
VRE4YOU
VIRTUAL REALITY EXPERIENCE
FOR YOUTH

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HANDBOOK

INDEX

Analysis of the state of the art on the use of VR in the field of non-formal education

The world faces a continuous evolution and openness thanks to globalization and the interdependencies between the world's parts. Individuals, organizations and states are all interconnected, and the co-dependency between them is more important than ever in the era of fast connections and communication, where technology plays an essential part. As a result, technology has undoubtedly become indispensable to our daily lives. From the moment we wake up in the morning, until the time we fall asleep at night, technology has become an essential factor in designing new connections and experiences.

Virtual reality is a computer-generated environment that creates the immersive illusion that the user is somewhere else. Instead of looking at a screen in front of them, VR allows people to interact with an artificial three-dimensional environment through electronic devices that send and receive information like motion sensors and movement trackers. The most essential VR device is the headset, which generally looks like a pair of thick goggles. Fitted out with a unique screen and motion sensors, a VR headset tracks the user's movement and changes the angle of the screen accordingly. Only recently, VR technology was viewed just as a means of creation in sci-fi movies, but nowadays this technology has entered our lives similarly to its predecessors, as it's getting increasingly accessible.The fields in which VR technology can be used vary greatly, from its applicability to games and entertainment to being essential in health, aviation and the military. ''Such devices typically promise a sense of phenomenological presence or immersion in the [virtual] environment". (Rob Shields, 2005).

Optional accessories can enhance user experience and include things like:

- *Hand gloves*. Wireless controllers that capture full hand and finger action in virtual reality and provide the user the sensation of touch.

- *Treadmills*. A mechanical device that looks nothing like the gym equipment you're used to, a VR treadmill translates your real-life body movements into virtual motion.
- *Vive Trackers*. Small hockey puck-esque devices that bring physical objects you own into the virtual world.

Technology, and especially VR technology, can enhance traditional education by integrating new experiences into the learning process. This can be applied to both formal and non-formal learning and it can be especially effective in engaging young people and students by stimulating curiosity and fostering a 'learning by doing' approach.

Uses of virtual reality in educational field

One of the most important spots that requires special attention is the education field. In the process of learning, technology's role is to enhance the conventional potential that education owns. Precisely, integrating new technologies such as VR in the learning process - no matter if it is formal or non-formal education - it will arouse the interest of the user, especially if we refer to the age category of young people and students, it will stimulate their curiosity of knowledge and learning by doing ability, as well.

When discussing the use of technology to create a computer-generated experience though VR, it can be referred to as a safe and controlled environment in which the education experience is enhanced. VR technology can provide multiple and diverse forms of learning and it can improve the efficiency of non formal learning methods. Non Formal learning, as defined in the Compass Manual, refers to planned and structured programs that focus on personal and social education for young people, aimed at improving a range of skills and competences outside of the traditional curriculum. Non Formal learning is voluntary, accessible and centered on the needs of the learner, with an emphasis on process-oriented methods. Non Formal methods are implemented to prioritize the needs and perspectives of the learners and to encourage the sharing of ideas, thoughts, and experiences in a safe environment.

When technology such as VR is introduced to non-formal learning, the benefits are maximized. These can include:

- A noteworthy educational learning through a vivid experience;
- Creative thinking encouragement;
- Peer interaction progress;
- Inclusion for all parties involved;
- The ability to inspire and discover inspiration.

The use of VR in non-formal learning can provide several benefits, including cost-effectiveness in the long term, despite the initial investment in equipment. Furthermore, it can make education more accessible for disabled individuals by providing them with opportunities for engagement and participation in activities they may not be able to experience otherwise - a VR experience may offer a wheelchair user the opportunity to run, for example. VR, in conjunction with AR (Augmented Reality) and MR (Mixed Reality), creates an immersive and engaging environment that is ideal for practical interactions, observations, innovation and the discovery of new skills.

K-12 education

At the K12 level (kindergarten to 12th grade in the US), virtual field trips are among the most common ways educators use VR. For example, in 2019, the Schaumburg School District 54 in Illinois utilized virtual reality kits in each of its 28 schools to bring students on virtual field trips to the moon, World War I battlefields, and the Great Hall at Ellis Island. The enthusiasm from kids has been overwhelming, said Associate Superintendent Nick Myers in an interview with EdTech magazine. “We’ve seen truly emotional reactions to it because the students can see it, they can navigate through and be part of the experience they’re learning about.” VR field trips are becoming so popular in education because, in addition to providing immersive and engaging experiences, they’re also accessible. Not every student may be able to join their classmates for a real-world trip to a museum or another country, whether because of a disability or expense. With VR, every student can go on the same trip at no cost. Because

they don't require expensive transport and logistics, virtual field trips are more cost-effective for schools. Other uses of VR in K-12 education include language immersion and virtual lab simulation. Language immersion allows students to connect with people all over the world. On the other hand, virtual lab simulation gives STEM students the option of experimenting in million-dollar labs or mixing different chemicals in a virtual chemistry class without fear of blowing anything up in real life.

Special education

For students with special needs, VR creates new opportunities to safely explore the world and practice real-world skills, like obeying traffic signals or interacting with police officers, in a no-risk environment. For example, Danvers Public Schools district in Massachusetts used VR to introduce new students to the district's middle school building in advance, something that was particularly helpful for students with disabilities.

Higher education

Choosing the right university can be a daunting and exhausting experience. With VR, applicants can go on virtual reality campus tours to see what it would be like to attend a college or university in another city or even another country. For example, the University of Michigan athletic department uses VR technology to give potential recruits the chance to see and feel the campus and the athletic facilities from wherever in the world they may be. But with VR, you may not even have to attend a physical university. During the COVID-19 pandemic, Steven Hill, professor at the University of North Carolina at Chapel Hill, ditched Zoom lectures for a virtual 3D version of his classroom. Students can walk around the classroom, talk to each other at different gathering spaces, and even break into groups. Of course, VR is useful for learners who attend physical institutions, as well. At the Beijing University of Chinese Medicine, students use VR to learn acupuncture. In the UK, the University of Westminster has implemented a virtual training center that allows criminal law students to investigate potential murder scenes.

Vocational training

Unfortunately, vocational training is often seen as a second choice — something that students do when they can't get into a university. Some trade schools are trying to change this by using VR technology to give prospective students a glimpse into a vocational

graduate's daily life. In addition to attracting new students to trade schools, VR can also give trainees more opportunities to practice essential skills in a safe environment. For example, electricians can rewire a house with fewer safety hazards. Moreover, because trainees work with virtual materials, trade schools can save tons of money on physical materials.

Benefits of using virtual reality in classrooms

According to one study that looked at 1,000 students in three universities, the implementation of VR in classrooms led to students improving by a full letter grade. One of the main advantages of using VR in education is that it raises students' grades. In another instance, a hospital found that using VR to train medical students increased their retention rate by 80% a year after the lecture compared to 20% a week after when they didn't use VR. This boost in retention isn't so surprising when you consider that VR promotes student curiosity and keeps them engaged even when learning challenging topics. For example, Barbara Mikolajczak, who runs VR camps and classes in Boston, was surprised to see how motivated her students were when working with other students from Australia when building a virtual version of a Boston church. "The students were so excited about converting meters to feet," she said. "They realized that the doors wouldn't be in the center, so that evolved into a lively discussion about what's more important: the pure numbers or the symmetry of design. You wouldn't have seen that in a normal lesson about the Old North Church."Other benefits of virtual reality include increased collaboration, cultural competence, and fewer distractions. VR can also help students build better habits. Indeed, according to recent research, after using VR, people have been found to exercise more as well as show more empathy, among other things.

What is the future of virtual reality in education?

By adding a new dimension to the learning experience, virtual reality can revolutionize education across every level. We are currently only seeing the early stages of an educational paradigm shift being created by virtual technology. As VR technology develops even further with better eye tracking and motion sensitivity, it will create new layers of immersive experience. In the future, this means that learners will fully live out and understand learning experiences and educational moments. Another part of the future of virtual reality in education is greater accessibility. As headsets and software become cheaper, virtual reality will ultimately become a ubiquitous part of education. As hinted at by the popularity of Google Cardboard (the official VR cardboard case costs just $14.95), VR's rise will change aspects of how teachers and educators work, too. However, the core tenants of education will remain the same. A powerful tool, VR will make great educators even better by giving them the means to engage new generations of learners like never before.

A legislative framework that governs the use of VR with young people

The Virtual Reality industry has seen significant growth in recent years, offering a new way to interact with and experience the world. In Europe, the adoption of VR technology is leading to changes in daily life and opening the door to increased creativity and innovation. However, it is important to note that the virtual world also presents new opportunities, challenges, and potential risks. As Herman Narula states, "A virtual world is a place that generates meanings for its inhabitants." (Narula, 2022, p.96). The European Union (EU) is aware of the potential implications of a virtual reality legislative framework, particularly with regards to data protection. The metaverse universe, which is made up of avatars, has the potential to generate data that may later be sold to advertisers. This data can include facial expressions, gestures, and other avatar reactions, as well as its digital footprint. As such, the EU's General Data Protection Regulation (GDPR) may apply to VR, but there is a need for further clarification in this regard, specifically within the boundaries of virtual reality. Currently, the EU does not have a specific legal framework for artificial intelligence (AI), but in April 2021, it proposed the AI Act, which aims to take a human-centric approach to AI. The Act calls for a ban on harmful AI practices that pose a clear threat to safety, livelihoods, and rights, and regulates high-risk AI systems that have the potential to adversely impact safety or fundamental rights. The Act also highlights the necessity of establishing a European Artificial Intelligence Board (with representatives from the Member States and the European Commission) to be responsible for designating national supervisory authorities. In addition, the EU's Network and Information Systems (NIS) Directive seeks to increase EU national cybersecurity capabilities and EU cyber-resilience. The General Product Safety Regulation also requires appropriate cybersecurity features for product protection. As VR technology becomes increasingly common among consumers, these regulations are becoming more relevant.

Lastly, it is important to note the role of the user of VR, and to support the EU has set a goal for 2025 to increase basic digital skills among European citizens aged 16 to 70 through an updated digital education action plan. Roy Keidar (special counsel), Nimrod Vromen (partner), and Ahuva Goldstand (intern) of Israeli law firm Yigal Arnon & Co. examine how the law is keeping pace with emerging virtual reality (VR), augmented reality (AR), and mixed reality (MR) technologies. As every law student knows, there can be no legal or criminal

ramifications to mere thoughts. We are free to consider, ruminate, or fantasize to our heart's desire about committing various wrong-doings with absolutely no legal consequences. As long as we don't turn these thoughts into action, it's not a matter for the law. Let's take this premise one step further. Say we express our private thoughts using technology, whilst still keeping them "private." For example, what if in the confines of a virtual reality (VR) game, we were to vent all of our pent-up rage at an avatar representing a boss or manager—sort of what we can see in the HBO's popular series, Westworld. From a legal standpoint, as long as these violent intentions do not transcend into the real world, there is no legal (criminal or tort) liability. In other words, if retained within our own private world, even though expressed virtually, these will likely be legally categorized as non-actionable, private thoughts, like so many rants scribbled into a personal diary. Now, what would the legal consequences be if an action carried out in the virtual world had very real, albeit unintentional, implications in the physical world? Complicating things further, what if such action was carried out not with VR, but with augmented reality (AR)? Unlike VR, AR doesn't replace the real world with a simulated virtual one; rather it augments the real, physical world with computer-generated sensory input, like sounds or graphics. Would we still be exempt from any legal liability for such actions? Or might we unexpectedly find ourselves on the wrong side of the law? This question is no longer a theoretical one. The evolution of VR and AR has raised new legal dilemmas both for users and product manufacturers, especially in the gaming industry. And some of these dilemmas could soon turn out to be, quite literally, game changers.

A theoretical framework for the use of VR in the field of non-formal education with GMOs

Virtual reality is built on the basis of the concept of simulation. Non-formal education environment stimulated by virtual reality offers a flexible space for young people to acquire the necessary knowledge at their own pace. It represents a safe space where young people with limited opportunities can start to develop themselves. Whether this space is found in libraries, or whether it is made available to them through NGOs projects, virtual reality depicts an ”an opportunity to accurately and realistically simulate dangerous or risky situations and make them safe for learning before engaging in the real situation.” (Ogbonna, 2019). Young people with fewer opportunities are not usually integrated in a vast amount of activities which helps their personal, educational and professional growth. When such opportunities are given to them to test the VR equipment, “learning of technology education may become a more interactive process, playful and experimental” (Ogbonna, 2019); shortly, they become oriented to action before putting it into practice in real life.For current research we broadly explore the potential of Virtual Reality for education. As a part of this we try to form some sort of theoretical framework to describe the unique characteristics of VR as a medium and how it can be used to explain complex concepts and teach different skills. With some googling you can find quite a few articles (both academic, popular and in-between) that describe the various ways VR could be used in education and non-formal education. There are even a few listicles out there, to use the parlance of our times. With a Virtual Reality headset students can explore 3D spaces and experience dangerous, expensive or inaccessible places and events. We can simulate emergencies. You can witness volcanic activity from close-by. You can walk through ancient cities and fly through the solar system. Architecture students can evaluate their buildings in new ways and medical students can learn about the body in 3D. With young people looking for work or building their career, you can work on their soft-skills as public speaking, time organizing, problem solving and so on. We’ll give some examples of actual VR softwares that can work on these aspects.

Potentially very good use cases of VR uses. However, we think these examples are all low hanging fruit and by no means a complete collection of the possibilities of the medium. VR

is still very young and there is a lot to be explored. Almost during every brainstorm session a new potential use case of VR arises from the group. In its ultimate promise, VR offers the possibilities to simulate almost any thinkable experience. Although VR is still quite far from this ultimate promise, the scope of possible Virtual Reality experiences is still huge. Forming a theoretical framework that we can use to categorize different VR experiences and describe the potential uses in education, is for this reason quite a challenge. For this purpose we created a question list which, in our experience, served as a good starting point for discussion. In this section we would like to share this list:

Question list for educational VR content

General
- What is the audience for this app?
- Is the app domain-specific, or is it a more general, platform-like application?
- Does the app offer a fun experience?

Immersion
- How immersive is the experience?
- Can you imagine a similar experience with a different medium? How different is this from the VR version?
- Does it use any multi-sensory output?
- Does the make app make good use of the 3 dimensional space?

Interactivity & embodiment
- What sort of input does the application use? (head-tracking, positional tracking, controller, hand motions, etc.)
- Do head movements influence the activities of the content?
- How interactive is the environment?
- Does the environment invite you to interact with it?
- Do you have a body?
- Do you use your body in a meaningful way? Does it have potential for embodied learning?

Duration

- How long does a typical experience of the content last?
- What is the total time of interesting experiences you can have with the content?

Simulation

- Does the application simulate a real-life environment or activity?
- Is there a special reason to simulate this activity? (e.g. dangerous or expensive)
- Does the application prepare you for a real life activity?
- Does the application offer a self-contained environment for solving certain problems?

Creativity & Imagination

- Does the app offer an experience that could not be experienced in reality?
- Is the user challenged to create new things in the application?

Social & Collaboration

- Does the app offer in-app social interaction?
- Does the app induce real-world social interaction?
- Is collaboration part of the experience?

Freedom & personalization

- Is the experience clearly directed, or are users more or less free to explore
- Does the app offer personalized learning experiences?
- Does the app tailor different kinds of learning?
- Is the aim of the app to transfer existing knowledge, or could you also discover new findings?

Feedback & rewards

- How is feedback handled in the app?
- Are there clear goals and rewards?

●How are you informed about your progress?

Feasibility

●Is the experience a first prototype or a finished product?
●Does it depend on future hardware or does it work with several off-the-shelf systems?
●How much work was involved in creating the content?

Learning content

●What could one learn from this app?
●How valuable is the information or skill that the app teaches?
●How is the content communicated? Does the application use text, audio or video? How well is this information integrated in the experience?
●Are there other ways of learning the same as this app offers? Compare this application with those.

Embedding in educational practice

●Is the application stand-alone or is it embedded in a larger educational program?
●Could the application be used in a small classroom setting (~10 people), regular classroom (~30 people) and/or a lecture setting (> 80 people). Or does the content require a setup different from commonly found in education?
●Could the app be used in a form of distance learning?Can you think of a specific use case?
●Does the teacher have a role? Is he/she a guide, a co-explorer or a more traditional teacher?
●What kind of hardware would be necessary to use this application in educational practice?

Comparison

●Compare this application with other, similar VR experiences

Improvements & expansions

●Where does this app need improvement? How could this be done?

A national and international collection of VR apps available on the market in the educational and social field

Virtual Reality is a growing trend in technology and is changing the way many industries train, educate and regulate their operations. People believe that VR should not only be applied in the gaming industry, but it can be applied in more applications and has a much more positive impact in our lives, for instance, the vital education area. In this article, we've picked 7 best virtual reality apps about education, covering space exploring, history, school education, medicine, language learning, and so on.

1. InMind VR 2 (Cardboard)

InMind 2 is an action/arcade VR game with a bit of decision-making strategy and neuroscience of the human brain. You'll take part in the process of one teenager named John becoming an adult, and help shape John's future self while experiencing an exciting journey inside the unusual micro world of the carefully recreated human brain. Remember that in this world even one small molecule can change a person's destiny!

2.Titans of Space

Titans of Space® is a short guided tour of our planets and a few stars in virtual reality. Through the "Titans of Space", students will be able to view the galaxy where we are in a virtual reality perspective. With the music and the perfect visual effect, it will allow students to a more three-dimensional understanding of the mysterious solar system. Planets will be reduced to one-millionth of the actual size to get a surreal experience. For example, the earth seems to be a small house or a size of 12.7 meters wide hologram. The space giants are self-regulating and are equipped with various options, so you can customize your patrols based on your preference for students. It can be used with VR devices such as Oculus Rift, HTC Vive and Monitor.

3. Anatomyou

Anatomyou VR is a perfect immersive app to learn human anatomy through virtual immersive 3D navigation of the human body. The app shows, using virtual immersive 3D navigation on a mobile device, the anatomical structures of various systems of the human body browsed at the minimally invasive procedures. Although this application is geared to health science students in the medical field, it can also be used to teach students knowledge of human anatomy. These include the following systems: nose, throat, gastrointestinal, circulatory (divided into arteries, veins, lymph) and female reproduction.

4. VR Lessons by ThingLink

The virtual reality courses, designed by ThingLink, focuses on primary school students, an interactive course that covers a wide range of topics such as art, language, and science. This application allows students to travel around the world and teach them the basics of each ecosystem. The VR courses can be watched through iPad or iPhone, but it would be much better to equip VR glasses for a better and complete virtual experience.

5. KingTut VR

There is no better way to learn about history than to be fully immersed in the subject matter. To experience the moment an important event took place is worth more than any number of pictures or chapters in a textbook. Unfortunately, there are few people that are lucky enough to travel to historical sites in order to learn first hand about the world's history. For example, to view the Death Mask of Tutankhamun one must travel to Cairo, Egypt and visit the Egyptian Museum. KingTut VR lets you experience the Tomb of King Tutankhamun on your mobile phone in Virtual Reality. See the awe-inspiring hieroglyphics and Death Mask of Tutankhamun up close from the comfort of your own home. The full 360-degree virtual environment lets you get a personal view of these impressive historical artifacts without having to worry about the curse of the Pharaohs.

6. Learn Languages VR

Learn Languages VR is a VR application for language learning. There is no doubt that the best way to learn a language is to integrate into this locale, but the current teaching conditions do not guarantee that every class has foreign teachers and not every student has the chances to communicate with native speakers. Learn Languages VR provides a dialogue from real life, including 28 languages, students can choose totally by themselves. As of April 2017, the global download has been more than 500 million times!

7. Unimersiv

Unimersiv is the largest platform to learn from Virtual Reality. By downloading the app, you will have access to multiple experiences that will let you learn about history, space or the human anatomy. The learning app makes learning new things fun again and helps students of all ages learn anything faster through virtual reality.

8. Puzzling Places

Pursues knowledge, concentration and a sense of space through over 16 different puzzles, from historical buildings to landscapes, all inspired and captured from the immediate reality with the help of photogrammetry.

9. Apatosaurus

The application is inspired by Jurassic Park and allows the user to interact with the virtual world of dinosaurs, the specific sounds of nature and even direct interactions.

10. Next VR

focuses on sports broadcasts. Their programs are broadcast on 360° videos, perfect for Gear VR applications. Football, basketball, golf and soccer leagues are some examples.

11. Notes on Blindness

It is the right application to understand how a visually impaired person interacts with the world around them. Its development was inspired by the audio diaries of a writer who gradually lost his sight.

12. Humber Hunt VR

uses gamification and has mathematical content. The purpose is to complete the set of target numbers that appear next to your left hand, with the help of mathematical operations.

13. Times Tables VR

gives you an operation with missing factors. You have to look everywhere around you and choose the correct option as soon as possible. It is based on interacting with the elements in the environment, using your imagination and kinesthetic learning.

14. #Befearless - the fear of heights

is composed of two branches. One is called "landscapes", and the other is called "urbanism". These include a virtual walk of the suspended bridge, which leads on a rocky edge, a helicopter ski experience, glass elevator ride and more. There are no interactive games, but 360 -degree videos; they are suitable to familiarise the user with the virtual space.

15. Limelight VR.

Through this application the user is placed in a social situation in small groups or one-one where interaction in situations that could be met in each one's daily life. Its purpose is to help the user to exercise and in this way the fear of speaking in public can be overcome.

A methodological proposal based on the integration of VR in the field of non-formal education with GMOs

Studies reviewed revealed various forms of learning gains. Many indicated that VR increased engagement, sparked learner motivation, and cultivated teamwork (Banu, 2012, Cheng & Tsai, 2013; Chiang et al., 2014; Cuendet, et al., 2013; Dias, 2009; El-Sayed, Zayed, & Sharay, 2011). Buesing & Cook (2013), Liarokapis et al. (2004), and Restivo et al. (2014) stated that VR provided a means to visualize concepts and spatial relationships to gain mental imagery. Librarians and other non-traditional educators endorsed VR and recommended adoption and integration into learning situations (Green, Leah, & McNair, (2014). VR use fostered collaborative environments, creating a climate of discussion, sharing, and problem solving. Studies using location-based triggers reported positive experiences, marrying physical locations with a VR curriculum. Team learning seemed to occur more in location based experiences. The high-level of interactivity of VR reportedly enhance learning, especially for kinesthetic and visual learners (Billinghurst & Duenser, 2012; Hornecker & Danser, 2009). When VR was used as part of a lesson, students had a tendency to revisit and reanalyze content and information in more of a non-linear fashion. For many, this reinforced the learning process. Non-formal learning activities also received positive feedback and produced enhanced learning environments with good results (Hsiso, 2013; Perez-Sanagustin, 2014). Overall, the technology itself received favorable reviews and was recommended as a valuable complement to traditional and nontraditional learning environments.

Only a handful of studies included empirical research that actually demonstrated learning gains through assessment outcomes. Billinghurst and Duenser (2012) found that after reading books that were solely text based students who were high-level readers had a higher comprehension rate than their low-level counterparts. When VR books were introduced, the comprehension rate for both high and low-level readers was comparable. In an accompanying test, Billinghurst and Duenser (2012) found that students who read an VR book scored 12% higher than students who read the text-only version of the same book. Jee et al. (2014) also conducted a pre and post-test with a VR book that yielded positive learning outcomes. Hsiao (2013) used pre and post-tests to compare scores of three groups. One learned using the

VR program, a second learned through PowerPoint, and a third learned using both PowerPoint and the VR program. Students who used only PowerPoint scored the lowest (mean: 56.47). Students who used both PowerPoint and VR faired better (mean: 60.48). Those who used the VR system without PowerPoint scored the highest (mean: 80.16). In contrast, Buesing and Cook's (2013) VR study resulted in higher scores for students who used a traditional learning method (text books) rather than VR for learning. The results were attributed to a well written, comprehensive textbooks compared with more limited information presented in the VR activity. This may indicate the value of summoning AR as one of many tools a teacher may have in his or her instructor toolkit.

Along with positive feedback, some challenges were also identified. Outdoor learning activities invited distractions such as overstimulation, peer side-chats, and a lack of focus (Chiang, et al., 2014). Other issues included problems with the technology itself. Program latency and GPS errors interrupted learner engagement and outcomes (Chen, et al., 2013; Wu et al, 2013). Location-based triggers also created a concern in that travel would always be required for the activity to succeed (Klopfer & Shelfon, 2010; Wu et al, 2013). In one study, young children had a difficult time conceptualizing that the artificial projections did not perform or react the way objects do in the physical world. Partnering was required for students to fully realize how the technology worked (Hornecker & Dunser, 2009). The use of complex technology and the need for multitasking skills may leave some students feeling overwhelmed and confused (Dunleavy et al., 2009; Hornecker & Dunser, 2009; Liu & Tsai, 2013).

Most all other studies utilized a qualitative approach to measure outcomes such as product satisfaction, usability, and discourse rather than quantitative approaches demonstrating increased knowledge gains through formal assessment. A qualitative approach seemed to be the norm for most of the studies found.

Recommendation

This review focused on using augmented reality in formal and non-formal learning environments. Of the 33 reviewed, 15 were identified as containing some form of research. The majority of the studies indicated that a qualitative survey was administered to gauge learner satisfaction with AR technology. Most, however, did not indicate if AR inclusion affected learning assessments positively or negatively. Of the 15 claiming research, only 4 administered some form of assessment (pre-post-assessment) to determine if the modality had an effect on knowledge gain. Santos et al (2014) found similar results in their meta-analysis of 87 research articles using augmented reality. Of the 87 referenced, only 11 were found to have comparison experiments that evaluated student performance. Of the 11, only seven allowed the

computation of an effect size. More research is needed to provide empirical evidence that augmented reality is effective in knowledge gains from a quantitative standpoint. After examination, the primary gap found in the documents reviewed is the limiting number of quantitative studies administered to determine if integrating augmented reality into a learning environment produces an increase in measurable learning. It is recommended that researchers employ a quantitative approach to measuring success with AR tools. As AR develops and evolves, more concrete results are needed to substantiate its impact on learning.

Conclusion

The future of VR lies in “fluid interface” projects like the ones being conducted at MIT’s Media Lab. Emerging AR apps will recognize physical objects and allow the user to modify the behavior of those objects, creating smarter objects that can be programed by the user (Markham, 2013). AR will function through a concept know as the Internet of Things (IOT), a process in which electronic devices will connect and evolve through Internet connectivity and coalition of data (The Internet of Things, n.d). In education, AR apps have the potential to evolve into tools that can provide a student with information about any physical object around them. The next generation of AR apps and servers can conceivably show a student the interworking’s of a car’s engine and guide them in repair, project the temperature of a science project and the chemical make-up of the ingredients, augment battle reenactments onto simulated battle grounds, and project a computer keyboard onto a student’s fingers, providing an immersive, interactive experience (Hill, 2014).

Augmented reality is a technology that has been around for many years. Integration of AR into the classroom combines the affordances of multimedia learning with active, participatory engagement. Due to the advancement of technology and greater acceptance of bring-your-own device (BYOD) programs, educators have begun to more readily integrate and accepted AR into their lesson plans. Studies and articles indicate positive experiences with AR in the classroom. There is still a need, however, for continued research to corroborate the value of AR with regard to knowledge gains.

Attachment A

Interview guide VRE4YOU

A semi-formally structured interview to map needs, experiences and existing non-formal methods for youth workers and other personnel working with VR/AR/XR, planning or already managing and maintaining something analogous to a VR-Corner.

Introduction and welcome

- Thank you for your interest.
- Aim of the project:
    - Bridge the practical and theoretical approaches to social work with VR/AR/XR
    - Collect best practice methodology and advice into a handbook
    - Transnational cooperation project between Norway, Italy and Romania, funded by the European Commission (via the E+ National Agency of Italy)
    - The involved NGOs do this on a strictly Non-commercial basis, with the intent of furthering the sustainable, impactful use of technology for recreational, inclusive, educational and therapeutic purposes. The inclusive aspects are highlighted.
- Time frame: ~1 hour for individuals, ~90 minutes for groups
- Confidentiality/consent - responses will be used, interviewee may consent to referencing, sourcing and contact info within the handbook itself. Consent to using a screenshot as proof that the interview found place, if online.
- Recording consent for those interviewers who wish to do so.
- Clearing out any questions before the interview starts. (interviewer should be at least familiar with the basic project details and grant criteria in order to answer.)

Introduction of the interviewee (current work, educational background)

- What is your educational background?
- What's your experience with using VR/AR/XR?
  (Type of technologies and for how long)
- Can you start by telling me a bit about your work? (target group, work setting, workplace)
- How does a normal workday look for you? Can you walk me through an average work day?

Methods 1 – Mapping of approach, experience and need, separating the experienced from the potential end beneficiaries of the handbook.

([IF APPLICABLE] = When the interviewee has experience with the technology)

- Do you have any thoughts on the future/trends in application of VR/AR/XR?
- Why is it important to have a methodical/systematic approach to this technology?
- What's the greatest needs of those trying to reach/work with a target audience with these technologies? (Shortcomings, knowledge gaps, immature technology)
- What are the greatest challenges about application of VR/AR/XR from your perspective? (Ethical concerns, costs, fear of technology, learning curve, escapism from reality, alienation, addiction, immaturity of the technology etc.)
- **[IF APPLICABLE]** What's the greatest potential in doing youth/social work with VR/AR/XR? (What can you do with VR/AR/XR that you can't do easily with other means)
- **[IF APPLICABLE]** What's the greatest potential in doing educational work with VR/AR/XR? (What can you do with VR/AR/XR that you can't do easily with other means)
- **[IF APPLICABLE]** What's the greatest potential in doing therapeutic work with VR/AR/XR? (What can you do with VR/AR/XR that you can't do easily with other means)
- **[IF APPLICABLE]** How much time does it take to adapt to a workflow which actively uses VR/AR/XR?

- **[IF APPLICABLE]** What kind of hardware setup would you recommend / startup-budget?
- **[IF APPLICABLE]** What kind of software setup would you recommend / startup-budget?

- What use could someone in your line of work have of a handbook on VR-corners? (What would a guide/handbook on VR-corners have to contain to be useful and interesting to you?)

[IF APPLICABLE] Methods 2A – specification of experience / praxis

[Simply skip non-applicable parts, e.g. If the interviewee has no experience with the technology, or is not working on inclusion, mental health and/or educational use, don't torture the interviewee with irrelevant questions]

When you work **individually** with your clients/youth/customers…

- …what does interaction with your clients/customers look like?
- …which topics and challenges do you normally work on?
- …which theoretical frameworks are you normally using, if any?
- …are you using methods on VR/AR/XR for..
- Creating a safe zone
- Regulating behaviour
- Promoting inclusion of minorities, language barriers
- Promoting inclusion of people with physical or cognitive challenges
- Creativity, art and co-creation
- Working with mental health
    - Screening and red flags

- Therapeutic methods

- Educational purposes (life skills or academic)
  - Social skills
  - Relationships
  - Daily life skills
  - Sexuality and gender identity
  - Emotional intelligence
  - Discipline and micro-routines
  - Addictions
  - Anxiety and depression
  - Burnout
  - Values and ethics

[IF APPLICABLE] Methods 2B – specification of experience / praxis

[Simply skip non-applicable parts, e.g. If the interviewee is not working on inclusion, mental health and/or educational use, don't torture the interviewee with irrelevant questions]

When you work **in groups of** your clients/youth/customers…

- …what does interaction with your clients/customers look like?
- …which topics and challenges do you normally work on?
- …which theoretical frameworks are you normally using, if any?

- …are you using methods on VR/AR/XR for..
- Creating a safe zone
- Regulating behaviour
- Promoting inclusion of minorities, language barriers
- Promoting inclusion of people with physical or cognitive challenges
- Creativity, art and co-creation
- Working with mental health
    - Screening and red flags
    - Therapeutic methods
- Educational purposes (life skills or academic)
    - Social skills
    - Relationships
    - Daily life skills
    - Sexuality and gender identity
    - Emotional intelligence
    - Discipline and micro-routines
    - Addictions
    - Anxiety and depression
    - Burnout
    - Values and ethics

Methods 3 - materials

- Of the methods that we have talked about so far, are there any materials/books/handbooks/information sheets that you can share with us?
- Which are the materials/publications/books/methods/ that have inspired you the most?
- Which are the materials/publications/books/methods/ that are commonly used in your work with VR/AR/XR ?

Closing of interview

That was everything that I wanted to know. One last thing before we finish the interview, is there anything you would like to add or say in the end that you think is important, or that we missed?

Thank you very much for your time.