and pilots.

Introduction: Virtual Reality in Education

We are already at the beginning of the third wave of adopting virtual reality (VR) in education.

The first wave occurred at the dawn of the new era of VR in the 1960s and focused on flight simulator training (Christou, 2010). Originally, VR training was developed for military purposes. Later, medical, firefighting and first responder training have all benefited from VR simulators, and training is still the most studied use of VR (Jacobson, 2017).

The second wave can be traced back to the end of the 1980s and early 1990s (Alhalabi, 2016, 921). During that time, many educators and researchers still paid attention to simulator models. For example, Christopher D. Wickens (1992), representing Aviation Research Laboratory at the University of Illinois at Urbana-Champaign, argued that good interface design was important for the learner. Sarah Hensel (1992, 38) moved a bit further by asking, "Will virtual reality allow educators to act as gods – creating new realities and magical

worlds with educational Utopias where all students learn?" Hensel believed that VR had the potential to move education from textbooks to experiential learning (ibid., 41).

The third wave in VR education started in the 2010s as VR technology advanced. New forms of VR experiences emerged like the first stories of immersive journalism (de la Peña et al., 2010). At that stage, more empirical testing of virtual environments in education was possible, and it was seen in the research literature. In summary, many studies from the third wave indicated positive feedback from tests of VR in education`. For example, Alhalabi (2016, 925) concluded, "Using any VR system dramatically improves the students' performance".

Today, the common premise is indeed that immersive environments (IEs) offer an active approach to learning and may, therefore, enable deeper learning experiences (Shute et al., 2017, 72). According to the research literature, many barriers exist in terms of adopting IEs in education.

For example, McGovern et al. (2020) argued that two main obstacles could be found in higher education: One is at the university level, and the other relates to the individual level of educators. At the university level, the lack of investment in a digital infrastructure is a common bottleneck. Another problem is a general hesitancy or even aversion among professors and lecturers toward adopting new technologies.

Furthermore, Richards (2017, 89) argued that integrating new technologies with existing classroom systems and with existing and emerging pedagogical practices has proved to be difficult. In addition, special health-related issues like VR-based motion sickness, a basic sensory conflict when brains are getting mixed signals from the environment, are still valid concerns. However, motion sickness could be avoided if continuous movement is minimized, and by using, for example, "teleporting" instead (ibid., 101).

Although research on VR education has been conducted for nearly 30 years, many scholars are still pessimistic about the adoption of the new tools, especially for K–12 classrooms. For example, Richards (2017, 102) argued, "We have not seen large-scale successful applications of immersive learning technologies in the classroom".

Editors Dede and Richards (2017, 238) concluded the following in their book:

> Immersive media have great potential to promote enriched curricular content, active forms of learning, performance assessments with high validity, and the application of academic learning to real world situations. However, much work remains to be done before these educational technologies will be truly practical, affordable, and scalable.

Despite these problems, by 2015, the immersive technology market for global education was larger than the industrial training market, and it was expected to grow from 1 billion dollars in 2015 to about 16 billion by the year 2020 (Richards, 2017, 90–91).

Next, we will shift our focus to higher education. The first experiments using VR in higher education included, for example, engineering students (Alhalabi, 2016), psychology and communications students (Bailenson, 2018), journalism students (Uskali and Ikonen, 2020) and business students (McGovern et al., 2020). Although research into VR has increased dramatically in recent years (Makransky and Petersen, 2021), we still lack knowledge about how VR has been used in teacher education. If VR is to ever be widely adopted in education, then higher education, and especially teacher education, play an essential role in the diffusion of VR skills. As Torro (2020, 24) argued, "Educating the educators about VR and its potential is critical".

But, before presenting our case study of JYUXR Campus focusing on teacher education, we still need to introduce a new term that is important for understanding the recent evolution of immersive VR: social VR.

Social Virtual Reality

Without high-quality real-time communication and social interaction, VR experiences are in danger of staying in solitude and marginality. Torro (2020) listed five important prerequisites for the success of VR in higher education: stand-alone head-mounted displays, quality over quantity, recognition of the complexity, educating the educators, and social VR.

It has been widely believed that as soon as the social element could be implemented in VR experiences, it would become the "killer application" that is needed before new technology can become mainstream and in everyday use. The imminent upcoming era of social VR has been predicted since at least the year 2011 (Spectrum IEEE, 2016). The engineering

magazine Spectrum IEEE (Ibid., 57) stated that "social virtual reality allows two geographically separated people, in the form of fairly realistic avatars, to communicate as if they were face-to-face".

In recent years, many new social VR applications have been published, enabling social VR to enter a new phase. The user bases of AltspaceVR, Facebook Spaces, Rec Room and VR Chat are already in the millions. In August 2021, there were about 170 million VR users worldwide (Petrov, 2021).

Maloney and Freeman (2020) pondered the meaningfulness of social VR for users. For their study, social VR referred to "3D virtual spaces where multiple users can interact with one another through VR head-mounted displays (HMDs)" (Ibid., 510). Their results identified five forms of activities that users find meaningful: full body mirroring activities, doing mundane and essential everyday activities in new ways, activities for social and mental self-improvement, immersive cultural appreciation and educational activities, and engaging in immersive events. It seems that social VR applications have already passed some milestones as some have even used the applications for getting sleep. Although their study did not focus on social VR in education, the interviewees mentioned that social VR platforms motivated them to learn, for example, to learn new languages and cultures. Also new methods for self-improvements like meditation were learned.

Even if social VR is clearly offering new immersive affordances to education, openly accessed applications also include the potential for misbehaviour and harassment, especially through real-time voice chat and avatar movements. A team of Facebook's Oculus VR representatives agreed, saying "Embodiment and presence make harassment feel more intense". As a solution, they proposed a bottom-up, community-led governance that should be based on "responsive regulation" (Blackwell et al., 2019, 23). Of course, this has often been the main strategy for social media platform companies: crowd-sourcing the handling of ethical problems for the users. However, social VR companies should also be responsible for creating safety features like enabling personal spaces and quickly responding to any cases of misbehaviour and harassment in timely manner. After years of news reports of harassment in social VR, Microsoft's AltspaceVR, for example, has created its own community standards, including instructions for how to report any violations of the community standards (Docs.microsoft.com, 2021)

All this reinforces the notion that social VR is maturing as a new technological platform that needs to be tested in the field of education. One of the first examples of how to use social VR in teacher education is the case of the Finnish JYUXR Campus.

Designing and Constructing the JYUXR Campus

Due to the COVID-19 pandemic, distance teaching and learning has been used by most universities around the world as a substitute for on-campus education since the spring of 2020. Videoconferencing tools and platforms like Zoom and Teams were in the key position when professors and lecturers rushed higher education from the campus into the home. Enter Zoom fatigue as a new term in educational vocabulary. This overload of constant streams of videoconferencing was one the starting points for creating a new VR teaching and learning environment at the University of Jyväskylä. JYUXR Campus was officially opened on 14 December 2020 via AltspaceVR, making it one of the first higher education institutions to test an open social VR platform for its teachers' education.

Of course, a few other VR platforms had already been tested around the world in some schools and universities, such as in the UK, and Australia via special VR environments designed for education; for example, EngageVR or VictoryXR. But these educational VR platforms are chargeable and closed systems, and therefore, they are less open for innovative testing and developing of new teaching methods.

JYUXR Campus arose from the need of the university's teacher educators to safely organize a mass learning event for about 100 teacher students during the COVID-19 pandemic. A virtual learning environment was required where students could meet each other and the teachers, chat together, learn together and laugh together. All of this should preferably be carried out in a space that would create the feeling that all participants were together on their familiar university campus. Collaborative learning, interaction and collaborative knowledge building were the key pedagogical cornerstones. To implement such pedagogies, new kinds of learning spaces needed to be designed and constructed.

AltspaceVR is a scalable multiplayer operating environment where you can move and communicate freely as an avatar and build your own spaces. It is a free environment for both users and virtual world administrators. All virtual modes/worlds are first built with Blender

and Unity and then loaded into AltspaceVR, which provides a lot of ready-made functionality for the worlds.

A Unity 3D modeler was hired to create unique learning spaces for VR. One of the starting design principles was that facilities on the JYUXR Campus must be available for download to the most used social VR ready-made services because they have versatile functionalities ready in a multiplayer environment. JYUXR Campus was ready to be used only two months after the first planning meeting.

The JYUXR Campus consists of four different learning spaces: the outdoor space of the campus (lobby/navigation space with portals to all other campus facilities), the lobby of the main campus building, 11 small identical group spaces placed in different parts of the real University of Jyväskylä campus and the Finnish Summer Cottage Island. All 11 small group virtual spaces show 360-degree images of the real university campus. They are designed for communal learning, but they are also well suited for various events, such as exhibitions, parties, academic events, meetings and professional and free-form meetings.

The opening ceremonies of the JYUXR Campus offered a glimpse of a new kind of a hybrid event, mixing old traditions and new technologies. When the President of the university and the Dean of the Faculty of Education and Psychology gave their opening speeches, an audience in the form of avatars were using emoticons. Also, a local musician played some of his greatest hits acoustically in real time, which again caused a wave of animated reactions. Social interaction and communication were key parts of the event and were enabled by moving avatars, emoticons and audio channels (see www.jyu.fi, 2021).

In designing the premises, special attention was paid to a manageable size, visuality and the aesthetics of the spaces. In addition, functionality and suitability for the joint activities of large groups were also important to apply, as was the possibility of dividing a group into smaller groups working peacefully in the same space. There is also a large screen in the learning space that everyone can access to share content stored on YouTube. In order to enrich learning experiences, for example, 3D models or image files (including 360 images) as learning objects could be brought to the space.

But of course there is still a lot that can be developed better; in particular, logging in and deploying require a lot time and know-how. Currently, one cannot use AltspaceVR on mobile

devices, and one faces a lot of challenges trying to use it on an Apple computer. The new update and collaboration with Microsoft's Mesh environment will be released in October 2021. Hopefully, that will bring numerous new opportunities for learning as well as virtual and real worlds merged into a common operating environment. It could be participated in both as an avatar from the virtual world and as a physical self from the real world.

JYUXR Campus was created as an open test bed for anyone interested in VR education. It is not limited to use by only the faculty and students at the Finnish university; on the contrary, JYUXR Campus is accessible to the whole world. Of course, this has already caused a phenomenon of passers-by, where individual avatars from around the world pay short visits to the virtual campus as part of their global travelling tour, teleporting from one destination to another without any means other than curiosity. At least so far, these virtual globetrotters have been well behaved.

Aims and implementation of experiment

The first teaching experiments of JYUXR Campus at the University of Jyväskylä were implemented in 2020–2021 as two fair-type events, which were part of mandatory courses in the subject teacher education program (pedagogical studies for subject teachers, 60 ECTC). The first group consisted of students who started their university studies in the autumn of 2020; the other group of students was finishing pedagogical studies (master's studies). Pedagogical studies give students the necessary qualifications to teach basic education and upper secondary school subjects they have studied at university for at least 60 ECTS.

Over a hundred students representing 13 different major subjects and five faculties participated for both fairs. Thus, both student groups were very heterogeneous. However, students share with each other much of the same. Although the autonomy of teachers in Finland is very broad, especially when compared internationally, the social cohesion of teachers (e.g. values and perceptions of what constitutes good teaching) is very strong. Subject teacher students typically look at their future work strongly from the perspective of their own subject (Veijola, 2013; Yrjänäinen, 2011). In addition, the nature of a subject teacher's work represents continuity and stability more than radicality and change. In teaching experiments, when facing something new, students are often polarized into three groups. First, a small group is immediately ready for change. Second, and the biggest one, consists students basically open-minded, but a step in a new direction requires practical

examples to follow. Third group is small and against the new (Rautiainen, 2008; Rautiainen and Veijola, 2019). From these perspectives, JYUXR Campus offered excellent spaces for subject teacher students to challenge concepts and practices of teaching and learning.

At both fairs, students made a project in groups, and the projects were presented for others on the JYUXR Campus. In practice, each group had their own space and exhibition point on the JYUXR Campus where they planned and implemented their presentation to others. The first fair was characterized by the transfer of the real world to VR reality. Groups presented their work via text-based presentations that visitors had to open using QR codes placed on media screens. This hampered interaction because it took a long time to not only open QR codes but also to read long text-based materials. Interaction and activity were marginal compared with the expectations we had before the fair. Based on this experience, interaction and activity were emphasized in the second fair for students during the planning period. In addition, QR codes were not allowed to be used in a similar way as they were used during the first fair. Instead, students were encouraged to use either pictures/photos or videos on media screens and, in particular, plan activities for interaction. As a result, groups implemented more diverse solutions in their own spaces. Some of the teachers had their own group in both fairs, which had a significant role in the developmental work: positive experiences from the first fair transferred towards stronger pedagogical development of the environment during the second fair.

AltspaceVR was familiar to only a few educators and students before the fairs. In addition, experiences in VR realities were more occasional than regular. Thus, special attention was paid to the use of AltspaceVR. For the first fair, educators were oriented together to the use of AltspaceVR, and educators then trained their students in their own groups. The same was repeated for the second fair, but now educators who had participated in the first fair shared their own experiences with others. At both fairs, educators were supported by an expert in the pedagogical use of VR realities and the developer of JYUXR Campus.

From experiences toward developmental work

In this section, we present key findings from our VR experiment in university education. We used collaborative autoethnography as an approach to understand our experiences. In collaborative autoethnography, the research data are researchers' own experiences and the material created about those experiences, like research diaries and discussions between researchers about experiences (Chang et al., 2012). The four authors of this article

participated in the fairs as teacher educators and pedagogical expert. In addition, we used course feedback collected by the university administration. The administration services at the University of Jyväskylä collects formal feedback for all courses by a questionnaire that is voluntary for students. Through the questionnaire, students have the opportunity to give feedback on teaching and working methods, as well as learning in the course. The questionnaire consisted of both Likert-based and open-ended questions. Thus, feedback did not focus on students' views and experiences of the VR as part of the course. However, students could give feedback about the fairs via open-ended questions. In all, 11 out of 61 students who filled out the questionnaire highlighted the fair experience in the AltspaceVR environment in their answers.

The polarization that is typical for students and educators participating in experiments in education was also realized in this experiment.

> The nearer the fairs are, the stronger uncertainty and critique against VR environment strengthen. I know it reflects more broader perceptions and understanding of learning, teaching and studying, but why these voices cannot be said at the beginning of the course? At this stage, "critical" voices are more or less signs of frustration of individuals. (Researcher A's research diary, 1.3.2021)

> I was wandering in XR-Campus and heard two students talking together and complaining how horrible JYUXR Campus is. I was confused first, but then I thought, yes – environment works, because students found themselves a peaceful place to talk. (Researcher C's research diary, 14.12.2020)

The polarization was visible also in student feedback gathered after courses: "The virtual fair in Altspace was also nice" and "Task in Altspace did not work at all" describe opposite experiences, but the reasons behind students' experiences may vary. As noted earlier, a subject student teacher's orientation towards pedagogical studies is strongly defined by the perceptions in the sub-culture of their major and teaching subject. In addition, students' orientations toward their studies differ generally (see, e.g., Beaty et al., 1997; Jeffrey, 2009). These different orientations to learning and teaching especially come to the fore when education is based on new and previously unexperienced elements, such as studying on XR-Campus. In general, discussion on the use of technological and digital learning environments in education has been focused on the question of whether technology should be used in

education rather than considering the possibilities of different learning environments (e.g. Jalkanen, 2015).

Although COVID-19 has radically changed this setup, during the experiment, we faced the question of why the fair could not be held in environments already in use, such as Zoom. This is the same phenomenon that Jalkanen (2015) describes in his research, but now it has moved into the discussion about technologies because educational institutions have been forced to use technology in education. We are now debating whether new and less familiar technologies should be used in education, and the XR technology and XR environments representing "new" opportunities are part of this debate.

In our experiments, the change in the pedagogical nature of fairs was remarkable between fairs. After initial technological uncertainty, teacher educators could focus more on pedagogical uses of AltspaceVR. Thus, the second fair offered more variety and different kinds of activities than the first fair, including games, action-based debates, discussions and physical exercises related to well-being. In other words, pedagogical processes were more communal in the second fair than the first one.

> Once it became clear that videos cannot be used because of new updates, I could concentrate on students' work and go around XR-Campus. After seeing all 11 points, I said "WOW" to myself. Some groups were implementing skillful, interactive and immersive pedagogical solutions that took advantage of the Altspace environment. My personal favorite was a point where participants had to express their opinion for certain claims via selecting a space in exhibition point. This was followed by discussion and short presentations of research findings concerning the claim. (Researcher A's research diary, 18.3.2021)

The use of new technologies in education usually involves technical problems, especially in the early experiments also faced in our Altspace experiments. Because of the complex technology of Altspace, a technical expert was an essential part of the team in our experiment. In addition, one of the educators was an expert in the pedagogical use of VR realities. Without their input, it would not have been possible to implement the fairs' unique experience.

> Experience was unique because we all were at the front of something new, never experienced. All we needed, was open mind towards experiment. Together – supporting each other! (Researcher B's research diary, 15.12.2020)

The Altspace environment is at its best when organizing interactive events, -and the experience is immersive when using a VR headset. This was possible for only a few participants, and most students used computers. It reminded many students of their childhood virtual environment Habbo Hotel (see more at habbo.com).

> I'm sure Altspace will offer lot of possibilities in education when it will be developed. (Student 6, course feedback, spring 2021)

The above-described experiments were the first ones for JYUXR Campus at the University of Jyväskylä. Based on our collaborative experiences and reflections, the following four elements were successfully implemented in our experiments and construct a basis for the use of Altspace in university education.

JYUXR Campus environment: Campus offered a lot of possibilities for interaction and different pedagogigal solutions since the beginning. After first experiments, more utopian spaces have been constructed on.

Support: The technical and pedagogical support of two experts were essential for the use of JYUXR Campus. Support enabled educators to focus on teaching in the new environment.

Educated staff: A common orientation, as well as peer learning, strengthened the activities of educators.

Confidence of students: The Altspace environment was new for most of the students. However, students' preparedness to use technology and adapt to new environments was high, and they could implement their activity autonomously after instruction and training in the use of the environment.

The following four elements require special attention when developing uses of Altspace in university education.

More and earlier is better: Activity in the Altspace environment was placed at the end of both courses, partly because JYUXR Campus was launched at the same time as our first fair. However, the use should start at the beginning of the course when critical views could be discussed before planning and activity. In addition, JYUXR Campus should be part of other courses as well, when the use would not be a unique, one-time experience but, rather, a normal environment among others.

VR environment's specificity: All students were slightly confused about why the fairs were organized in JYUXR Campus, not in environments mostly used in university education. Thus, JYUXR Campus special features should be stressed more for students and there should be emphasis on activities not possible in real life.

Immersion: Only a few students had the possibility to use a VR headset at the fair, and because of COVID-19, the university could not support students having an experience on the JYUXR Campus via VR headset. Even if the university does not have the possibility to offer VR headsets for all students during fairs, all students should experience the environment of JYUXR Campus via VR headset.

Focus on individual learners: At both fairs, our resources were mostly focused on organizing the new event as itself and groups as a unit implementing exhibition points. However, resources should focus also on individuals to encourage their activity in VR environments.

Next steps

The first phase of the JYUXR Campus building process ended in summer 2021. After the first experiments described in this chapter, new spaces were constructed in spring 2021. During academic year 2021–2022, JYULearn is implementing JYUXR Campus inside the university and supporting experiments in all faculties (see Figure 1). JYULearn is part of JYU's strategy work that promotes, via experiments, for example, pedagogically and digitally appropriate teaching practices.
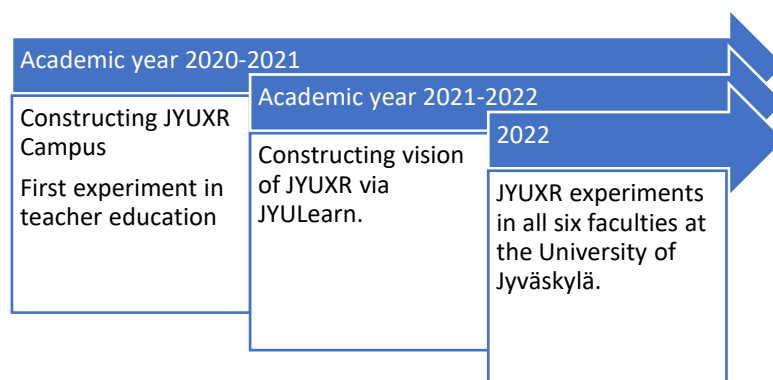

Figure 1

Implementation of JYUXR Campus inside the University of Jyväskylä.

The developmental work in coming years will focus on different activities for strengthening collaborative learning in JYUXR Campus. As noted earlier, AltspaceVR is at its best in activities emphasizing interaction. Own environments in VR environment e.g. for students, programs and faculties could be possible solutions as well. In addition, own content production, like 3D models, are part of long-term developmental work as well as strong infrastructure (VR labs) at the university. In autumn 2021, the university will open several rooms where it is possible for all staff and students to use VR headsets. Thus, the most important goal is to get university staff and students to JYUXR Campus and use it in different, innovative ways. Alongside this goal, co-operation among other stakeholders using VR environments is essential. The University of Jyväskylä is part of regional ecosystem, where educational institutions and companies develop a shared environment together that contains existing VR environments like JYUXR Campus.

Conclusion

As Dede and Richards (2017, 242) acknowledged with regard to VR education, "It's crucial to see experiments that are 'informative failure' as a success in advancing knowledge". They also assert that it is still rare to find educational test beds that include risk-taking and experimentation. Clearly, JYUXR Campus is operating as one of these early test beds for immersive learning in teacher education.

We argue that VR indeed offers new opportunities for immersive teaching and learning, but many bottlenecks still exist. Our leading premise for this chapter was that new immersive technologies should be first tested and adopted in the teacher education, and only after that should it be implemented in schools. We add that without proper and functional VR learning environments, nothing noticeable will ever happen. As the current VR technologies already support platforms that offer real-time immersive 360-degree social experiences, we trust that social VR could finally enter into every level of education. However, more risk-taking, experiments and investments, especially on the newest models of stand-alone head-mounted displays, should be done in the higher education before social VR will be reality for every student and teacher.

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