Charles University
Faculty of Education
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MASTER THESIS

First-time user's experience and learning in virtual reality

Prvotní zkušenost nových uživatelů s osvojováním technologie virtuální reality

Bc. Alena Škopová

Supervisor:	Mgr. Ondřej Hrabec, Ph.D.
Study programme:	Teacher Training for Secondary Schools
Branch of study:	N AJJ

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I declare that I carried out this master thesis independently under the lead of the supervisor, and only with the cited sources, literature and other professional sources. I also declare that this thesis was not used to gain any other degree.

Praha 12.7.2021

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ABSTRAKT

Tato práce se zaměřuje na zkušenosti prvouživatele ve virtuální realitě. Zkoumá psychologické a pedagogické aspekty této zkušenosti a učení ve virtuální realitě. Teoretická část také vysvětluje pojmy ponoření, presenci, odložení nedůvěry a kognitivní přítomnost s cílem lépe vysvětlit zkušenosti uživatelů, Proces prožívání VR je srovnáván s tradičnější zážitkovou pedagogikou a s dvěma jejími modely spolu s teorií konektivismu. Empirická část je založena na datech z pozorování a hloubkových polo-řízených rozhovorech. Do interpretace výsledků jsou zahrnuty také 3 roky praxe v místě, kde výzkum probíhal, herně virtuální reality VR Dimension. Práce zkoumá pocity účastníků, vnímanou hloubku jejich ponoření a jevy, které by mohly ponoření přerušit v různých situacích; jejich zkušenosti z různých her; kde pociťovali nepohodlí, strach nebo vzrušení či úžas. Smyslem této práce je také odhalit problémy, s nimiž se učitel může setkat při používání této technologie pro vzdělávací účely, a nabízí řešení založená na literatuře nebo vlastních zkušenostech výzkumníka s používáním této technologie. Tato práce je určena pro kohokoli, kdo chce učit ostatní pomocí VR, nebo pro kohokoli, kdo se zajímá o překážky, které mohou nastat.

KLÍČOVÁ SLOVA

virtuální realita, imerze, zkušenost, prvouživatel, prvotní zkušenost, prezence, učení, ovládání

ABSTRACT

This work focuses on the experience of the first-time user in virtual reality. It explores the psychological and pedagogical aspect of this experience and learning in virtual reality. The theoretical part explains immersion, presence, suspense of disbelief and cognitive presence in order to better explain the users' experience. The process of experiencing VR is compared with a more traditional experiential pedagogy and with its two models. The empirical part is based on data from observations and in-depth semi-structural interviews. 3 years worth of practice by working in the field of research, the VR Dimension gaming centre, is also included in the interpretation of results. The thesis explores the feelings of participants, the perceived depth of their immersion and what might break it in different situations; and their experience in different games, where they felt discomfort, fear or excitement and awe. It also tries to detect the problems that a teacher might encounter when using this technology for educative purposes and offers the solutions based on literature or the researcher's own experience of using this technology. This thesis is meant for anyone who wishes to teach others using VR or for anyone interested in some of the obstruction that may arise.

KEYWORDS

virtual reality, immersion, experience, first-time user, first experience, presence, learning, controls

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Introduction

This thesis was written with the purpose of finding the answers to the questions regarding a first-time users experience in virtual reality. I chose this topic because I have been working at a virtual reality gaming centre for three years and I see a lot of potential in using this technology in education.

This thesis explores the experience provided by virtual reality (VR for short in the following lines) from the user's perspective and the process of learning involved with the first-time users of VR.

The theoretical part comprises basic information about the technology and gives a short summary of its history. It lists the key aspects involved in the process of experiencing virtual reality. It focuses on the depth and types of immersion and explains the meaning of presence in VR along with the meaning of suspense of disbelief and cognitive presence. There is a focus on what makes the acquisition of this technology difficult and what obstructions that a teacher using this technology might encounter.

There is also a theoretical basis for experiential pedagogy and the two models it is based on: Kolb cycle and Peter Jarvis's model along with a connectivist learning theory relevant in the digital age.

The empirical part describes methodology used in the research and gives a detailed description of the research sample and the field of research.

The gathered data is then sorted and analysed using coding, comparison of the VR experience and the experiential lesson plan methodology and a narrative analysis structured in order to provide answers to the research objective and sub-objectives. The main objective focuses on the experience of a first-time user in connection with any possible obstructions that might hinder the process of learning, providing solutions to these issues where possible and suggestions of a practical use of VR for education.

The research takes place in a gaming centre of Virtual Reality VR Dimension in Prague. It was chose because the researcher has access to it and already has years of experience working in this particular establishment. It provides the opportunity to acquire a diverse

research sample since the centre is frequented by many first time users. Therefore it was chosen for this thesis as the place where all the observation takes place.

1 THEORETICAL PART

1.1 Basics of virtual reality

Virtual reality is a rather recent term for technology which among other things tries to simulate what humans perceive in the world around them and duplicate it in a way that makes them believe that what they are seeing is quite real. It comes in all shapes and sizes and the only limit truly is the imagination of the creator of a virtual space and their capability to make their ideas come true.

"The main goal of VR is to create in the user the illusion of being in an environment that can be perceived as a believable place with enough interactivity to perform specific tasks in an efficient and comfortable way. There are two main factors that describe the VR experience from the physical and psychological points of view: immersion and presence." (Gutiérrez et al. 15)

„When we use the word "VR" now, it specifically refers to computer generated imagery and hardware specifically designed to bring those sights and sounds to us in a way that is totally immersive.

Many definitions also stipulate that VR must be interactive. This would differentiate it from things like 3D -movies, 360-degree video and other similar "look but don't touch" media. "(Virtual Reality Society)

When subjected to virtual reality, the user's brain uses past experience to create certain rules by which the world is interpreted. For example, the ground tells us where down is, the shadows tell us which direction the light comes from and the relative size of things help us judge distances. The brain creates these rules to operate more efficiently. (The Franklin Institute)

Therefore, creators of virtual spaces try to provide this information by using such rules. If an object follows an expected type of movement or general rules of physics, it becomes more realistic and believable. "*Sometimes, when the virtual cues don't quite match your brain's expectations, you can feel disoriented or nauseated. Because the human brain is much more complex than even the most sophisticated computer, scientists are still trying to understand which cues are most important to prioritize in VR."* (The Franklin Institute)

1.2 Brief history of VR

If virtual reality is the creation of an illusion that is believable, then even the early 360-degree murals or panoramic paintings from the nineteenth century can be considered the oldest attempt at virtual reality. They were supposed to invoke the feeling of being in the place depicted in them by filling the viewer's entire field of vision.

The history of virtual reality can be traced all the way to the 1830's. In 1838, Sir Charles Wheatstone was the first to describe stereopsis and researched binocular vision. His earliest type of stereoscope used a pair of mirrors at 45 degree angles to the user's eyes, each reflecting a picture located off to the side. (Barnard)

"...the mind perceives an object of three dimensions by means of the two dissimilar pictures projected by it on the two retinae..." (Wheatstone 375).

Almost a hundred years later, there was a rather daring attempt at a fictitious pair of goggles which enabled the user to see, hear, taste and even touch a movie. The narration follows an American science fiction writer Stanley Weinbaum who invented a fictional model for VR in a short story by the name of Pygmalion's Spectacles. (Virtual Reality Society)

In 1956, Morton Heilig made a Sensorama which simulated a ride through a real city environment. Using multisensory stimulation he let the users see the road, feel the vibration, hear the engine and even smell the motor's exhaust. The Sensorama featured six movies which he shot, produced and edited himself. *"It featured stereo speakers, a stereoscopic 3D display, fans, smell generators and a vibrating chair. The Sensorama was intended to fully immerse the individual in the film."* (Virtual Reality Society).

Officially, VR as we know it today was invented in the 1950's. The Sword of Damocles is the name of the first VR head-mounted (HMD) system and it was brought to life by a computer scientist Ivan Sutherland in 1968 with the help of his student Bob Sproull. The objects in the virtual reality were displayed against a real background so it can be considered the first example of augmented reality, which was an important step for VR. (Swagsoft)

1980's then saw the term virtual reality gaining some recognition thanks to Jaron Lanier, founder of VPL Research (Verdict).

The following years were full of changes and developments related to virtual reality:

"1984 – Jaron Lanier founded VPL Research, one of the first companies to develop and sell VR products." (Verdict)

Jaron Lanier was very crucial to the development of VR since he stood at the beginning of this technology as we know it. He not only developed or co-developed most of his VR technology, he was also the person who popularised the term "virtual reality".

Louis Rosenberg invented the first fully immersive AR system called Virtual Fixtures (1992). This inventor worked for the United States Air Force and shows that VR and AR have roots in the military like many other technologies.

As I worked in the virtual reality gaming centre, there was one customer who claimed to have worked for the military and he said he was the programmer who helped create virtual environment for soldiers to train in. He quipped that the soldiers had to use collars which would shock the wearer when hit in the VR. Thankfully this part of the technology did not make it into the entertainment and education industry yet.

The 1990s introduced many VR arcades and game consoles. In 1991 Virtuality Group introduced the first VR arcade machine – Virtuality, which provided a 3D gaming experience. It was reached using VR headsets with realtime stereoscopic 3D images and it even offered some multiplayer games. Sega introduced its VR-1 motion simulator in its SegaWorld arcades in 1994 but did no ye provide the home game consoles fearing that the experience could be too real and people would get hurt. Therefore, home game consoles were brought by Nintendo in 1995 and their Virtual Boy is considered a bad example of a virtual reality headset. "*Forget that the unit was fixed and offered no head or motion tracking, the graphics consisted entirely of red lines drawn on a black background. Decades later some people may still be getting over the migraines this thing gave them."* (Wiltz). It may not have helped the technology forward, but it served as an example of how not to do it.

Strangely enough, another important point in the history of VR is a movie. The Matrix was released in 1999 and it presented the audience with a completely immersive virtual world. This might have served as a wake-up call for many developers and it opened the minds of future consumers to such possibilities.

After Google introduced Street View in 2007, a major step was born via a Kickstarter crowdfunding campaign in 2010 – the Oculus Rift headset was designed. It was a complete breakthrough and offered unrivalled immersive experience using a much more advanced field of vision and rapid head movement tracking. In 2014 Facebook acquired this technology, while Sony worked on Project Morpheus and Google released the Cardboard which effectively turned a smartphone into a VR device and Samsung launched its Gear VR.

In 2013, Google released Google Glass bringing internet, video recording and taking photos into one pair of glasses. "*Glass was also met with a good deal of social backlash over fears that wearers were violating people's privacy by secretly recording them or just generally being snide jerks about their new toy. Bars and other establishments even banned Glass wearers – so-called Glassholes."* (Wiltz). It was used by a wide variety of users but ended up being criticized heavily to be later in 2015 used mostly for enterprise application.

2015 – The HTC Vive headset, developed by HTC and Valve, was unveiled at Mobile World Congress (Verdict). It was quickly followed by Sony's PlayStation VR (PSVR) in 2016. This VR system made Sony the first company to truly allow gamers a home VR experience and quite recently, they have announced that another PSVR was slowly on the way. (Verdict)(SwagSoft) (Wiltz)

There are many more companies and developers moving in many directions. Each year the technology becomes more elaborate and even a new VR set becomes financially more acceptable to an average user. But for now, the decision to buy VR for personal use is not easy since it is by no means a cheap type of entertainment just yet. That is why gaming centres offering the trial of headsets and a wide selection of games to experience are a rather vital part of the VR chain serving the function of introducing this form of entertainment to general population.

The history of VR is more complex than can be covered in one section but this basic outline of its development should help the users understand where it stands now and the speed at which it progresses today. And that speed is phenomenal and shows no signs of stopping.

1.3 Key aspects of the VR experience

Experiencing virtual reality is mostly about enjoying a world different from the one we live in. Most games and applications provide an experience such as sightseeing, solving problems, fighting, exploring etc. Basically, the experience provided in VR Dimension and therefore relevant to this work is mostly focused on the gaming side of this technology - gaming and experiencing exciting events or seeing places not available under usual circumstances. But what makes VR so successful and how do designers achieve that people get completely lost in another world? It is all about perception. If we believe that what we see is real, it is real.

The psychological theoretical basis of virtual technology leans mainly on immersion, presence and suspension of disbelief.

1.3.1 Immersion

The key to achieving a successful virtual reality experience is immersion.

"Immersive virtual reality is a technology that aims to completely immerse the user inside the computer generated world, giving the impression to the user that they have "stepped inside" the synthetic world." (Furht 345)

There are many types of immersion differing with each author. Ernest W. Adams separates immersion related to game industry into three categories:

1. **Tactical immersion**

Tactical immersion is immersion in the moment-by-moment act of playing the game, and is typically found in fast action games. It's what people call being "in the zone" or "in the groove." This type of immersion is physical and immediate (Adams). It is about the fraction of a second-decision which induces the trance like state. Tactical immersion is reached by offering "...*flawless user interface, one that responds rapidly, intuitively, and above all reliably."* Slow, awkward controls would hinder the immersive feeling. Tactical immersion can be destroyed by abrupt changes in the nature of the gameplay, some shifts in the user interface, or by a hard to beat boss character denying the usefulness of previous game experience. (Adams)

2. **Strategic immersion**

"Strategic immersion, on the other hand, is a cerebral kind of involvement with the game. It's about seeking a path to victory, or at least to optimize a situation. The highest, most abstract form of strategic immersion is experienced by chess masters, who concentrate on finding the right move among a vast number of possibilities. When you're strategically immersed, you're observing, calculating, deducing."(Adams)

The players who are more interested in the strategy of the game usually don't care about the story. For some highly strategic players, a story may even pose as a distraction. To reach the strategic immersion, the game has to provide mental challenges the players might enjoy. If the gameplay is not logical or it becomes somewhat awkward, it can destroy strategic immersion. (Adams)

3. **Narrative immersion**

"A player gets immersed in a narrative when he or she starts to care about the characters and wants to know how the story is going to end. The player who is immersed in the narrative can tolerate a certain amount of bad strategic and tactical gameplay."(Adams). Narrative immersion is entirely dependent on the abilities of the storyteller. If the story is bad, no matter how good the visual part of the experience is, it can completely destroy this type of immersion.

There is one more typology that is very similar to Adams but uses different titles and even expands the number of types. Staffan Björk and Jussi Holopainen call them:

1. **sensory-motoric immersion**
2. **cognitive immersion**
3. **emotional immersion**, respectively.

They also add one more type: **spatial immersion**.

Spatial immersion "*refers to the type of immersion triggered and maintained by the spatial qualities of the virtual environment. In spatial immersion, the immersive effect of the virtual environment can be achieved by the deliberate manipulation of a few spatial compositions of the scene, such as swift zoom-in and zoom-out, abrupt change of camera angles, or the whirling sensation of on-the-fly sky-diving shots. All these*

filmic techniques achieve a phenomenological experience as if the user could walk into the virtual environment and touch and feel the spatial mise-en-scène." (Zhang et al.)

There are many ways to understanding immersion but in gaming and thus in virtual environment, it is tied to the depth of users' experience. In some theories and publications the term immersion can be parallel to presence. For the purposes of this thesis and for some degree of differentiation, I chose to regard these terms as closely related but separate.

Barfield and Furness explore the meaning of presence in *Virtual Environments and Advanced Interface Design*.

1.3.2 Presence

As was already mentioned in the previous section, presence and immersion may be considered interchangeable. But if we choose to define them as different aspects of the same process, we can see that they actually complement each other and it could even be said that one could not truly exist without the other. Presence in the most general of sense can simply be defined as the feeling of "being there". We can separate this particular meaning into different levels of reality. Barfield and Furness discuss the theory of presence as follows. *"To discuss presence in the context of virtual environments, it is first necessary to discuss the concept of presence in the non-virtual or real world."Presence" generally refers to the sense of being present in time or space at a particular location (Webster's II Dictionary, 1984). Thus, presence is a cognitive state which occurs when the brain processes and makes sense of the myriad of stimulus information impinging upon the human's sensory systems."* (Barfield and Furness 475). Therefore, our senses are processed by our brain and it gives us the information about our environment. If we believe that environment is real, we feel present.

Barfield and Furness had to first establish the meaning of presence in general to be able to define virtual presence. *"A virtual environment is an interactive, multisensory, three-dimensional, computer-synthesized environment. Virtual presence refers to the human's level of presence or inclusion within a virtual environment. In a recent article, Sheridan (1992b) defined virtual presence as the sense of being physically present with visual, auditory, or force displays generated by computer. We extend this definition to include cognitive presence in a virtual environment as well."* That means, that even if our senses

give us the information that our environment is real it doesn't necessarily mean that we believe it. Achieving cognitive presence also means that the user believes that the presented world is real.

"The terms "virtual presence", "virtual environment", "virtual reality", "artificial reality" are experienced by a person when sensory information generated only by and within a computer and associated display technology compels a feeling of being present in an environment other than the one the person is actually in." (Barfield and Furness, 481-482)

Therefore, creating a virtual environment which enables us to immerse ourselves fully is paramount to creating the type of subjective sensation which makes us believe that the virtual is actually real. As hard as it is to immerse ourselves, it is also just as easy to lose that connection to the other reality. Since the perception is subjective, the manner and degree in which we experience virtual reality is individual.

1.3.3 Cognitive presence

Cognition refers to the mental processes involved in acquiring knowledge and comprehension. They include judging, remembering, knowing, thinking and problem-solving. ("Cognition"). Cognitive processes allow us to establish presence. By processing the stimuli and understanding the world around us, we are present.

The term cognitive presence has been widely discussed and recently it has been included in distant learning related studies. Together with social presence and teaching presence, it creates the educational experience. When it comes to this term, cognitive presence is strongly connected with the community of inquiry. In a community of inquiry, the participants are able to construct a meaning through communication and cognitive presence is the extent to which they are able to do so. ("Cognitive Presence" 00:05–00:57)

Center for Teaching and Learning (CTL) describes it as "*the result of teacher and social presence; the promotion and communication of analysis, construction, and confirmation of meaning and understanding; creating learning environments where students develop their own questions and responses."* Cognitive presence is for example created when students not only read the syllabus, but are also aware of its meaning and importance in their studies and are able to connect it to the lessons' objectives. Simply put, the students are aware of

the bigger picture. Cognitive presence also promotes the idea of four phases on learning: Triggering Event, Exploration, Integration and Resolution. This model is called The Practical Inquiry Model and in its centre lays experience ("Cognitive Presence" 00:57–04:16). This particular approach to cognitive presence is deeply rooted in the pedagogical approach and it seems to have been defined with learning in mind. But to look at the term in general, Nunez and Blakes define it as "*...the degree to which the virtual environment dominates over the real environment as the basis for thought."*

They define virtual environment (VE) as a set of data displayed in such a manner that it creates the impression of certain objects in space. They also explain the term Cognitive dominance which might be quite important to understand when creating a virtual educative environment. Nunez and Blake define Cognitive dominance as a state *"where thought is more aligned with the virtual environment than it is with the real environment, and can occur in degrees."* The implication of such a state could mean that if the VE during the experience is stronger and more dominating than the experimental setting, then that will impact the memories of it. The user's responses will be appropriate to how he/she would react to the virtual world and not the real world. Therefore, if we wish to simulate a real world environment in order to teach proper responses used in real-life, we must take this aspect into account.

Garrison et al. also consider cognitive presence to be a "*vital element in critical thinking, a process and outcome that is frequently presented as the ostensible goal of all higher education."*

1.3.4 Suspension of disbelief

It was Coleridge who first mentioned the term suspension of disbelief in his Biographia Literaria in 1817. "*In this idea originated the plan of the 'Lyrical Ballads'; in which it was agreed, that my endeavours should be directed to persons and characters supernatural, or at least romantic, yet so as to transfer from our inward nature a human interest and a semblance of truth sufficient to procure for these shadows of imagination that willing suspension of disbelief for the moment, which constitutes poetic faith."*

The traditional understanding of this term is that readers need to be able to believe in what is usually not believable at all. For example, if someone firmly doesn't believe in ghosts and reads a story which features them, unless that reader knowingly decides to believe in them for the purpose of immersing in the story or he refuses to believe in them even then, but does not truly enjoy the story as it was designed. Suspension of disbelief is a willing choice of putting aside our truths to accept others.

Norman N.Holland (73) states in his book that "*Psychologist Richard Gerrig, however, has convincingly rewritten Coleridge's "willing suspension of disbelief." He notes that we take away only some information from a fiction. That is, if I am reading Sherlock Holmes stories, I will take away information about hansom cabs and gazogenes as part of my permanent knowledge. But I will not believe that there was a Sherlock Holmes or a Dr. Watson or a Mrs. Hudson. One can explain this phenomenon, Gerrig claims, by saying that we believe all and then we disbelieve some."*

Gerrig is not the only one who doesn't consider our usual immersion in a story a complete suspension in disbelief. Some even call our involvement in a book or a movie a secondary disbelief.

Mikkel Marfelt describes what a **complete suspension of disbelief** would look like and compares it to a well-known movie: "*A complete suspension of disbelief is what Neo experiences in the matrix before realising he is living in a simulated reality."*

He also gives a logical explanation of when the complete suspension of disbelief is desirable and when it would have the opposite effect. "*For some purposes the holy grail of VR is to make you experience the virtual world as the real world. For educational purposes, complete suspension of disbelief is great to unlock, but not necessarily the best way to learn."* Some simulations they develop at Labster would not be very effective with the complete suspension of disbelief. "*We develop simulations where students can use explosive materials, work with deadly viruses and other things that people would not engage with, if sensing a complete suspension of disbelief (you would not risk blowing yourself up if you truly believed this could happen in a virtual world)."*

As can be clearly seen in the example above, it is not always necessary or even proper to reach for a completely immersive experience. In some cases, if we wish students to learn something in a particular manner, we have to hold back on the complete realism and adapt the environment and the activities so that they meet the students' needs. Just like in any other good lesson, teachers adapt to the situation.

This chapter provided the overview of some of the most important aspects of virtual reality which need to be understood to be able to fully comprehend the process of experiencing virtual reality. It listed the types of immersion occurring in VR, the suspension of disbelief necessary in order to accept the virtual world and it explained cognitive presence which is necessary for learning in VR.

1.4 VR in education

Since virtual reality has been around for years and it has been applied in many fields, it is only logical that it has found its place in education.

When we talk about the influence of technology on education, VR is something that could be considered a descendant if ICT (Information and Communication technologies). Great changes need time to implement and even more so in education. This field was slowly influenced by the digital age and its many innovations. During my teaching practice, we were supposed to gain as much experience from the teachers in field as possible. One of the points of interest that I decided to find out was the attitude of the school towards the use of phones at school and the reasons for their choices. There were some common features that I found when talking to several teacher in Akademické Gymnázium in Prague and in the primary schools where the practice took place. At first, what might have been noticed the most was actually the negative impact of technology on students' learning process. From the viewpoint of some teachers, it had great impact on their attention span when phones were becoming widely used among the population and more available for the younger individuals. Not all students had to be influenced negatively by it but for some teachers, it has become progressively more difficult to gain the students' interest and to motivate them. And with the introduction of social media, teachers had to start waging a war in order to gain back the lost attention. With this type of approach, some schools even forbade the use of phones at school and especially during the lessons.

But not willing to give up and needing to adapt, many teachers managed to turn this disadvantage into an advantage. Some schools and some teachers are able to use these distractive devices in ways that actually support their methods and help students become active agents in the process of learning. There are many online platforms that make teaching easier and more approachable.

Another major influence on pupils was gamification. Since it is increasingly difficult to fight an influence, it was recognised, that actually using the distractive nature of games could prove useful. Applying game-design elements and principles into non-game contexts can be considered one of the answers to the attention span problem (Deterding et al.). Ever since J. A. Komenský outlined a game based teaching model, it has been implemented into

many teaching styles and approaches. Unfortunately even some of these approaches and methods are becoming obsolete when facing the age of technological advances. Even the department of education needs to stay up to date and constantly revise its attitude towards new techniques.

One of the most innovative technological advances that can be implemented in many educational models is virtual reality. Since virtual reality provides experience, we can safely say that it may be a version of situational learning. Other than that, it also has its place in a branch of pedagogy that stands on experience, experiential pedagogy. For this thesis and analysis I chose to compare virtual reality and models based on theories from experiential pedagogy, because this pedagogical approach from more traditional teaching is one of the closest ways to achieve a similar type of learning. Both approaches follow the theory of learning by doing.

1.4.1 Experiential pedagogy

"In its simplest form, experiential learning means learning from experience or learning by doing. Experiential education first immerses learners in an experience and then encourages reflection about the experience to develop new skills, new attitudes, or new ways of thinking." (Lewis and Williams 14)

Virtual reality may benefit experiential pedagogy itself if used effectively. It does not have to be necessarily about creating games, but learning through experience in many ways reminds us of game design. There are experts leading us through the process, achievements along the path, there is problem-solving and conditions that have to be met to continue forward. And all of this is actually a part of situational learning. Some games, such as Job Simulator, provide all these factors in a fun manner. Children are able to learn about various aspects of several jobs and observe the consequences of their actions.

Theoretical basis for experiential pedagogy

There were many approaches and many theories that put emphasis on the fact that learning and practice are inseparable. For the purposes of this work, I choose two models that illustrate the exploration of experience in teaching. The two models are Kolb cycle and Peter Jarvis's approach.

Kolb cycle

Kolb cycle is inspired by John Dewey's active experimentation, Jean Piaget's genetic epistemology or cognitive structures having impact on the process of cognitive equilibrium and by Kurt Lewin's cycle, which can be considered a model for Kolb cycle.

For Kolb, learning is a process where knowledge is created through experiences. Kolb defined learning as a developmental process in which knowledge is acquired through the transfer of experience. The learning process consists of four complexities: affective (emotional component), symbolic (thought process, cognitive abilities), behavioral (actions) and perceptual (perceptions). The following stages of the Kolb cycle are based on these complexities: concrete experience, reflective (thoughtful) observation and active experimentation (Kolb, 21-25).

Kolb also points out that it is necessary to define the ambiguity of the word "experience". Kolb is aware of this ambiguity of the word. Therefore, it illustrates the double meaning of these two examples. Experience of joy and happiness, which has a subjective meaning for him, and thus it is the inner state of the individual. The second example is 20 years of experience on this job, which, in turn, has an objective meaning (objectified summary of knowledge) and associated with the environment ("Komparace modelů zkušenostního učení Davida Kolba a modelu zážitkové pedagogiky Petra Jarvise - Edukační technologie - Bc. Karel Šimeček").

Kolb's stages

David Kolb's theoretical basis and the reason his theory was chosen for this thesis is mentioned in detail in the theoretical part. To summarize, he created a model of learning through experience which can be compared with learning in virtual reality. The following text outlines the stages and learning styles involved in his cycle.

These learning styles are a combination of two axis lines, which Kolb speaks of as dialectically connected regimes in the name of the dimension of processing continuum and the dimension of perception Continuum (Mcleod).

The first stage is **Concrete Experience**: "Something happened".

In this case, it is a matter of obtaining a specific experience by an individual who experiences it spontaneously. It is therefore a phase in which the very, non-transferable experience takes place. This phase focuses on the learning style of feeling. (Šimeček)

The second stage according to McLeod is Reflective **Observation of the New Experience**: "What happened?"

Subsequently, the experience from the previous phase is explored. The individual thinks about the meaning of the experience and tries to describe it via self-reflection. In other words, he makes "thoughtful observations." This phase focuses on the learning style of perception (watching). (Šimeček)

McLeod names the third stage **Abstract Conceptualization**: "Expanding our knowledge"

The individual thinks logically in the abstract and seeks (generalizes) logical conclusions from his reflection. From these conclusions he creates his theories or complements the existing ones with his new knowledge. Thanks to these theories, he can change his behavior in the future with a similar or the same experience. This phase focuses on the learning style of thinking. (Šimeček)

The fourth stage is called **Active Experimentation** (McLeod): "Lessons from experience"

The individual actively tests the activity mediated by the experience. Thus, there is a newly acquired practical experience, which the experience mediates. This leads to active testing and subsequent improvement in the coming situations. As already mentioned, the cycle has a spiral course, so on the basis of this "active testing" another learning cycle starts. This phase focuses on the learning style of doing. (Šimeček)

Kolb cycle has been criticized and built on by many authors. Even Kolb himself has been working on his theories and improving on them ever since he first publicized this theory.

"The analysis of the four stages shows that learning assumes the presence of some abilities which are complete opposites: the ability to carry out tasks, concrete experiences and the ability of abstract conceptualization, of theorizing. The two dimensions, action and reflection, interact closely; if one is sacrificed, the other suffers. The cycle of experiential learning described by David Kolb reveals to us a certain way of understanding the process

of gaining new knowledge, within an integrative and holistic perspective which combines experience, perception, cognition and behavior." (Sălăvăstru 550)

Peter Jarvis

Another important representative of experiential pedagogy is Peter Jarvis. Karel Šimeček mentions him along with David Kolb since the latter was one of the sources of Jarvis' theory. He was inspired by the work of Dewey, Piaget and Lewin as well but took other sources into account.

"He understands learning as a process through which we, as whole people (both body and mind) in our life-worlds (our reality), are changed through cognitive, affective, and practical processes. According to Jarvis, these three dimensions of emotion, thought/reflection, and action interact, often simultaneously, feeding into each other in multiple ways in the process of learning. Learning is prompted by an individual's experience of a situation or event. The result is the changed person and life history, through memories that are integrated into our biography." (Brown 3)

Kate Brown also states that Jarvis's model is just one of many theories of learning that echoes one or more themes. His focus on emotion, action, reflection/cognition, or their combination is not quite unique, but his interest in all three of these responses is what makes his model different from the other approaches. (Brown 6)

Dorina Sălăvăstru (550-551) also defines Jarvis's model: "*Jarvis defines learning as „a continuous process which seeks to give a meaning to the daily experience, connecting the human conscience with time, space, society and their multiple relationships" (1991, p. 11). The model integrates several elements (situation and practical experimentation, reasoning and reflection, memorization and evaluation), which possess a certain dynamic and can allow combinations in order to outline several routes to carry out the learning. The intention of P. Jarvis was to propose a much more complex model than Kolb's, which has at its core the reflection process. There are enough voices, though, which assert that the model is too thick and does not communicate efficiently which are the learning routes."*

P. Jarvis' model builds on Kolb's cycle and becomes quite complicated. And even if it is not considered applicable as it is at this point, it has one important truth within. As people

learn, they change. After every experience and after every lesson learned, individuals emerge as new people. It feels as if Heraclitus applied his saying *"No man ever steps in the same river twice, for it's not the same river and he's not the same man."* to education.

It is possible to talk about experiential pedagogy as an educational concept in the Czech Republic from the second half of the 1960s, when the first concepts following European tendencies appeared, especially from German, British and American pedagogy. (Šňupárková)

These are projects such as the Outward Bound by the German pedagogue Kurt Hahn, a project created in the USA by Project Adventure combining classroom learning with challenge and adventure, or a model of experiential learning in an Anglo-Saxon environment. The founder and pioneer of experiential learning is considered to be the American philosopher and educator John Dewey, who identified experience as a fundamental factor in education and developed a three-stage model of experiential learning based on the interaction of observation, thought and judgment. Dewey's concept of experiential learning is followed and further expanded by Kurt Lewin, the founder of American social psychology, the Swiss educator Jean Piaget [4] or the American scientist David A. Kolb. (Šňupárková)

Šňupárková also summarizes the methodology of creating an experiential lesson. She uses three stages as the pillars of her experience lesson plan.

It is clear that the preparation of a lesson based on the principles of experiential pedagogy, its goal, content and methods is extremely challenging for the teacher himself. It is not possible to conceive a lesson only as a game in which students are more or less involved, but it does not lead to a predetermined goal. Experiential pedagogy and its application in teaching require a precisely thought-out structure and methodology.

Each lesson must contain three basic parts. These include:

1) Introductory phase

2) Activities

3) Reflection and evaluation of the lesson

The role of the teacher in this process therefore begins with the preparatory phase. The teacher introduces the pupils to the lesson, tells them the content goal of the lesson, what they will be heading for. At this stage, it is also important to motivate students to prepare and set rules that everyone will respect during the lessons.

Activities follow. These activities require the full commitment of the teacher and are very challenging for teachers, even though the student is in the foreground, not the teacher. However, it is an essential part of this process, it manages it and monitors the direction of individual activities. The activities themselves are based on the form of the game. Every game as a method of experiential pedagogy is a means of fulfilling certain predetermined goals of the pedagogue. Through play, we are able to develop students' abilities and skills in a non-violent way and in many ways. Pupils learn to accept their share of responsibility for the running of the group in which they work, develop the ability of new, original and non-traditional solutions to situations, the ability to accept various roles, accept them and identify with them, develop flexibility and adaptability. Forms of games can be different. The basic, most often used in pedagogy include the so-called initiative and strategy games, in which a certain problem is set that a group of students must solve, as well as various types of simulation and staging games for a given environment, time, circumstance, dramatic games with social or psychological issues and more.

At the end of the teaching there should be the last phase of work with students, a kind of evaluation of the lesson or calming phase, during which the teacher tries to summarize the individual activities and at the same time deduce together with students whether the set goals have been achieved.

In connection with the methodology of experiential pedagogy and its use in teaching in schools, there are, of course, many arguments of teachers who consider this methodology time consuming (experiential pedagogy methods are better used especially in two hours to complete the planned activities). They are not comfortable with a large number of pupils in the group, low motivation of children who can abuse these methods in regards to their discipline, or the reluctance of pupils to communicate and cooperate (this can also be caused by a change in the established school environment). Last but not least, the

argumentation of teachers against experiential pedagogy is based on the complexity of preparing and conducting such a lesson. In this case, the basic rule of motivation in the educational process applies. If we want to motivate pupils and create a creative environment for them at school, we must be motivated ourselves. The motivation of the teachers themselves is a never-ending process that makes this profession challenging, but at the same time beautiful and fulfilling. (Šňupárková)

There is another example of a slightly more complex lesson plan methodology originally from Seton Hall University (although, it is not available anymore on the website). This particular methodology states **6-step procedure**:

1. Introduction – Teacher activates prior knowledge and experiences and connects them with what is presented, reviews what was learned in prior lessons - then introduces content and vocabulary necessary for today's lesson.

2. Exploration: "Do it" – Ss perform or do an activity with little to no help from the teacher (role-play, giving a presentation, playing a game, problem – solving, making products or models...). It may be an individual or group experience, but it always involves doing. This part of the lesson may be new and uncomfortable to the learner. The teacher using this method needs to be aware of that and take it into account.

3. Sharing: "What Happened"- Ss publicly share the results, reactions and observations. Teacher and students discuss feelings generated by the experience.

4. Processing: "What's Important?" - Discussion, analysis, reflecting upon, looking at the experience. Teacher and students discuss how the experience turned out, possible problems or issues. They find themes together and share their opinions.

5. Generalizing: "So What?" – The teacher and learners connect the experience with real world examples and identify principles of real life in it.

6. Application: "Now What?" – The last step is application and learning from past experiences. Teacher and learners discuss the experience applied to other situations and its usefulness in the future. The teacher should make learners feel that they learned from this experience.

Purdue University created another methodology for teachers who wish to employ the principles of experiential pedagogy. It seems to be a model that stands between the one mentioned by Šňupárková and the one from Seton Hall University.

It comprises **5 stages**:

Experience

Engage in an activity that: is likely unfamiliar to the participant, is possibly uncomfortable, pushes personal limits, offers minimal instruction- let the participants figure something out before being told how to do it

Share (What happened?)

Participants should talk about what they experienced while doing the activity - reactions , observations, feelings

Encourage discussion and expression of ideas and feelings. (The leader should have some questions ready to aid the discussion or should bring up major points.)

Process (What's important?)

Analyze and reflect on what happened.

Discuss how problems and issues were brought out through the experience.

Discuss how these problems and issues were addressed.

Discuss personal experiences of participants.

Look for recurring themes.

Generalize (So what?)

Find trends or common truths in the experience.

Relate the experience to "real life."

Identify key items that were learned.

Identify key terms to relate to the experience.

Apply (Now what?)

How can lessons be applied elsewhere?

How will the lessons learned be useful in the future?

Discuss how behaviour and actions can be modified to improve the results, or how results can be accomplished more efficiently. (Purdue University)

All three of these models are based on the same principles and the stages go through the very same processes, even if named a bit differently or divided in a different manner. Some teachers welcome the simplicity of the three stage model while others appreciate the leading and structure of the 6-stage model. Nevertheless, they bring the same type of experience directed pedagogy into teaching. In the empirical part I will compare these models with the virtual reality experience observed during the research.

Aside for Experiential pedagogy, I would like to add one important theory connecting learning and technology.

1.4.2 Connectivism

There were theories emerging throughout the times and they emerge even now. One of the slightly newer theories is focused on the digital age. Constructivism was the first of the educational theories to adopt a dynamic view of brain function. It is based on a model according to which the number of brain neurons and the number of synapses changes dynamically throughout our life. This process can be simply imagined as a network in which the overall capabilities are defined by the knowledge connecting the individual stored information. Even with them, there are constant dynamic changes during their lives. (Brdička)

Downes states that *"In connectivism, a phrase like 'constructing meaning' makes no sense. Connections form naturally, through a process of association, and are not 'constructed' through some sort of intentional action. And 'meaning' is a property of language and logic, connoting referential and representational properties of physical symbol systems."*

Chatti states another major point: *"the main intent of network creation is to enable learners to continue to stay current in the face of rapidly developing knowledge."*

Connectivism introduces the kind of learning that is always accurate and updating. The aim of such learning is to learn skills and to keep learning them even as they change and develop. Our brain does so via the network it creates and keeps working on.

Basic principles of Connectivism:

1. Learning is a process during which specialized nodes of a general complex network are connected (sharing access to information resources, knowledge).
2. Cognition is based on a number of diverse experiences (connection of different cultures, use of different technologies).
3. The ability to learn is always more important than current knowledge.
4. Establishing and maintaining a connection is a condition for continuous learning (community building).
5. The key competence is the ability to distinguish connections between different fields, concepts or ideas.
6. Presence is an important attribute of connectivist educational activities (what we know to be true today, may not be true tomorrow).
7. Even inanimate devices are capable of learning (shaping the structure of the network, ways of searching for information).
8. Making decisions is part of the educational process (changing reality requires the ability to change one's own attitudes).

(Brdička)

Downes also mentions that there is truly no such thing as transferring, building or making knowledge. We grow and develop ourselves and the society around us in certain ways. Connectivism is also about choosing relevant knowledge from all the information available. Since ability to learn is more important than the current state of knowledge, it means that it is important to know where to find the information needed and how to acquire it. And since we cannot experience everything ourselves, we can draw on the experience of others.

The theory of Connectivism is criticized by many. For Example Bill Kerr states that it is not necessarily a new theory and it might have actually been done better by others. Other authors state that there are missing parts of the learning process. (Chatti)

If connectivism is about making learning in a rapidly evolving world and it tries to keep up with the ever increasing amount of knowledge, then it is definitely a theory relevant to VR. Virtual reality is one of the most quickly evolving technologies in recent years. Every year it takes leaps and bounds and keeps going forward. People using this technology have to

keep learning along with the development. Therefore according to the theory of connectivism, we keep making those connections and adapting to everything new.

This chapter was devoted to the theories and approaches that connect learning and virtual reality. It explained the common features of experiential pedagogy, Kolb's cycle and Peter Jarvis's model which provide the basis of contemporary experiential lesson plan models and base the process of learning on experience. It also explains the theory of connectivism which states that learning is about creating connections and it may serve the learning of the digital age better than the traditional theories.

2 Empiric part

2.1 Methodology

In the following section I present the research part of the work. This qualitative research is based on data from observations and in-depth semi-structured interviews. The qualitative research was chosen rather than quantitative because this experience of first-time users has not been researched into depth in connection with learning in VR. It also gathers data from subjective experience of each participant, which could not be achieved via quantitative methods. The researcher has worked in the field of research for three years and has experience which can be taken advantage of during research and when analysing data and interpreting. The data is analysed using open coding through which categories corresponding to the research objectives were created. (Švaříček and Šeďová 213) These categories were used to write a comparison of the whole process of providing a VR experience in the gaming centre and an experiential lesson models. In the following text I deal in detail with the definition of research objectives by describing the chosen methodology and presenting research conclusions.

2.1.1 Research objectives

The main research objective can be separated into two major parts.

Research objective 1: The first part focuses on the experience of the first-time users when they first encounter the technology of virtual reality, their immersion and the way they perceive the new experience.

Research objective 2: The second part searches for possible obstructions of this experience and how they can impact the use of this technology in the field of education.

Both aspects of the researched phenomenon lead to one important aim: practical use of VR in education. This work explores the first-time users' experience and tries to identify potential hindrances that the educator may encounter. Recommending already existing preventive measures or offering solutions based on the researcher's experience in this field is also one of the objectives if this thesis. There are also sub-objectives which delve into particular aspects of the areas of interest and connect these aspects with the main objective. These sub-objectives are named in the following text for review:

How do the users feel when they wear the headset for the first time?

How does the control affect the user?

What elements affect the immersion?

What do users experience in different games?

Which in-game situations cause fear?

What do users feel after the use of virtual reality?

2.1.2 Data collection methods

Observations

Observation was one of the two methods chosen for this research. It was chosen since it gathers necessary data without disrupting the observed subjects and process. The observations are recorded only via observer's notes. The observations were made by a partially participating observer. There was necessary interaction, and leading in some situations but the observer was not present in the virtual environment. (Ciesielska et al. 34) The observing process was direct, unstructured at first (with certain areas of interest in mind but with no specific objectives defined) and became more selective with each observation. There were both covert and open observations made (Švaříček and Šeďová 146). Covert observation was the initial chosen method and it brought most of the data from observations. It was selected since the observer worked with customers and felt that the information that they are being watched could have had a negative effect on their experience. For the respondents that also agreed to be interviewed I chose the open observations since they were intentionally asked for participation in order to provide more detailed information.

In- depth interviews

There were 10 interviews in total. One was conducted in October 2020 and the remaining 9 took place in April 2021. The long delay and the unnatural segregation of the observations and the interviews were due to the complications caused by the covid-19 preventive measures.

In-depth interviews are a qualitative data collection method that allows for the collection of a large amount of information about the perception, attitude and behaviour of the interviewees (Bhat). Using the semi-structured interview made it possible to follow a specific guideline of set questions but it also gave the freedom to pursue other aspects or to delve deeper into certain arguments and points of view.

The interviews were recorded using a mobile phone. The use of audio recording was associated with obtaining the consent of all players, which was done orally. It was explained to the participants that all the data would be anonymized and used solely for the purposes of this thesis.

2.1.3 Data analysis method

The method which was chosen to analyse data in this thesis was open coding. Open coding is a technique used widely in all sorts of researches. It is a process through which the text is broken into units, these units are given names and codes and these units are then processed further by the researcher. These units are selected via reading and re-reading the field notes from observations and the transcriptions of the interviews. No software was used for the coding; it was all done personally by the researcher. Along with the creation of codes and after the codes were successfully selected, they were grouped together into categories. The categories were created inductively from the small units. These categories were created with the research objectives in mind to find the answers for them. There were also three categories which arose during the analysis. These were not a part of the objectives but they bring the participant's perception of virtual reality and education and they are mentioned at the end of the results chapter. After the analysis, the data was interpreted and compared to traditional education with the purpose of showing common features and differences along with illustrating how virtual reality could be used in education.

The description of the experience in VR Dimension

The process starts with the interaction between the instructor and the customer. The initial contact might also be prior to the meeting of the day of the experience. There is usually some type of communication regarding the reservation of the slots in the gaming centre. Sometimes it is in person and other times it is by phone. In both cases, when interaction is

involved, there is also a probability of pre-introduction to the variety of games available. The instructor provides a basic summary of the most popular games and their recommended sequence and some information about the gaming centre.

On the day of the reservation, the customers arrive around the time of reservation. The recommended time of arrival is 10 minutes prior to the start of the experience. The gaming centre is quite difficult to find since it isn't immediately visible from the street. The customers have to pass through a passage, enter the building opposite the passage. They walk up the stairs and find the doorbell on the right side of the door right on a large poster of VR Dimension. There are, of course, signs along the way as well, but finding the right door and doorbell can prove difficult for some people visiting the centre despite the signs.

When the customers successfully enter the gaming centre, they are welcomed by the receptionist/instructor. The receptionist kindly directs them to where they can leave their shoes and jackets. As the customers are settling in, the receptionist starts to ask some questions regarding their experience with this particular type of entertainment. If they are experienced, the receptionist asks what games they have tried before and which they liked the most. The receptionist's task is also to find out what the customer expects from today's visit and how they can satisfy it. If the customer has no experience and no prior knowledge, the instruction has to be a bit longer. Under such circumstances the receptionist leads the customer towards the wall with the posters, which is right next to the clothes racks. There she shows the individual posters and shortly describes the games. To complete beginners, she usually recommends calm games full of sight-seeing such as theBlu, Everest VR or Google Earth (although this game always comes with the warning of slightly more complicated controls).

The instructor also mentions the categories of the games. There are calmer sight-seeing games, as mentioned earlier. There are popular shooters, simulators or games with a particular type of experience, such as Richie's plank experience. There are of course horror games or at least horror elements in some games as well.

When the customers were given some time to think about their choices, the instructor leads them to their gaming are. She shows them the equipment that they will have on their head and in their hands. She describes their functions and peculiarities, usually using the games

they chose as the examples. She clearly shows where the boundaries of the gaming area end and explains how that boundary will be visible in their virtual reality vision. She also explains the need for boundaries and if there is a time, shares a story that exemplifies the error of ignoring the boundaries and getting injured as a consequence.

After all the safety instruction is over, the instructor invites the first customer to enter the area and directs him/her towards the middle of it. She turns the customer in a predetermined direction and puts on the helmet. At the moment when the customer first puts it on there are two choices for the instructor. The game can be loaded beforehand so that the player can enter straight into the virtual game environment. Or it can still only be at the ready and the user enters the waiting virtual space. This virtual space can have many forms and it depends on the owner. VR Dimension changes the virtual space occasionally and there is no set pattern to it. Since instructors change in the centre, it can even be a surprise when a customer sees something the instructor did not predict. At such a moment, it is quite difficult to say if the instructor may seem unprepared or if the customers find it interesting that even these aspects of the experience are ever-changing. This reaction is entirely subjective and cannot be predicted. Therefore, the guide of the virtual space can only use it to their advantage and ask the customers to share what they see. This also shows us that the virtual waiting space is not visible even when the image is being projected. Only the wearer of the helmet sees this space.

Once the helmet is put on the head it has to be adjusted. The most important part is to place it above the nose and together with the customer to find the angle and location where it provides the clearest image. When that is achieved, there are also adjustable lenses and straps that secure the helmet in place. It is important to strap the helmet on tightly enough, so it doesn't fall or slant. But it cannot be too tight since that would cause discomfort.

With the helmet on, controllers come next. The instructor puts a strap securing the controller around the user's hand and tightens it enough to prevent the controller from falling off. She then puts it into the player's palm and explains the buttons needed for the first game. The user tries out the buttons and familiarizes himself with the controller. The receptionist slowly guides the player through the experience. VR Dimension's policy is to let the customer explore and give advice or help when necessary. The customer goes

through the experience and the instructor monitors and guides. The process of changing the game is usually in the hands of the receptionist at the customer's request. Some more advanced users can change the games themselves via the Steam button.

10 minutes before the time is up, the instructor announces the remaining time, then again 5 minutes before the end. When the 60 minutes are up, the receptionist calls out that she is turning the game off. If at any point the customers express a wish to play longer, the receptionist checks if the space is available and provides the info about the price range of extension. When the customers are done playing, the instructor welcomes them back into reality while taking of their helmet. She usually asks how they feel and if they enjoyed it. The receptionist lets the customers slowly adjust to reality and chats with them while sanitizing the equipment. She asks about the games, any problems they encountered and their opinions in general. After that, when the customers are satisfied, they leave the gaming centre and the instructor thanks them for their visit and kindly sends them on their way.

2.1.4 The field of research

The observations took place over 11 months from June 2020 to April 2021. The field of observation was chosen by the researcher based on access and experience. The chosen field was the VR gaming centre VR Dimension in the centre of Prague near Wenceslas Square. I chose this specific gaming centre because I have been working there part-time as a receptionist and an instructor since 2017. Unfortunately, the gaming centre was closed for extended periods of time because of the covid-19 preventive measures. That is also the reason why the interviews were done mostly after the observation phase. The centre was not available until April 2021. These specific conditions make this research a bit unique since the interviews and observations are usually done simultaneously, but that was not quite possible in this case.

Upon entering the building, there is a set of stairs which leads to two doors that give access to the gaming centre. The room, when observed from the entrance, is equipped with one reception counter with a computer used to control the users' gaming environment and to process customers on the right.

The larger part of the room on the left of the entrance is devoted to the VR equipment. There is a large softened carpet divided into two parts via a wooden board. This softer portion of the floor is devoted strictly to the users of VR and the necessary equipment. It houses two computers and a box of accessories used for gaming or cleaning of the equipment. The carpets are surrounded by a seating area with sofas and small tables which face the wall with the projecting screen across the gaming area. Behind this seating area is another seating arrangement with larger tables reserved for larger groups of people or for celebrations and special occasions.

The left wall door (several metres from the entrance) leads to a small hall with toilets at the farther end and a cleaning room right behind the door. The small hall is also the only place with uncovered windows. The whole gaming centre has the windows covered by a dark foil and there are curtains obstructing all natural light. The light in the centre is usually set to the intimate level and there are decorative lights behind the curtains along the wall surrounding the gaming carpets. The overall impression sends the message that you are no longer in the outside world, but in another space entirely.

There are also two large supporting columns, one between the gaming area and the reception, and one next to the carpet and slightly separating the two seating areas by the gaming space. The whole main room is painted in grey and white colour and offers very few other decorations. The only colourful wall is the one next to the reception counter and it has a very specific function. It is covered by VR game posters and it serves as an inspiration for players and as a helpful tool for the instructor when offering games.

Used equipment

In VR Dimension gaming centre, the users can try out HTV VIVE. It's described as a room-scale VR featuring SteamVR Tracking. The set provides 360-degree controllers along with headset tracking, HD haptic feedback and directional audio. (HTC VIVE)

The following text provides the specifics of the HTC VIVE:

Headset Specs

Screen: Dual AMOLED 3.6'' diagonal
Resolution: 1080 x 1200 pixels per eye (2160 x 1200 pixels combined)

Refresh rate: 90 Hz
Field of view: 110 degrees
Safety features: Chaperone play area boundaries and front-facing camera
Sensors: SteamVR Tracking, G-sensor, gyroscope, proximity
Connections: HDMI, USB 2.0, stereo 3.5 mm headphone jack, Power, Bluetooth
Input: Integrated microphone
Eye Relief: Interpupillary distance and lens distance adjustment

Controller specs

Sensors: SteamVR Tracking
Input: Multifunction trackpad, Grip buttons, dual-stage trigger, System button, Menu button
Use per charge: Approx. 6 hours
Connections: Micro-USB charging port

Tracked area requirements

Standing / seated: No min. space requirements
Room-scale: Up to 15m^2 (an area of approximately 3.5m x 3.5m).

(HTC VIVE. "Buy VIVE Hardware | VIVE European Union." *HTC VIVE*, 2011–2021, www.vive.com/eu/product/vive/#vive-spec.)

The user wears a headset with adjustable straps and interchangeable inserts. The headset itself has eye relief adjustments and a front-facing camera and with only a few exceptions it fits most glasses. There are two base stations mounted by the movement area providing 360-degree play area tracking coverage and a rather helpful wireless syncing, although, the first syncing has to be done using the cable. The last item the user needs to manipulate with is the controllers. With several buttons and functions differing in many games, they provide the user with occasional complications but they are worth the effort since they were designed exclusively for VR and the haptic feedback enriches the experience and helps the user immerse in the virtual reality. (HTC VIVE)

2.1.5 Research sample

There were a total of 61 participants over the 11 months of research who experienced virtual reality for the first time. 10 of them participated in both the observations and the interviews.

51 of the observed participants were the customers visiting the gaming centre and most of them were unaware of the ongoing research. The age of participants ranged between 7 and 50 years. Among the 51 participants that were observed, there were 19 females and 32 males. In general, all participants are given the same set of instructions but they can differ depending on the context and many variables that cannot be accounted for. For example, if the participants arrive late, they are given a shorter version of instructions and it is compensated during the experience. Such compensation may impede the depth of immersion and for that reason participants are advised to arrive at least ten minutes earlier (via information on vouchers, by phone or on the website). There are of course many other variables, such as technical issues, misunderstandings, health conditions, physical discomfort etc. And all of these in some way affect the experience in virtual reality.

The 10 participants that were knowingly observed and agreed to be interviewed are acquaintances, friends or family members of the researcher. They were all first-time users at the time of observation. Their ages range between 7 and 57. There are 5 males and 5 females.

For better orientation, I divided the participants into age categories: 6-10 years old (1 participant), 11-15 years old (1 participant), 31-35 years old (1 participant), 36-40 years old (3 participants), 41-45 years old (1 participant), 51-55 years old (1 participant), 56-60 years old (2 participants).

Participants 1, 2 and 3 visited together as a family along with their youngest daughter (about 11 months). As is obvious from the interviews, she seemed to be a distraction which hindered immersion of both participants 2 and 3 (parents).

Participant 1 is a female from age category 6-10 years old. She attends primary school and comes from a household of highly educated people. She is the daughter of male Participant 3 and female participant 2 and seems to be influenced by their technical

education both in her behaviour and in her answers during the interview. She experienced theBlu, Job Simulator and Tilt Brush.

Participant 2 is a female from age category 31-35 years old. She works in a field of technology and education. She is highly educated in a technical major. She is the mother of female Participant 1 and a partner of male Participant 3. She experienced theBlu, Beat Saber, The Lab, Richie's Plank Experience and Bulletproof.

Participant 3 is a male of the age category 41-45 years old. He also works in the same field as Participant 2 and has similar education. He is the partner of female Participant 2 and the father of female Participant 1. He experienced theBlu, Waltz of the Wizard, Richie's Plank Experience and Brookhaven.

Participants 4, 5, 6 and 7 also came together as members of the same family. They sometimes engaged socially even during the member's experience in VR which could have had a distractive influence on the depth of immersion.

Participant 4 is a male from age category 11-15 years old. He attends primary school and excels in languages. His weakness is maths and logic (which the researcher knows since she tutors him occasionally). He is the son of female Participant 5 and male Participant 6 is his foster-parent. Male Participant 7 is his grandfather. He is a very experienced gamer of PC, Xbox and PS games. He experienced Desert Ride Coaster, Job Simulator, Serious Sam, Brookhaven, Beat Saber and Bulletproof.

Participant 5 is a female of age category 36-40 years old. She is a certified nurse and works in several places, but her main job is a nurse for a local practitioner. She is the mother of male Participant 4, a partner of male Participant 6 and the daughter of male Participant 7. She experienced Desert Ride Coaster, theBlu, Zombie Training Simulator, Brookhaven and Bulletproof.

Participant 6 is a male from age category 36-40 years old. He works as a welder and commutes to Germany. He is the partner of female Participant 5 and a foster-parent to male Participant 4. He experienced Desert Ride Coaster, Serious Sam and Brookhaven.

Participant 7 is a male from age category 56-60 years old. He works as a lorry driver. He is the father of female Participant 5 and a grandfather of male Participant 4. He

experienced Richie's Plank Experience, Desert Ride Coaster, Serious Sam, Brookhaven and theBlu.

Participant 8 and 9 came as a married couple and they arrived with Participants 4, 5, 6 and 7. They are friends and acquaintances. They are also the researcher's parents.

Since the two groups came together, their experience was influenced by their social interactions. This situation is not very different from what the educator may encounter when using VR for educative purposes. Therefore, I did not isolate the participants, nor did I interrupt any of their socializing and interaction.

Participant 8 is a female from age category 56-60 years old. She works as a self-employed dressmaker (tailor). She is the spouse of Participant 9 and the researcher's mother. She experienced Everest VR, theBlu, Serious Sam (in cooperation only), Richie's Plank Experience, Desert Ride Coaster, Google Earth and Beat Saber.

Participant 9 is a male from age category 51-55 years old. He works in manufacturing industry as a former responsible for industrial form (mold) maintenance and function. He is the spouse of female Participant 8 and the researcher's father. He experienced Everest VR (In real-time he experienced this particular game at the same time as female Participant 8 and there was occasional interaction a socialising between the two participants. In some situations, this could be a distracter regarding immersion, but since both of them were actually in virtual reality – just not truly together in the same space – and they were seeing the same landscapes and events, it could have actually had positive influence on their immersion.). He also experienced theBlu, also at the same time as Participant 8. They also played Serious Sam together and then he played the game by himself. He regarded the solo play as the better option in the interview.

Participant 10 is actually the first one interviewed during this research. She is a female from age category 36-40 years old and she works as a corporate administration specialist. She is also highly educated and has a consulting side job. She came with her husband and foster-daughter but was the only one to provide an adequate interview for this work. She experienced theBlu and Beat Saber and stayed with the latter option till the rest of her experience.

2.2 Results

As mentioned above, the analysis was conducted via open coding and in vivo coding. The coding gave birth to categories and these categories provide answers to the main research objective and the sub-objectives. This part of thesis discusses the observed experience in connection with the research objectives and the conducted research.

2.2.1 Analysis based on research objectives

The observations and the interview were conducted in order to find the answers to the research objectives. The observations were a bit narrow but specifically targeted the reactions and behaviour of players along with their linguistic expressions where it was deemed important or illustrative. The linguistic aspect of observing was included later in the research.

For the purposes of this analysis, the codes for participants will be shortened. Participant 1 will be referred to as P1, Participant 2 as P2 etc.

How do the users feel when they wear the headset for the first time?

The first research sub-objective emerged from the very first interaction that users have with the VR equipment. It focuses on the feelings that the users have when they put the helmet on for the first time. It was also one of the first questions asked during the interviews. At the moment or before the helmet was put on some participants answered that they felt comfortable, such as P10: "*I guess, maybe some, if we're just talking about something before it started playing, then fine, I wasn't worried or feeling claustrophobic. Absolutely fine."*[1]

Other participants said they felt expectant. P2: "*Well, I was waiting for what would happen."*[2]. The interviewer then asked a follow-up question: *What did you expect would happen?* P2 answered "*Well, let's say, since we are partly technicians, aren't we, I was*

[1] *Asi, asi nějaké, pokud se bavíme jenom o tom, než se začlo něco přehrávat, tak v pohodě, neměla jsem obavy ani stísněný pocit nic. Úplně v pohodě.*
[2] *No, čekala jsem, co bude.*

waiting to see how the sensors would react."[3] Perhaps since P2 has technical education, she was interested in this aspect of the helmet. P3 had slightly similar worries and didn't know what quality to expect: "*Like what the image quality will be later. Because when those glasses were put on my eyes, I wondered if it would be blurred or not, and in the end it wasn't."*[4]

Some users felt confused such as P7 or P8:

P7: Confusing...

Interviewer: Aha and how confusing?

P7: Orientation.

Interviewer: Uhum. What bothered you?

P7: As if I couldn't balance myself in that place.[5]

He could not really find himself in the space at first but gradually got used to it. P8 was similar in feeling some confusion but hers came from suddenly seeing something that was not actually real. I believe it was some kind of inner conflict and maybe at first, she refused to suspense her disbelief. As mentioned in the theoretical part, not everyone is willing to give in so easily and some people prefer a different type of immersion. That might be the reason it took her a bit longer to accept the facts of the new world around her. "*Strange, very strange, because I didn't actually see anything normal around me. I only saw something that wasn't, so that was weird."*[6]

The moment some players saw the first game they felt in awe. P1:"*Well, because the first to appear was the sea then incredibly amazed, amazed like how all this is possible, that I'm actually there, and that it's like real. Astonishment, I guess it was the main thing, the main word."*[7] P1 saw theBlu for the first time. It is a visual game where sight-seeing is the main

[3] *No jako, řekněme, že, protože člověk je taky tak trošku technik že jo, takže jsem se čekala jako jak budou reagovat ty senzory.*
[4] *Jako, jaká bude kvalita obrazu potom. Protože když se ty brýle nasadily na oči tak jako v podstatě jsem přemejšlel nad tim jestli to nebude mázlý nebo nebude a nakonec nebylo.*
[5] *P7: Matoucí... interviewer: Aha a jak matoucí? P7: Orientačně. interviewer: Uhum. Co ti vadilo? P7: Jako kdybych se neuměl na to místo jako srovnat.*
[6] *Zvláštní, hodně zvláštní, protože jsem vlastně neviděla nic okolo sebe normálního. Viděla jsem jenom něco, co nebylo (tazatel: jo), tak to bylo takový zvláštní.*
[7] *No, protože se objevilo první to moře tak neskutečně úžas, úžas takový to jako co je všechno možný, že tam vlastně jsem, a že to je jako reálný. Úžas, asi to byl ten jako hlavní, to hlavní slovo.*

motive and as she has experience scuba-diving, she seemed quite surprised at the realism and beauty of the scenes around her. P4 expressed a similar feeling from his first encounter with VR: "*So my, my feeling was like this: Whoooooaaaa!"*[8]

There is one particular reaction that teachers have to take into account the most when they decide to use VR in their teaching. And that is fear. Some participants felt fear and each one did so in their own way. P6 felt fear mixed with what he called "mixed feelings" and some anticipation „*I'm scared and such mixed feelings, I didn't know what awaited me."*[9]**,** while P5 felt genuine fear of the unknown: "*Fear of the unknown."*[10].

The process of putting on helmet is accompanied by careful introduction and explanation. The instructor herself puts on the helmet and tightens the straps so that it sits firmly on the head but isn't too restrictive. The helmet is rather heavy and can sometimes get in the way of the players movement. There was also a participant who didn't mention any feelings or emotions but focused on his physical discomfort instead. P9: *"Constricted face."*[11]

Different users emphasize different sensations and perceptions. Teachers need to be prepared to adapt to all types of reactions and especially to the fearful ones. Fear is one of the greatest obstructions to a successful use of VR in a lesson and it needs to be slowly worked with and if possible replaced gradually by a more positive memory. This particular aspect of trying new things leads us to another research objective which focuses on the in-game elements that cause fear.

Which in-game situations cause fear (in users)?

As mentioned above, fear can be an obstruction even before the user puts on the helmet. One type of fear was explained by P6 as the fear of unknown. This user also experienced the fear of heights while playing the game Desert Ride Coaster: "*It's fear, but it's the fear associated with falling from great heights and falling from them twice, right. But that roller coaster is really authentic."*[12] P10 was enjoying theBlu while sitting on the carpet and looking around and at the moment she saw the whale she looked away and refused to

[8] *Tak můj, můj pocit byl takovej: Tyyy jo!*
[9] *Bojim se a takový smíšený pocity, nevěděl jsem, co mě čeká.*
[10] *Strach z neznáma.*
[11] *Staženej obličej.*
[12] *To je strach, ale to je strach spojenej s tím, že z vejšek a tam padáš z vejšek 2× že jo. Ale tam je to hodně autentický na tý horský dráze.*

look at her again. (field note: *she seems really immersed – shock and refusal to look at the whale*). P10: "*...when the whale was there, I was really scared."*[13]. In the same game, P10 also experienced fear of darkness: "*And I, because I don't like darkness, yes, when there was, when there was the cave from the beginning, where I didn't know what was around me, what it looked like, then that was a no-no."*[14]

P1 also felt fear when playing theBlu: "*Well, at first those, the shining fish, that one, that one scared me a little. And the crabs, when I realized that they could still pinch you. And the fish, that it's still scary."*[15] P1 saw the angler, which is often a scary fish when encountered in a dark ocean during this game. I managed to calm the participant down but she needed to be regularly reassured and still didn't like it. With some interaction and shining jellyfish, she started to enjoy the dark part of the ocean as well. When the game started and she accidentally chose the dark ocean part of the game she asked "*And when can I leave?"*[16]The ocean then progressively becomes more beautiful and filled with bioluminescence and shiny jellyfish. But at the very end, all the fish suddenly swim away and a giant squid appears above the user. Some users don't even notice it, but P1 did and cried out: *"I want to go awayyyy!"*[17] I changed the scenery for her but comforted her that the squid is actually friendly and it just wants to take a look at her. She still didn't like it so we switched to the whale part of the ocean. She seemed to lose the fear as she pointed and exclaimed: "*Stingray, aunt! Look how close I am to him."*[18]

P4 also played theBlu shortly but almost immediately after entering the dark ocean wanted to leave *"I am really scared. Can you take me out?"*[19]

Teachers will have to plan ahead for the children that might be scared of this new experience. It might help if they see their peers try it out first but sometimes there are simply children that need time to prepare mentally. And it is also important to have good

[13] *…když tam byla ta velryba, tak jsem fakt byla vystrašená, jo?*
[14] *A já tím, že nemám ráda tmu tak ano, když tam, když tam byla ze začátku ta jeskyně, kde jsem nevěděla, co je kolem mě, jak to tam vypadá, tak tak to ne-e.*
[15] *No zpočátku ty, ta svítící ryba, ta, tak ta mě trochu děsila. A krabové, že když jsem si uvědomila, že furt to umíš štípat (tazatel: smích). A ta ryba, že furt je děsivá.*
[16] field note: P1: *A kdy můžu odejít?*
[17] field note: P1: *Já chci jít pryyyyč!*
[18] field note: P1: *Rejnok, tete! Koukni, jak jsem blízko něj*.
[19] field note: P4: *Já se bojím strašně. Můžeš mě vyndat?*

rapport in the classroom since the children trust the teacher and are more willing to do something considered risky in their opinion.

The question of fear brings us to the next research objective which explores the experience that the users go through while playing different games. Fear would be one of them but since it was already covered in the previous part of the analysis, it will not be delved into too deeply. This research objective was one of the last questions in the interviews.

What do users experience in different games?

For clarity, I decided to divide this research question according to the games played. The first game is theBlu, since it is usually the recommended starting game.

TheBlu

TheBlu is a game offering customers to experience the ocean without having to scuba dive. There are three sequences that they can experience. The moment the game starts they are faced with three pictures and they have to aim their controller at the desired picture and press the trigger to enter the sequence. The first one on the left is a picture of a turtle titled Reef Migration and offers the longest (almost 7 minutes) sequence. The second one is the shortest and it is called the Whale Encounter (1.5 minute). the third one is called Luminous abyss (5.5 minutes) and it offers the bottom of the ocean where there is total darkness at first and the only light is the user's torchlight and the angler fish swimming around the huge skeleton (huge ribs protruding from the ocean sands bellow the user) in which the user stands. This game probably draws the user in via spatial immersion since it uses very realistic environment to seem believable.

It is already mentioned in the previous part, P4 was scared after a short while spent in the dark ocean. P1 experienced both fear and joy during this game. P10 had similar experience. Both of them were mesmerised by the visual side of the game and scared by some of its aspects (the whale, the dark ocean). P3 said *"I can just lie down here and enjoy myself."*[20] and lied down to watch the ocean from the ground. During the interview his opinion of the theBlu was "*The sea was good. Like, I went to IMAX to look at something similar. So the sea, as I say, was just an IMAX sea with no spectators, no distractions*

[20] field note: P3: *Já si tady takhle můžu lehnout a kochat se.*

around. Far better effects of course, you just don't have that chair there, it's all just really around you."[21] P3 considers theBlu a better version of IMAX cinematic movie. In a way, that is a rather close description. TheBlu is all about the visual and there is very little interaction with the environment. But the little there is, is usually explored with delight which is illustrated by P2's description of her feelings when sharing her opinion of the game "*I liked the jellyfish there and I like that it really is done in such a way that when it gets closer to your eyes, it's actually like the intensity increases a lot. It was nice, that was really nice. I mean the fact that it vibrated when touched, it sort of felt like you really touched something in reality. But otherwise I have to say that this one, this one gets a bit boring."*[22] P2 enjoyed the game at first and explored the responses of the game but quite quickly got bored with it. She started with the whale and cautiously said her greetings while closing the distance: *"Hellooooooo!"*[23]. P2 asked the instructor *"I should approach her and pet her, right?"*[24]. She continued with the dark ocean where she explored the skeleton around her with great interest. She found the anemones which close when touched and proceeded to interact with them while bending down to the ground. P2 tries to interact with other objects spread on the ocean floor but finds out that they do not react at all. She discovered that fish run away from her controllers and "bullied" them a bit and then moved on to the orange jellyfish which she tried to catch and managed to stop in her tracks. At the end the game crashed, which was very disruptive, but P2 claimed that she was already bored of the game and decided to move on to another one.[25] P2 managed to get the most interaction out of the game and practically had nothing left to explore. She seemed quite daring in her attempts and wasn't afraid to try anything, just cautious at times.

P5 started with the longest sequence of turtles and orange jellyfish and was quite talkative during the whole game: *"Don't talk, come here!", "Where should I go?", "Come here. (at*

[21] *Moře bylo dobrý. Takhle jako, já jsem se byl v IMAXU podívat na něco podobnýho. Takže to moře, jak říkám, to bylo prostě IMAX moře bez diváků, bez rušivějch vlivů kolem. Daleko lepší efekty samozřejmě, prostě nemáš tam to křeslo, seš prostě opravdu okolo.*

[22] *Tam se mi líbily ty medúzy a líbí se mi, že opravdu je to udělaný tak, že když se ti to přiblíží k těm očím, jo že vlastně jako se hodně zvýší ta intenzita. To jako bylo fajn, to jako bylo hezký. Říkám, to že to vrnělo při dotyku, tak to bylo takový, že člověk měl jako v uvozovkách pocit, že se teda něčeho dotknul i jako dotykem. Ale jinak musím říct, že jako zrovna ta ta, že zrovna ta jako už potom je taková jako nuda.*

[23] field note: P2: *Nazdaaar!*

[24] field note: P2: *Mám k ní dojít a pohladit jí, jo?*

[25] field notes: temné moře – se zájmem objevuje kosti atd.; želvy – našla sasanky a zavírá je, objevuje korály, šikanuje rybky, kochá se, interaguje s medúzami – chytá je

the fish)"[26]. When she saw the whale she exclaimed in surprise *"Whoooaa!"* when she first saw it. She interacted with the jellyfish and showed no fear towards them. P2 was also a bit impatient: *"And how do I turn it off again?"*[27] and I had to assure her that something interesting was still about to happen here. "*The sea, well, the sea, the first one was like... (the interviewer suggests: It was the turtles.) It was the turtles, well they were, I would say almost boring after a short while. Kind of like: Aaah nice, but um, what now."; "So then there were the jellyfish and that was unnecessarily long."*[28] She showed fear only when interacting with the whale and in the dark ocean:

"P5: *It is short but intense. And the third part we will not talk about (interviewer: dark ocean), that was fear."*

Interviewer: And from the darkness or from that ...

P5: Well, overall, depth, darkness, I don't know what will be where, what will jump at me. That was fear. Till the end.

Interviewer: And has it gotten better? Or were you scared until the end? Didn't even the glowing fish help?

P5: Till the end. I just felt that I had the skeleton over me and maybe a bit of claustrophobia.

Interviewer: Alright, what else, at the end, something surprised you, didn't it?

P5: Well, the squid. But it wasn't as bad as having a shark there.

Interviewer: I'd tell you if there was something like that, yeah.

P5: Well, I'd probably pee a little (laughs). [29]

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[26] field notes: P5: *Nekecej, pojď sem.; Kam mám jít?; Pojď sem. (na ryby)*
[27] field note: P5: *A jak to zase vypnu?*
[28] *Moře, no moře, to první to bylo tak (tazatel napovídá: To byly ty želvičky.) to byly želvičky, tak ty byly, bych řekla až jako za chvíli nudný jako že, aaah pěkný, ale hm co teď.; Takže potom byly ty medúzy a bylo to zbytečně dlouhý.*
[29] *Ta je krátká, ale intenzivní. A trojku nebudeme o tom hovořit (tazatel: temný moře), to byl strach. interviewer: A z tý tmy nebo z toho...; P5: No, celkově, hlubina, tma, nevím co kde bude, co na mě vyskočí. To byl strach. Až do konce.; interviewer: A zlepšilo se to? Až do konce ses bála? Ani nepomohli třeba ty svítící rybičky?; P5: Až do konce. Prostě jsem měla pocit, že jako mám nad sebou tu, tu kostru a asi jako trošku klaustrofobie.; interviewer: Dobře a co tě ještě, na konci tě ještě něco překvapilo, viď?; P5: No, krakatice.*

Another sequence where she experienced fear was when her light turned off accidentally in the dark ocean sequence: *"Alenkoooo, shit!"*[30] I had to quickly get to her and help her turn the light back on. She wanted to leave the dark ocean sequence but I assured her that it is a peaceful game and nothing would try to eat her. I stayed by her side until the first animals emitting bioluminescence appeared and her attention was away from the darkness of the ocean.

Participants 8, 9 and 7 also played theBlu. P8 seemed mesmerised and calmly enjoyed the scenery "*Yeah, that was nice. It was like, like a caress."*[31]. P9 simply said *"Hmm, nice".* He enjoyed it but wasn't exactly thrilled by the experience. He was much more entertained by the shooting game later. And the last one to play the game was P7, who was particularly calm the whole time he had the helmet on. He showed almost no reaction throughout his whole experience but showed his appreciation through an occasional comment *"That's nice".*[32] He seemed to like the ocean and I asked him if there was anything surprising and asked specifically about the whale. P7 answered "*No, no, no, no, no. I could hear her when she arrived there, and by the fact that P5 already had it in front of me, I knew what would happen and that she would be there, that I could see her."* The fact that P7 knew about the whale ahead of time was because those who were not playing could sit in the seating area by the gaming space and watch on the projected screen what the others were doing. It takes away some of the surprise and it might even have some impact on immersion, since I believe that being surprised actually adds to the feeling of reality a brings more depth to the experience.

From the observed customers, a few also played theBlu. One female customer from age category 31-35 felt physically uncomfortable and another woman from age category 21-25 felt fear and refused to continue in the game. Others who decided to try it mostly admired the scenery and enjoyed the sightseeing.[33]

Ale dobrý tam to nebylo tako jako kdybys tam prostě měla žraloka.; interviewer: To bych ti řekla, kdybych ti tam dala něco takovýho, jo.; P5: No, to bych si asi i čůrla (smích).

[30] field note: P5: *Alenkooo, do prdele!*

[31] *Jee, to bylo hezký. To bylo takový jakože, takový pohlazení.*

[32] field note: To je pěkný. – řekl klidně, obdivně (u temného moře)

[33] filed notes: žena (25) – strach, odmítnutí hrát dále, hlubší prožitek; muž (33) – totál kochál; žena (30) – trochu divně se jí udělalo…

Overall, this game usually provides a calm experience of being inside the ocean. It is visually pleasing and offers very little interaction. The controls are also not very demanding, therefore, it is usually the first game I recommend to first-time users. In education, it could have its place in geography or science for example.

Job Simulator

As the name suggests, Job Simulator offers the user 4 jobs to try out. The role of the user is a human working in the world of bots (they basically look like old floating monitors from the times of Windows XP). There are four options to choose from in the form of old cassettes. This fact makes it slightly more difficult to explain to younger users, since children nowadays do not know what a cassette is. Nevertheless, they may choose from four jobs: Mechanic fixing cars, Shop assistant, Cook and Office worker. When they insert the cassette into a panel they can pull a lever and start the simulation. There is also an option to make the whole game's scale smaller for small children, which is very helpful, since this game is mostly popular with younger users. I believe this game pulls the user in via spatial and narrative immersion.

The player only needs two buttons in this game, the trigger to hold objects and the menu button, which is so small that many users have a problem locating it on the controller. The menu button only has one function in this game and that is to change jobs. Therefore, the only regular button used here is the trigger.

From the observed customers, 12 played this game (7-12 years old). Two have them were prepared for the game by watching Youtubers. Almost all of them were able to quickly grasp the controls.[34] Trigger was usually easy to teach and the menu button needed to be explained again in some cases. One boy had very small hands (8 years old but his mother told me that he is much smaller than his peers) and had a very hard time holding the controllers and pulling the trigger. He also kept putting his hands in a position which made him push the menu button all the time. That always made a suitcase appear in front of him (the suitcase is used to change the jobs) and he started to seem very agitated and angry that

[34] field note: kluk (10) – spoušť – okamžité, no prob; kluci 12 a 8 – oba samouci, experimentují, ovl. – ok, rychle u obou

it keeps happening. I kept correcting his grip, but to no avail.[35] Another boy (10) kept toppling virtual object over. Some children would respect the boundaries and try to stay away, while others would go up to them or even try to cross them. One girl (11) mostly respected the boundaries but as she backed away from something, she didn't realize that there is limited space behind her.[36] There was also an interesting reaction of one boy (8) who was not really able to pass through objects in VR. When he was fixing a car and wanted to get inside of it, he would raise his feet one after another as if getting into a real car.[37]

Only participants 1 and 4 played this game in the gaming centre. P1 one had some trouble grasping and holding the objects with the trigger. She learned rather quickly what she has to do in this game ("*Well, for example, that I am there, I pick it up and give it to the customer. But I couldn't open it well and put it back."*[38]*)* and commented the whole process loudly: *"Where is the trashcan?", "Ok, what should I cook?".*[39] The game while she played was quite glitchy and had to be restarted twice. There was one important moment of P1's experience which shows the spatial immersion in her case was deep indeed. She wanted to lean on the table and since there was no table in reality she fell forward. What is interesting is that when asked about the fall, she did not remember it after playing.

Interviewer*: "And what about your fall, how did that actually happen?"*
P1*: "Where?"*
Interviewer*: "Well, during the Job Simulator, you fell there. How did you manage that? What you were doing at that moment?"*
P1: *"I don't know when I fell."*
Interviewer: *"This usually happens to children when they try to lean over a table or something."*
P1: *"Yeah, I, I thought I could actually lean on that table and and ..."*
Interviewer: "*And it wasn't there, was it?..."*[40]

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[35] field note: kluk (8) – Job S. – frustrace, mačkání menu tlačítka (malé ruce) – pořáááád, nepozornost a roztěkanost (otáčí se kolem příliš rychle a neumí identifikovat věci kolem sebe - netrpělivost)
[36] field note: holčička (11) - boundaries: ok – nevnímala tu vzadu, couvala
[37] field note: kluk (8) – znal z Youtube, ovl. ok – rychle, těžší si uvědomit, že prochází věcmi (zvedá nohy při nástupu do auta)
[38] *No na příklad jsem, že tam jako, jako že to zvednu a že to dám tomu zákazníkovi. Ale nešlo mi to moc otevírat a vybírat zpátky.*
[39] field note: trochu problémy s udržením předmětů a atžením…; rychlá orientace v prostoru (vaření, prodívání); *„Kde je kooš?", „Tak jo, co mám uvařit?"*
[40] tazatel: *A co ten tvůj pád, jak se to vlastně stalo?*
respondent: *Kde?*
tazatel: *No, během toho Job simulátorů, tak jsi tam upadla. Jak se ti to podařilo, co jsi dělala v tu chvíli?*

The fall may suggest that P1 was deeply immersed via a combination of narrative and spatial immersion. I came to her to help her get back up but she told me *"I can get up by myself."*[41]

P1 was aware of the boundaries and respected them: "*And for example, I had to learn how to lift those things from a ground where there is no border yet. I've already learned that, I took it, just like that, I went through that counter. But because that, the thing couldn't go through that counter, I had to go like this and back and then I had to get up and only I could put it somewhere."*[42] P1 learned that she could pass through things but the objects that were virtual could not pass through the table that was also virtual. This answer shows that P1 was learning about the limits of virtual world which she later mentioned when asked about what she learned in VR.

P4 also played Job Simulator. He already knew how the game is played from watching Youtube, therefore, he quickly grasped the controls and the system of the game. He was very independent and fast at fulfilling the tasks. He also seemed quite immersed in the narrative and space since when he ate a bad donut and the virtual him started vomiting, he leaned over as if it was him who was throwing up.[43]

The Job Simulator is a very good example of learning by doing and it could be used not only for entertainment, but also in civics, or preparation for profession. It certainly could be used in some lessons and there could also be collaboration among the children. It also trains coordination and motor skills. From the viewpoint of Connectivism, users in this game constantly need to update their network. The game starts with simple tasks and

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respondent: *Nevím, kdy jsem upadla.*
tazatel: *Většinou se to stává dětem, když třeba se snaží přehnout přes stůl nebo něco takovýho.*
respondent: *Jo, já jsem, já jsem si myslela, že se vlastně o ten stůl můžu opřít a a...*
tazatel: *A on tam nebyl, viď?*

[41] pád! – u Job Simulatoru – *„Já se umím zvednout sama."*

[42] *A například jsem, musela jsem se taky naučit jak zvedat ty věci ze země, kde ještě není hranice. To už jsem se naučila, to jsem vzala, takhlenc jako, já jsem prošla tím pultem. Ale protože to, ta věc nemohla projít tím pultem, tak jsem musela jít takhle a dozádu a potom jsem se musela zvednout a teprve potom jsem si to musela někam dát.*

[43] field notes: zná z Youtube, rychle si zvyknul na ovládání, mise plní rychle a samostatně, při virtuálním zvracení – předklonil se jako by zvracel opravdu

objects that are easily found but with each other task, it gets a bit more difficult. The user needs to keep developing their skills and finding solutions for arising problems.

Tilt Brush

The name suggests that this game is about creativity. Users have one controller to draw with and the other one serves as a panel with many functions. There is work with the whole sketch, there is some teleportation around the drawings and there is a colour panel and brush options panel. Users can choose the landscape around them or even have another drawing which they can draw into. This game has no narrative and therefore draws mostly from spatial immersion. The controls in this game can be quite challenging since they use the touchpad in a completely different way than the other games. Users need to update the connections already made with the previously learned function of this button and add one more type of use into their network. They keep using the button to develop the skill and use it to create in VR.

There were only five observed users (ages 7-25) that played Tilt Brush. One of them was also P1. *"Aunt look at my surroundings. I'm walking among the stars!"*[44] P1 drew starts all around her and walked through them. She then proceeded to add more colours and snowflakes. Then she sat down and took in the scenery.

"Well, it seemed limited to me that I couldn't go on. That I can't draw a pile like that, but I liked the way I could make snowflakes, stars ... and different backgrounds everywhere. That was beautiful."[45]

One of the observed players, a girl at the age of 12, played for 10 minutes and then had to rest since it seemed to tire her out. She learned the controls slowly but managed to understand it.[46] The other users mostly took in the visual scenery they themselves made.[47]

This game is peaceful and entirely dependent on the player's actions. There is no narrative, no need for strategy or fast reflexes, so I dare say that this VR experience leans on spatial

[44] field notes: všude kolem nakreslila hvězdy, pak seděla, kochala se, přidávala barvy, vločky; P1: *Tete, koukni na moje prostředí. Já chodím hvězdama.*
[45] *No, ale přišlo mi omezený jako, že nemůžu dál. Že si nemůžu nakreslit takovouhle hromadu, ale líbilo se mi jak jsem tam všude mohla dělat vločky, hvězdičky...a různý ty pozadí. To bylo krásný.*
[46] field note: slečna (12) – 10 min. – pak to na ní bylo moc -> odpočívat, ovl. vesměs ovládla, ale pomaleji
[47] field notes: kluk (11) – ovl. ok – rychle se naučil; žena (25) – spíše vizuální vnímání - klidné

immersion. It could easily be used in Art or Drama Education. It doesn't have to be played in long intervals; children could switch every few minutes or even collaborate on one work of art.

Everest VR

Everest VR is a game I usually introduce as a transition game between the sightseeing and interactive options. It is still a game based on the visual and pulls the player in via spatial immersion. But it also follows a narrative. The user is a part of a group slowly climbing Mount Everest. It is a slowly moving game with a short action phase on every stage. It uses the trigger button to pick up or hold objects and touchpad to teleport where needed. This is usually one of the first times that users encounter the teleportation function of the button, since the game is suitable for beginners. In connectivist theory, users learn a skill by using it. Even the grip button is challenging when it is first used to climb the ladder, but as the user updates the knowledge gained by trial and error, he/she slowly gains mastery over the controls.

7 of the observed users climbed the virtual Mount Everest (ages 8-56). Some users get bored of this came soon after they start playing it and some enjoy it to the very end and even sit on top of the highest mountain and take it slowly in. Most of the players rather quickly got the hang of the controls. One boy (8) had a hard time understanding that he doesn't need to raise his legs to climb a ladder. It was hard for him to grasp that he could climb by only using his hands.[48] Participants 8 and 9 played this game simultaneously. They were not in the same virtual space but they were in the same game and shared their experience. P8 enjoyed the experience slowly and had no problems along the way *"I liked it, I liked it, because I always joined a group, right, they waved at me and I went to them again, and I climbed up and finally I reached the peak. It was nice there, because I really liked it there."*[49] P9 also liked it and enjoyed the view *"There were nice views and such."*[50]

[48] field notes: pán (40-50) – rychlé seznámení s tlačítky, klidnější; kluk (8) – těžké pochopit šplhání jen rukama (tlačítky)

[49] *To se mi líbilo, to se mi líbilo, protože tam jsem vlastně, jakoby se vždycky přidala k nějaký skupině, že jo, ta mě zase jako tam někdo zamával, já jsem zase šla k němu, a jako by jsem šplhala a nakonec jsem dosáhla toho vrcholu. Tam to bylo hezký, protože tam se mi to líbilo no.*

[50] *Byl to dobrý záběry a tak že jo.*

This particular game could find its use in geography and it could easily become a part of a lesson. It would probably have to be a longer one, since the climbing can take 20-45 minutes. It depends on how much the user enjoys the views and how quickly they proceed forward.

Google Earth VR

As the name suggests, this game is based on PC Google Earth but uses virtual reality to make the player feel like they are truly there. There are however some downsides to this game. The environment is created using photos of the places and they have a chance of overlapping at the cost of spatial immersion. There are also tourists, cars, people or anything that was present there at the time when the photograph was taken. Another problem comes with the difficulty of controls. Each button has different function and it is only described in English and for users who are not fluent in the language, it could make the game much more difficult. Participant 8 was the only one that tried this game and her experience revealed more issues that users might have with this game. She mentioned that the controls were difficult *"It was a bit complicated."*[51] She also felt uncomfortable with how she was hovering above the ground in the game. She felt that she was too high above the ground and didn't have solid ground under her feet.[52] And the greatest problem of her experience in Google Earth VR was the fact that the game crashed. It suddenly stopped turning with her vision and the image got stuck which resulted in slight nausea and great discomfort. The game had to be shut down immediately so as to avoid any further issues.

Unfortunately, technical issues are not something we can always avoid. The teacher that encounters such issue has to be ready to deal with it swiftly and if that is not possible, then has to have plan B. It is always good to be prepared in case of trouble.

The Lab

The Laboratory is actually several mini-games in one. The introductory game shows the ability of teleportation and the player meets an adorable robotic dog and learns that it can be interacted with. The most popular instance there is the Longbow where the user defends a castle against invaders and does so using a long bow. Other games involve saving a

[51] *Bylo trošku složitější.*
[52] field notes: náročné ovládání, nepříjemné – cítila se moc nahoře – nebyla pevná půda pod nohama

spaceship from a galactic onslaught, short interaction with the solar system, a see-through human body or skeleton, a fantasy magic shop, robot repair or a career ending slingshot. The controls are not demanding since only trigger and touchpad are used regularly, The first one for grabbing and holding, the latter one for teleportation. Menu button is used when the user wishes to exit the mini-game and go back to the lab.

Only two observed users tried the Lab. A boy (10) played the Longbow for a while but decided that it was too difficult to coordinate his movements.[53] Participant 2 decide to explore more parts of the Lab. "*Yeah, well, the dog was awesome, but of course being a twisted soul, the next thing that occurred to me was throwing it into the abyss. And I was quite sorry that the dog managed to run there and that there was rubble there.", "Like it has nothing to do with the dog. I would send any animal there."*[54] She seemed to really like experimenting with everything around her. She used to throwing stick to beat the dog with it lightly over the head.[55] Perhaps the fact that she realised she's not in reality, she tried to send the virtual doggie into the abyss. It could be the lack or real-life consequences, but she had lowered inhibitions as opposed to meeting a dog in reality. She also tried the Longbow instance "*Archery was good, but the glasses bother you there. Because really if you wanted to stretch the bow the way you want to stretch it, it just won't work."*[56] Since P2 does archery in real life, she saw that it didn't quite work the same way.

P2 moved on to another mini-game where she had to protect a spaceship that was being shot at from all sides. She had the ship in her hand and simultaneously dodged and shot at the origin of the danger. "*Yeah, this one. Well, what bothered me like that was the fact that it was like everywhere, so you just couldn't see it well. But if enemies attack me in real life, they probably won't wait until I just turn around, right, so it's okay. But the fact is that in general I probably don't like things that I can't actually control or predict."*[57]

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[53] field notes: kluk (10) – Luk – ne – koordinačně náročné

[54] *Jo, no, pejsek byl boží, ale samozřejmě jako, jsem duše zvrácená, takže hned další co mě napadlo, že mu to hodím do tý propasti. A docela mi bylo líto, že tam odběh, že tam byly šutry. Jako nemá to nic společnýho s pejskem. Poslala bych tam jakýkoliv zvíře.*

[55] field note: interakce s pejskem – hází klacek, lehce pejska mlátí klackem

[56] *Lukostřelba dobrá, jako tam teda ty brejle vaděj. Protože opravdu jako, když by to člověk chtěl natahovat, tak, jak by to natahovat chtěl jo, tak to prostě nepůjde.*

[57] *Jo tohle. No, tohle mě jako vadilo jako v tom, že vlastně, že to bylo jako vlastně všude, takže to prostě člověk jako blbě viděl. Ale jako reálně třeba, když by na mě útočili nepřátelé, tak asi taky nebudou čekat až*

P2 was satisfied with being able to try many of the mini-games and found something she liked everywhere. These games cover a great variety of themes and subject matter. They could be used in biology, astrology, physics, PE or many other subjects. The games are usually short and could be easily implemented into a lesson plan.

Waltz of the Wizard

Exploring the room in a high tower that belongs to a wizard does not belong to strictly educative games. The players use the trigger to grab and hold and the touchpad to teleport. They can combine ingredients and create magical effects. It might find its place in some chemistry lesson plans, but otherwise it has an entertaining purpose. There was one problematic moment for P3, the only participant who played this game.

P3: "*With the wizard, it was much stronger, of course. There's just the table like ... there, the wizard probably scared me the most with the look down."*

Interviewer: *Yeah, you actually lost your balance there.*

P3: "*I lost my balance there, plain and simple. To be more accurate, I expected to look there, I leaned over and wanted to lean on it and there was nothing there. There just wasn't the reaction back."*[58] P3 also had some issues with the gaming area and teleportation "*I was trying to get out of the pen ... and after a while I realized that I was actually in the corner of the pen, and that in order to just get the game space I needed, I had to go back in the middle of the pen first and then move to the end."*[59] By the pen he meant the boundaries of the gaming area. And it took him some time to realize that he had to navigate the teleportation together with the real-life movement. This is another great example of a possible issue that the teacher might encounter with first-time users. This one should not be

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se zrovna otočím, že jo, takže jako v pohodě, ale s tím, že já obecně asi nemám ráda věci, který vlastně nemůžu kontrolovat, nebo predikovat.

[58] *U toho čaroděje to bylo daleko silnější samozřejmě. Tam prostě ten stůl jako... tam u toho čaroděje mě nejvíc asi vylekal ten pohled dolů teda.*
tazatel: Jo, tam jsi vlastně ztratil rovnováhu.
P3: Tam jsem ztratil rovnováhu, opravdu férově jako. Respektive jsem očekával, že se tam podívám, naklonil jsem se a chtěl jsem se opřít a ono tam nic nebylo. Nebyla prostě ta reakce zpátky jo jako.

[59] *Z tý ohrádky se jako dostat jsem říkal hele to že jsem... a po chvíli vlastně mi došlo, že už jsem vlastně v rohu tý ohrádky, a že k tomu abych prostě dostal ten herní prostor, kterej potřebuju, tak se musím vrátit nejdřív doprostřed ohrádky a pak se přesunout na konci.*

too hard to overcome. The teacher should lead the user back to the middle of the area and then tell him/her to teleport from there.

Richie's Plank Experience

This game provides one intensive experience and several nerve-wracking ones. The main attraction here is riding the elevator to the highest possible floor, walk on the plank and jump off it. There are also mini-games involving flying around a city. The plank experience has very lifelike environment and provides rather deep spatial immersion. The instructor also puts real plank under the player's feet. The depth of the immersion is, of course, individual.

14 observed users tried this game (ages 15-57). Some users take longer to jump and some of them have no problem walking to the end of the plank and stepping off.[60] It might be connected to the suspense of disbelief and the depth of spatial immersion. Some users believe the virtual world so much that they are not even able to step on the plank. Other users use cues from the real world to anchor themselves and that helps them make the jump. For example, P8 mentioned that if she didn't first take her foot off the plank and onto the carpet, she would not be able to jump. The experience was quite uncomfortable for her.[61] Many players lose their balance while jumping and almost all of them at least rock at the moment they "hit the ground". P7: „*The problem was with the landing. Your legs give way there, you feel you have to make up for it. And then it got better, because you have to say that it's not reality. Then it was nice between those buildings"*[62]. P7 didn't really mind the jump, just the landing part, but he truly enjoyed the flying mini-game. One of the problems that a teacher might encounter in this game is nausea cause by both the jump and the flying. P2: "*Yeah well, I'm not able to turn my brain off, so it feels very real to me and I get sick pretty quickly. Just like I feel sick in a car, so ..."*[63] This type of nausea is actually quite a regular occurrence in some types of games. The teacher can treat it as a

[60] field notes: muž (29) – skočil poměrně rychle, trochu klepání; žena (27) – trvalo déle, ale skočila, při létání se trochu klimbala do stran;
[61] field note: Richie – nepříjemné – kdyby nedala nohu první z prkna, tak by neskočila
[62] *Problém mi udělal ten dopad. Tam ti podlomí se nohy, máš pocit, že to musíš vyrovnat. A pak se to zlepšilo, protože člověk si musí jakoby říct, že to není realita. Potom příjemný to bylo mezi těma panelákama.*
[63] *Jo tohle, hele já ten mozek nejsem schopná vypnout, takže prostě pro mě jako opravdu, mě by by bylo asi za chvíli jako hodně blbě. Takže jak se mi dělá blbě v autě, tak...*

nausea caused by riding in a car. It happens to some people and some users don't ever experience anything like it. The gaming time has to be cut short so that the children don't get too sick.

Desert Ride Coaster

One of the shortest games in VR Dimension is this 2 minute experience of a coaster ride. It's almost like a roller coaster simulator. The user sits on the ground, some chair or keeps standing (but in that case the instructor has to be there to catch him/her). There were 13 users observed playing this game (ages 8-57). There are three levels of reaction in this game. The first one is almost no reaction during the ride.[64] Level two is rocking to the sides and leaning back and forward.[65] The third level is strong movement, usually accompanied by sweating and/or along with screaming. P8 was sitting on a sofa and screaming *"Aaaaaaaaah!"* and *"You've got to be kidding me!"*[66], P4 screamed *"Ohohohhh! Jeeeeee!"*. In some cases, they do not even finish the game for the discomfort or nausea it causes.[67]

This game probably does not have many educative purposes. It is an experience created for the sake of the thrill. It however is an example of another type of game that causes nausea and is quite immersive for some users. I believe it is spatial immersion that plays the main role here.

Beat Saber

Beat Saber is a game that uses tactical immersion since it focuses on the minute decisions and reflexes of the user. It is also a rhythmical game. The player has two swords, one blue and one red and cuts cubes that fly at him/her in the rhythm of the music. The cubes have to be cut clearly and in the rhythm. Mines have to be avoided by the swords and the obstructions have to be avoided by the player. There are no buttons involved that the player has to push while playing. The game is all about the movement and it is immensely popular. 25 customers (ages 10-56) played it during the research. The controls were easily

[64] field note: P7 – nehybný, klidný, jen zpocený
[65] field notes: žena (30) – lehce náklon, zavřela oči po chvilce
[66] *To si ze mě děláš prdel!*
[67] field note: muž (33) – hned vypnuto (prý to fakt nešlo - nepříjemné); děvče (17) – po třetí zatáčce zavřela oči – trochu nevolno

learned in all cases.[68] Some players quickly understood the colour system where the blue sword had to cut the blue cubes and the red sword also cut its own coloured cubes only. Some players had a hard time getting used to the speed, the colours, the obstructions and the arrows on the cubes which indicate the direction in which it has to be cut. There are also different reactions to the obstructions that have to be avoided. Some players ignore them and some players are afraid of them initially.[69] P4 had a problem coordinating the swords when the colours switched sides.[70] P2 was quick to adapt to the whole game's system and quickly raised the difficulty. She really seemed to like the game and I asked why. "*What do I enjoy in it? The fact that it forces me to coordinate my movements, but according to the scheme that someone gave me. This means that it has clear rules and I can actually see it in advance, so I can decide that movement in advance."*[71]

In my opinion, this game could be used perhaps in Physical Education. There is a song that the makers of the game added during the covid lockdown called Fitbeat and it truly does serve as a very good substitute for indoor sports when played at a higher difficulty. The issues that the teacher may encounter are exhaustion of the user since the helmet is heavy and enclosed. That also causes rigorous sweating in the area of the user's face. this issue cannot really be dealt with by the teacher. This has to be left to the development with hopes that each generation of VR equipment will be better.

Shooting games

I decided to put all the shooting games in one category since they have very similar concepts and system. This category comprises **Serious Sam: The Last Hope VR, Brookhaven, Bulletproof and Zombie Training Simulator**. Serious Sam is a game divided into stages. The main character embodied by the player has to save several planets and gets to buy new weapons and perks between the stages. Brookhaven is a scary zombie shooter and it is a rather old game by now but it still makes some people scream in terror.

[68] field note: kluk (27) – rychle zvládl ovládání
[69] field notes: kluk (10) – nejdřív neviděl šipky; kluk (10) – horší koordinace; kluk (11) – překážky nejdřív ignoroval; dívka (16) – silná reakce na první překážku proti obličeji (kryla si obličej i tělo)
[70] field note: problém s přehozením barev
[71] *Co mě na tom baví? To, že mě to nutí koordinovat pohyby, ale podle vlastně schématu, kterej mi někdo dá. To znamená, že to má jasný pravidla a ještě k tomu je vlastně vidím dopředu, takže prostě vlastně o tom pohybu můžu dopředu rozhodnout.*

The two last games are designed mostly for younger users and have childish features. P5 talked about the Zombie TS: *"The cute zombies are for kids"*[72] The zombies are made of cardboard and Bulletproof is a rather adorable cowboy shooter where the gun can reflect the bullets of the enemies. They are both based on surviving stages. In Bulletproof, P4 lied on his belly on the carpet to use the virtual barrels as a barrier between him and the bullets. P5 commented on this occurrence: "*But because I have bad joints, I couldn't kneel and last that long. P4 worked it out, he knelt on both of knees."*

Serious Sam is one of the favourites in VR Dimension. It can be played as a multiplayer or solo. P8 and 9 played it together at first and then P9 played solo. He preferred the solo playing since he could direct it himself.[73] There is one button that Serious Sam and Brookhaven both use and it often causes difficulties. It is the grip button and it is located on the side of the controller. Brookhaven uses it as a reload button and Sam uses the button to turn on the shield.

These shooting games might be useful perhaps for language teachers since they are in English and Bulletproof or Serious Sam even tells a story, but otherwise, I do not really see how it could be used in education. The players' reactions differ and the immersion here seems to be a combination of spatial and tactical immersion.

Some games and experiences are useful for the educator and some may only be fit for entertainment. In the end, it all depends on the abilities of the teacher, on the type of lesson plans and, of course, on the students' needs.

How does the control affect the user?

Most of the games in virtual reality have need for some type of controllers. Some games a have a simple use of a button or two, while other games opt for a much more complicated control system, such as Google Earth VR. The important aspect is how the controls affect the user's experience, how the teacher can work with it and how to deal with some arising issues. In connectivist theory, learning the controls is achieved by using them and updating the user's network. Since the controls change with almost every game, the users need to keep up with the changes and development. Practice makes perfect.

[72] *Roztomilý zombíci jsou pro malý děti.*
[73] *No já bych řek, že když to člověk hrál sám, tak mi to připadalo lepší, nevim.*

The easiest button to use is probably the **trigger**. It is the basic button of all games usually used to grab and hold items or to select some options. But even this basic button can be problematic. P1 had a problem holding onto an object as mentioned above under Job Simulator. It sometimes poses a problem to younger users and pushing the wrong button at the wrong time can cause frustration or anger.[74] When the learners hands are small, there isn't much the teacher can do. He/she can only hope that there will be controllers designed specifically for children. Until then, all the teacher can do is to correct the way that pupils hold the controller to find the most effective grip and have patience with repeated mistakes.

The most problematic button for many users is the **grip button**. Users can find it on the side of the controller but it isn't always easy to feel.[75] It has different functions in different games. Sometimes it is a reload, other times it serves as a shield. Most users have difficulty with it at first but gradually get used to it.[76] Participants 2, 5, 6, 7, 8 and 9 all had some issues with the grip button. In case the game is reflexive and speed is necessary, not being able to find the grip button can cause panic, uncertainty or even failure in the game.[77] The players need to be reminded if they do not immediately use the grip, but with some practice they should be able to use it without greater issues.

The **menu** button is small and can be hard to find but it usually isn't used regularly and doesn't really seem to distract the users much. It wasn't mentioned in the interviews as a problematic part of the controller.

One of the interview questions was also directed at the **visibility** of the controllers in VR. It seems that it usually never had a disruptive nature and they were visible where necessary.[78]

[74] field note: kluk (8) – malé ruce, mačkání více tlačítek najednou, frustrace
[75] P2: *No takový to tlačítko, co se muselo jako dlouho hledat.*
[76] P5: *No dobře no. To jako si člověk musí zvyknout, že to musí dobít no. Ale myslím, že to šlo úplně normálně.*
[77] P5: *Nějákej ten, ale vůbec to nedrží, jako vůbec to ne to, vůbec to, klouže to z prstu a právě dobiješ a nevíš, jestli to máš dobitý.*
[78] P2: *Já myslím, že zrovna, jako že to bylo tak, že tam, kde měli bejt jako vidět, tam byly. A tam, kde vidět nebyly, tak to bylo taky v pohodě.*

P2 was particularly surprised by the **vibration** that the controller makes upon touching certain objects.[79] I believe that the haptic feedback that the controller provides can provide depth and it may support spatial immersion.

The change of the appearance of the controller in the game can be disruptive in certain cases. One example can be found in the shooting game Serious Sam. Touchpad is used there to change the weapons. Since the game is about speed and reflexes, the players can sometimes press touchpad accidentally in the heat of the game. At that point the weapon in that hand suddenly appears as the controller until the user chooses the new weapon from the selection in front of him. This issue could destroy the tactical immersion since it basically slows down the tempo of the game and stops it at the most exciting moments.

There is another complication which might easily happen. Surprisingly none of the observed experienced this issue. The controller is strapped to the hand but it is still quite loose and in the heat of the game, it can be accidentally **thrown or dropped**. I believe that could prove as the greatest distraction since the player would have to deal with it back in reality. This particular issue can be dealt with by changing the design and grip of the controllers.

What elements affect the immersion?

Many of the disruptive elements were mentioned in the text above in the section devoted to individual games. The participants were asked about the depth of their immersion. If the immersion was 10/10, then there usually was no follow-up question. But when the immersion was not full in their opinions than the interviewer asked why they were not fully immersed.

Participants 4, 6, 7 and 10 were fully immersed in their opinions giving these numbers describing their immersion respectively: 10, 20, 10 and 12. (They were asked how immersed they felt from 1 to 10 where 10 was the most immersed and 1 was not immersed at all.).

[79] *No tak jako, jako blbě. Jo, stejně tak třeba, když člověk se dotkl takových těch sasanek nebo něčeho, tak ta rukavice trochu jako zavrněla, ale když jsem se chtěla dotknout neživých předmětů, jo jako nějaký šutr nebo tohle, nebo na ně v uvozovkách šlápnout, tak jako nic*

P2 didn't give a specific number and stated that she felt normal.[80] What might have had a negative effect on her immersion was that she had her one-year old daughter in the gaming centre and could hear her crying even through the headphones. She herself realised that that was also the reason why she was still not fully immersed in the virtual world. She also mentioned that the virtual reality she experienced here could be considered a better PC game.[81]

P3 gave the number 8. For him, it is still an artificial environment. He didn't really perceive the reality or the passage of time but the games were not designed well enough for him to be fully immersed. He described his experience as a better 3D movie.[82]

P1 also didn't give a specific number but was adamant that it felt really great, almost too great.[83]

P5 stated that she felt 9/10 immersed and her reason was that she was still holding the one for something better. She mentioned that the graphics could be better.[84]

P8 chose number 8. She said she was okay. She could sometimes hear the voices from the others in the gaming centre and the headphones helped her get more immersed. She didn't really notice the passage of time.[85]

P9 also chose 8 saying that he heard the people in the centre as well but he states that it didn't really disturb him. He refused the headphone since he thought they would just be more constricting.[86]

When asking follow-up questions, there were several recurring distracters identified.

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[80] P2: *No to je hrozně jako, hrozně jako těžký pro mě takhle říct, protože normálně, naprosto normálně. (tazatel i respondent: smích) No, sorry, ti říkám, že nemůžu říct jako jako, jestli dobře špatně.*

[81] *Takhle, já jako jsem i vnímala ten svět, protože přece jen člověk slyší tu Betty, že jo.; To je takový, že tohle bohužel jako nevypneš. Ale jako rozhodně jsem si pořád uvědomovala, jako kde jako jsem. Takže takový jako, taková jako lepší počítačová hra.*

[82] *No v pohodě, jako je to virtuální realita. Tzn. je to umělý, je to poměrně, v uvozovkách, primitivní systém jako se zpětnou vazbou, takže nějaká osma? Bylo to slušný, jako ten efekt prostě jako 3D kino, no.*

[83] *Že to bylo až moc dobrý.*

[84] *Grafiku bych vylepšila.*

[85] *To jako že si myslím tak osmičku bych řekla, protože já jsem byla v pohodě jinak. Když se mi neudělalo špatně, tak jsem byla v pohodě.*

[86] *Tady ty divný lidi mluvili, ty jo (humorná narážka na skupinu). Nemoh jsem se soustředit.; No možná, nevím ale. Ještě by byl člověk víc utaženej, ta hlava myslím.*

The first one is **the cable**. P10 for example said that if the VR was wireless she would be completely there.[87] Nowadays there are some wireless options available and with each generation of VR it gets better and more advanced.

The second distraction is **the helmet**. It is heavy and it gets in the way in some games, such as the obstruction to the archery game in P2's experience mentioned in the section dedicated to the Lab. The solution is the same as the previous issue - the better the equipment, the better the experience.

The third disturbing element is **the controller**, especially the grip button which was mentioned in the shooting game section. Unfortunately, unless they design a more intuitive controller, the practice makes perfect will have to be the main solution.

The fourth distracter is the **design**, specifically the graphics and physics in the games. Another issue which can only be dealt with by those that bring us the experience.

Barriers are the next distraction. They are necessary for safety reasons so unless a more advanced and less distractive solution is invented, it will have to stay in place.

Every type of progress comes with learning and even technology learns from its mistakes. Therefore, the next issue is **technical problems**. They are not something that can be predicted at all times, so the only thing to do is be prepared and adapt.

And the last distraction mentioned by the participants is the **language barrier**. Not everyone is fluent in English but that still is the main language of games and ICT in general. Hopefully, the future will bring us more efficient translators so that we do not have to worry about this type of limitations.

All of these were mentioned by the participants in the previous sections but for better overview I decided to list them together. They also answer the sub-objective and offer solutions or hope for future ones.

What do users feel after the use of virtual reality?

How the users feel is the very first question asked in the interviews. Most of the participants felt relaxed or simply fine. P9 mentioned he felt sweaty and P5 felt sort of

[87] *Kdyby to asi bylo bezkabelový, tak bych, tak bych byla úplně vevnitř, jako úplně.*

interesting and conveyed her opinion that this type of activity may easily give rise to addiction.[88]

The participant didn't really delve deep into their present state but they were given follow-up questions about their opinions on the use of VR and on the obstructions that could make the use of this technology difficult.

Opinions on the use of VR

The opinions on the use of VR were usually somehow influenced by the occupation of the participants.

P10 does consulting on the side and that might have influenced her opinion that VR could be used in healing obsessive compulsive disorder, problems with motor skills, learning language interactively or online travelling. She also mentioned that it could just as easily be used for some nefarious purposes and it should only be used for good. But she still says that VR could be used practically everywhere. P6 agrees that it could have any use imaginable and specifically adds administration.[89]

P2 suggested that VR could be use effectively to train people. But she also warns that they should not get used to the fact that their actions don't have any real-life consequences.[90]

P3 only talks about the use of VR in entertainment but stresses that that is something that can always be improved.[91]

P1 considers the use of VR at school right away. Since she attends primary school, it is not surprising.

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[88] *Zajímavě, myslím si, že na tom vznikne rychle závislost.*

[89] P10: *Úplně všude. Já si myslím, že úplně všude, že by se to dalo třeba, protože mám klientku, která má obsedantně kompulzivní poruchu. Tzn. že ona potřebuje vytvářet nějaký stereotypy chování, aby snížila míru stresu, což se ne vždycky úplně daří, protože prostě to má nějaký zákonitosti, tak myslím si, že tam by se dalo kontrolovaně bezpečně po nějakých dávkách tohleto řešit, jo? Dalo by se řešit s lidma, který mají problémy s motorikou, třeba něco, jo? Dalo by se, dalo by se možná možná by se interaktivně učit jazyky ještě nějak, jo, protože nemuseli by lidi cestovat, pokud třeba nemůžou, tak by se to dalo řešit takhle jo? Myslím si, že to použití je úplně úplně, že to je jenom o tom si otevřít hlavu a na to to použít, ale zase, aby to bylo jako fakt jako pro dobro lidí, že samozřejmě seto dá zneužít, že jo. Všechno.*

[90] *…ale jinak si myslím, že třeba zrovna na jako tréninky lidí, ať už třeba jako možná i těch chirurgů, já nevím, jako, že to jako zase jako nevím, aby si ty lidi jako zase nezvykli, jako že prostě řezat do masa je to samý co jako tady jako řezat do virtuální reality, tak jako to nevím, jak moc to škodí. To přesně vždycky říkal můj učitel na autoškolu, že neschvaluje trenažéry, protože prostě ten člověk, jako když se učí na tom trenažéru, tak má potom v reálnym provozu jako pocit, že má ještě 10 životů.*

[91] *Na zábavu v podstatě si myslím, že se toho dá vymyslet spousta a, že se to furt bude zlepšovat.*

P5 mentions medical school. (Continues in the education section lower.)

P8 isn't sure where else but the entertainment industry and simulators it could be used. She states that his work is unfortunately not one of the options but that it would be great if it were possible.[92] P9 and P7 also agree with the use of simulators.[93]

P9 thinks VR could be used as a more advanced 3D TV.[94]

P4 doesn't really see any other potential in VR than home entertainment.[95]

Obstructions to the use of VR mentioned by the Participants

The participants were also asked about the possible obstructions in the process of using VR technology.

P10 mentioned technical issues. The equipment should be more available, wireless and perhaps more compact. And the fear that people have towards this technology could also be a problem, not to mention people who are sensitive or mentally unstable. She also talked about the possibility of addiction and its dangers.[96]

P2 doesn't consider the VR headset to be comfortable and contemplates the use of muscles. If it were a regular type of use than using the same muscles over and over again could be problematic. P4 also agrees with the problem being in the headset and also adds that the controllers coudl be troublesome as well.[97]

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[92] *Kde? U čeho? Tak určitě ne u mojí práce no, bohužel, to je škoda. Člověče, když tohlento je fakt jako spíš určený na tu zábavu, možná jako trenažéry na nějaký jo*

[93] *Virtuálka? Manuální práce asi ztěžka. Asi ten nácvik těch letadel a takovýhle věci. Tech-techniku zvládat. Ale myslím, že i šoféři by v autoškole si to, na velký auta, že jo. Proč by ne?*

[94] *No jak jsme se o tom, jak jsme se o tom bavili v tom...ono to je vlastně, je to podobný jako 3D televize jak byly dřív. Něco na ten způsob akorát, že to je ještě lepší. Takže, jestli třeba někdo někdy budete sledovat film v takovýmhle takovýmhle systému…*

[95] *Tak virtuální realita se dá použít doma spíš.*

[96] *No, řekla bych, že rozhodně technický, aby ta technika byla dostupná, jednoduchá, třeba i menší než než je to teď, třeba bezdrátová. A samozřejmě možná nějaký obavy lidí a ještě otázka, což já třeba nevím, co jsem se tím až tak nezabejvala, jestli to pro nějaký senzitivní lidi může znamenat nějaký narušení psychiky, což já nevím.; Nebo třeba, třeba si umím představit, že by to mohl být druh nějaký jako závislosti. No, takže to si myslím, že by mohlo být jedno z nebezpečí, protože počítačový hry už závislosti jsou opravdu lidi, lidi mají s tím problémy, mají problém prostě žít svůj vlastní život, protože leckdy v tý virtuální realitě, nějaký hře, jsou úspěšnější, měla jsem takovýho klienta navíc, takže to si myslím, že je velice, jako velice tenkej led.*

[97] P2: *No tak samozřejmě není to úplně ,úplně pohodlný, to je jedna věc. Druhá věc je, že zapojuješ v těch rukách jiný svalový skupiny, takže jako pravděpodobně, kdyby to mělo bejt jako pravidelně, tak prostě budeš mít problém s timhlectim, s těma jako svalama. To si myslím, že určitě. Jako nemyslím, že by snad jako že by lidi přestali vnímat jako realitu, to snad jako ne.; P4: Tak, um, mohlo by jim vadit to, že, to ovládání, nebo ty brejle.*

P3 talks mostly about the technological aspect of VR and about its creation. He says that someone will always have to create it and it would be entirely dependent on their skills. And the main issue in his opinion is that there is really nothing new you can come up with but some new interactions.[98]

P1 fears that children might not be very happy about having to wear the headsets or the limitations set by the borders. She also thinks that some children might be startled when meeting the whale for the first time or scared when experiencing the dark ocean.[99]

P5 considers that blurry vision after a short while of using could be an issue. People with epilepsy and migraines should probably not use the technology either.[100]

P8 talks about the demanding nature of this technology. It needs quite a lot of space, it is dependent on electricity. It can cause nausea and it can be simply interrupted by technical issues.[101] This particular issue could be caused by her firsthand experience with said issues.

P9 considers the financial side of this technology. If it were cheaper, it would certainly be better. He would also prefer the wireless version of the headset.[102]

P6 sees the greatest problem in the length of the experience and in the strain it puts on the human body and especially on the eyes.[103]

P7 brings up a very interesting opinion saying that getting back to reality could be a problem.[104]

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[98] *Tak musíš udělat ten fyzikální prostor. To znamená, musíš udělat tu realitu, prostě musí někdo naprogramovat. A vždycky to bude omezený jenom tou interakcí. A bude to o tom, že jediný co můžeš je vymejšlet nový interakce.*

[99] *No, že by, že by jim třeba vadilo, že děti by museli nosit brýle.; Myslím, že by to některým dětem mohlo vadit, že jako maj tam omezenou hranici a že nemůžou dál, že třeba nemůžou skočit z tý lodi.; No, jako když první zkusí jako první to temný moře, tak by se mohl leknout těch rybiček a nebo toho kraba a nebo tý velryby.*

[100] *Rozmazaný viděním za chvíli, protože jak se soustředí a jinak v tom jako nevidím...; No jasně tak epileptik by ti to hrát nemohl. (tazatel: To ne no.) Nevolnosti, ty, co mají migrény, možná taky ne*

[101] *No tak možná i to, že to jsou poruchový věci, že jo, že se to může porouchat, a potom tě to může brzdit a a někdy se u toho třeba udělá zle. Že to závisí na proudu, že jo samozřejmě, no na elektrickým proudu, no takže to tam tak může dělat nějakou neplechu. Pokaždý potřebuješ k tomu teda vlastně energii, potřebuješ k tomu prostory…*

[102] *No tak, bylo to, je to drahý samozřejmě.; Jasný, ale jako přímo fyzicky bych bral kdyby se tam prostě člověk nemusel mít ten kabel, jo tím že by, no a že se tam přitom, že se mu v tom zapotí obličej, ale to asi to je to jsou technický řešení, který možná někdy budou vyřešený nebo taky nebudou s tím kabelem.*

[103] *Překážky? Já si myslím, že tam asi ty oči. Ty oči, to jako to je masakr, a když, chceš prostě, jen nevíš, nevíš prostě, jako třeba hraješ, uh hodinu v kuse, a ten mozek - podívej se na mladýho. Ten je úplně vysekanej jako jo. Ale prostě jako hrát to nějakou delší dobu nevím, nedal bych to asi.*

Participants' opinion on the use of VR in education

P2 would use VR in several subjects at school such as chemistry, physics or any type of experiments. She especially emphasizes that children could see the results of their experimenting. P5 also mentions experiments.[105]

P3 doubts that it is needed in education. He mentions the operation simulators and conveys that it could be used in construction.[106]

P1 introduces the idea of educational games.[107]

P5 talks about the possibilities that VR operations might have for neurosurgeons. she says that it would be perfect if it could be designed down to the smallest detail. She also contemplates the use in Maths and the possibility of manipulating the numbers physically.[108] P8 and P7 adds geography and history to the list of subjects. P9 mentions the use of the theBlu and Everest VR with relevant subjects at school as well.

P6 mentions a more advance ICT, Maths and geometry. [109]

Opinions of learning in VR

One of the last questions that I wanted participants to answer was what they think they actually learned in this VR experience. Participants 3, 9, 6 and 4 all mentioned that they learned the controls and how the technology works.[110]

P10 was gaining her calm as she was getting more experienced. She was getting better at the timing for Beatsaber etc.[111]

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[104] *Asi se vrátit zpátky do reality, ne? Když do toho zahučíš.*
[105] *Jo, ale jako myslím si, že jako spousty těch věcí, co by se právě dalo využívat i pro ně. Třeba jako ve fyzice víš, kdyby jako viděli výsledky jako svejch spočítanejch experimentů...to by bylo úplně super.*
[106] *A tak jako určitě. Otázka, jestli ve školním... Je to potřeba někde, na co jo? Tzn. jakej, aby prostě byl výsledek. Že se dělaj nějaký operace, to se obecně ví jo, že si můžeš obecně vyzkoušet. Jako já si myslím, že spíš nějak jako ta konstrukce, že by v tom mohla být zajímavá, ale toť otázka.*
[107] *No, třeba kdyby se tam daly nějaký naučný hry, tak by se to dalo využívat ve škole.*
[108] *Tak hele ne daleko ode mě, že jo, takže lékařství si myslím, že kdyby udělali virtuální operace, že by to nebylo úplně špatná a třeba jako neurochirurg dobrý. Přímo kdyby byla jako úplně do detailů, tak pro neurochirurgy úplně skvělý.; No možná hele ale i matika, když mám vyzkoušený, když dosazuješ, kdyby jsi mohla manipulovat s číslama jako takovejma a házet je do příkladů. Tak to by možná bylo lepší, než kdyby, kdyby se někde psaly a odškrtávaly a tak. To bych řekla, že jo. Čeština ne, to je na psaní. Fyzika ,chemie, pokusy. Jako, že by sis udělal atomovku a můžeš si jí udělat. Takovej malej hříbeček, že by si ho puf.*
[109] *Ty děti, nějaká ta výuka nějakých těch počítačů, kdyby se dostali někam dál, to je úžasný jako.*
[110] P4: *Tak naučil jsem se je ovládat a tak, a tak dále, se bát...*

P2 learned that it is easy to fool our senses and that getting back o reality could be difficult. Also that people have different ways of thinking and their brains process information differently.[112]

P1 surprised me with the depth of her contemplation. She said that she learned that not everything that is in virtual reality is also here in the real world. We for example cannot fly. She also mentioned that we do not have such boundaries but virtual reality and such games have them.[113]

P8 mentioned that she learned that there is use of quick observation in VR and that she does not enjoy the feeling of hovering in the air without having solid ground under her feet.[114]

Only P7 didn't think that he learned anything.

There are opinions that share the same basis and opinions that differ significantly. From the answers, it could be glimpsed that the participants' answers were strongly influenced by their field of expertise, the VR games they have experienced and the knowledge they have about the technology in general. And even if the learners themselves do not believe that they learned anything, our job as teachers is to make sure they understand that they learn from every single experience they go through. And according to Jarvis's theory, they emerge as new people.

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[111] *No, když vemu toho Beatsabera tak určitě uh, určitě... Čím dýl jsem to hrála, tím tím víc jsem byla v klidu, že je na všechno dost času, že naopak, když to dobře načasuju, tak to líp zvládnu a že to není vo nějaký přehnaný překotný rychlosti, ale je to spíš o klidu a koordinaci. (tazatel: Uhuh.) No a jinak u těch, u těch podmořskejch možná...um. Možná taky o zachování klidu no, ale tam třeba u tý velryby to bylo těžký no.*

[112] *Že si myslím, že asi jako některý lidi, kteří maj jinej druh myšlení, protože že jo každej samozřejmě má, prostě ty hemisféry mu fungujou jinak. Každej prostě jinak vnímá pocity, takže si myslím, že u některejch věcí můžou ty lidi mít velký problém se vrátit zpátky do reality. Protože budou očekávat jako, prostě ta adaptace třeba bude jiná jo, jako já nevim jestli rychlejší nebo pomalejší, to nedokážu říct, ale že ta adaptace potom může jakoby bejt zajímavá. Jako, že hmm, jako jak vlastně málo stačí k tomu, aby se některý ty smysly oblbly.*

[113] *Například, že všech...že všechno, co je tam, že, že není u nás, že například neumíme létat.; A že nemáme tak vel...že nemáme hranice...my, ale virtuální realita, takovýhle hry, mají hranice.*

[114] *Možná, možná jsem zjistila, že je tam jakejsi takejsi postřeh. Nějakej tam je. Pak jsem zjistila, že nemám až tak úplně ráda volnej prostor pod sebou, to teda fakt jako nemusím, to mně nedělalo dobře. Když jsem nevěděla, že stojim pevně na zemi a měla jsem pocit, že jsem ve vzduchu, tak to mi nedělalo dobře jo.*

3 Discussion

In this part I will summarize the research objectives and the results of analysis. I will discuss and compare the results with available relevant literature and the theory explained in the theoretical part of this work. The research focused on the experience of first time users, their learning in VR and the obstruction that might have gotten in the way of the process. A section was devoted to how the users feel when they first put on the headset. Another concern was their perceived immersion and elements which cause fear in VR. The next part explored how the controls affect the users. Another objective was what the users experience in different games and the last section delved into the feeling and state immediately after using VR.

Before the actual experience

The users had quite a few different reactions to the first moment of the experience, putting on the headset. Some of them felt anticipation or excitement. Some of them felt awe and wonder. Others just had an odd feeling or even no feeling at all. And aside for physical discomfort cause by the headset, one of the negative starts to the experience was fear. It was specified as the fear of the unknown. Therefore, it is a kind of fear that may be fended of via learning.

Bailenson in his book summarizes some of the many reactions he has witnessed in his experience: *...when a person is first enveloped by a virtual environment—thousands of times, and I've seen a lot of reactions. Some gasp. Some laugh with delight. Depending on what's being rendered in the program, I've also seen people cry out in fear, or throw their hands up to protect themselves as they hurtle toward a wall."*

In my experience during the research, I have not seen anything so dramatic, but I have found out that the reactions are truly an individual experience. There have not been any issues during the research and all the participants were able to keep the headset on and experience VR. Learning to use the VR headset is from the perspective of connectivism another skill that is learned and perfected with practice. This theory focuses on the always developing digital age and therefore applies perfectly to the virtual reality technology

which is one of the fastest developing technologies of this age and its use in education is on the rise.

The controls

Any game, to be played, needs to be controlled in some way. To allow full immersion, controllers should not be distractive in nature. During this research, I have found that in some games, the controllers were less of a distraction than in others. Participants mentioned that the controls would get easier over time as they got used to it. Some users felt that the controls were easy in some games and difficult in other games. For example theBlu basically uses just one button and none during the actual experience sequence. On the other hand, Google Earth VR has rather complicated controls and their description is only in English. There are also certain problematic buttons and in particular types of situations. The grip button has emerged as the most problematic. It was used as a reload or as a shield. In both games, the button was hard to find and 7 participants have shared this discomfort. It had a disruptive nature, since they had to deal with a virtual reality matter via real-life reality and that broke any type of immersion they were able to achieve. The touchpad is another button which seemed to cause a break in tactical and spatial immersion. Serious Sam is a shooting game and touchpad is used to change weapons in action. Unfortunately, its size is quite large and users often press it in the heat of the game. In this type of situation it has a very disruptive effect. There were some studies conducted regarding the naturalness of controllers. *"Overall, results of this study indicated that there was no significant difference in game UX or sense of presence between the Xbox controller and Oculus Touch controllers in both game genres."*(Hufnal et al.). This study did not find any particular differences between Xbox and VR controller. There were only slight differences in favour of the VR controller in one of the experiments. A study by Seibert and Shafer (15) proved that the naturalness of controllers promotes spatial immersion in VR. "*We have demonstrated in this study that VR HMDs paired with control interfaces that seem natural and intuitive to the user are powerful gateways to immersive virtual worlds."* The naturalness also seemed to be prevalent during the research, but the disruptive nature of a too well hidden grip button and the possibility of erratic pushing of touchpad may result in worse experience. These aspects of controllers should be revised

and there certainly is space for more development. Perhaps VR gloves will become financially feasible with time and this dilemma will be solved.

It was mentioned already in the results chapter, but learning the controls is a skill which is mastered with practice. Just like giving advice and sharing gained experience in a particular game, the instructor adheres to the principles of connectivist learning theory when sharing the button functions and explaining where the user is making a mistake (be it holding and pushing the wrong button, timing or holding the controller awkwardly).

Immersive Experience

Users experience a myriad of emotions and each game provides different type of experience. Some games try to evoke fear or anxiety in order to engage the user and make him/her feel a strong emotion. Some games on the other hand are made in order to help the user relax and enjoy a beautiful visual experience, to make the user gape in awe and wonder. These types of games would be favoured by users preferring spatial immersion. Other games bring us to places that we could not reach otherwise, whether because they are too far away or because they do not exist. And there are games that bring action and the users favouring tactical immersion can become the character or the instrument in the virtual environment to get completely lost in it. But for truly experiencing the environment fully and for learning, what seems very important, is cognitive presence. The user needs to truly believe the world around them. Some users seemed to have achieved this presence and described their experience to be fully immersive and even more than that. For some users, the virtual environment was simply not believable enough and they saw the flaws and issues in the games. These users probably were not able to reach cognitive presence. But regarding cognitive presence, the worrying factor is cognitive dominance. Some of the actions, reactions and knowledge gained in the games played will probably never be transferred to real-life use. For example in Job Simulator, there are skills to be learned. The user can also learn about the real world and how to finish some tasks. But these tasks are set in a very specific environment. There is a possibility, that the experience gained in this game will stay in the game and it will not be useful in the real world. In such cases, using VR for education would not be effective and to be used well, more research has to be done into this topic.

There are as many reactions as there are emotions. How Bailenson commented on it is as true here as it is in the section devoted to the first objective. Some people scream, others are slack-jawed and some crawl on their knees. "*At a demonstration at the Tribeca Film Festival, the rapper Q-Tip crawled across the plank on his hands and knees."*

Shelstad et. al. (2074) have done research into the satisfactory scale of the VR user. They compared a PC platform and VR with a particular game and found that users considered VR more enjoyable, engrossing and open to creative freedom. These findings are important since it shows that any game, even an educative one, has the potential to be more immersive in VR.

But strong immersion can bring strong negative reactions as well as the positive ones. As mentioned above, there are so many types of fear among the human population, that one person could not possibly name them all. It is not surprising that even VR isn't exempt from bringing fear to some users.

In my findings, I have observed several cases of fear occurring in participants. Some of them felt the fear of the unknown upon putting on the headset. Some felt this type of fear when entering the dark ocean sequence which provided very little assurance in the beginning or the fear of heights when falling to the ground in a desert coater game or when standing on the plank with a long fall ahead of them. Another recurring situation causing fear was the meeting with the whale in the same game. The environment of this short encounter is not in essence a scary place per say. The user find him/herself at the bottom of the ocean standing on a sunken wooden ship, but there is plenty of light and fish and mantas are peacefully swimming around. The point where the participants felt fear was the moment they were face to face with the whale. It is after all a large animal and if they were not looking in the direction of its arrival, it was there the moment they turned. None of the participants were able to truly explain why they were afraid. They simply refused to look at the whale or requested a change of the game.

Genheimer states that fear or rather anxiety and its triggering depends on the stimulus. If the user judges that there is some kind of imminent danger, then the fear may be triggered.

"In apprehension of potential danger, anxiety is characterized by an increased overall sensory sensitivity to threatening stimuli in a certain context (Baas, Nugent, Lissek, Pine & Grillon, 2004) and feelings of insecurity and helplessness (Grillon, 2002; Grillon, 2008)."(Genheimer) Therefore, it would seem that the users perceived the darkness or the whale to be a threatening element and that triggered their self-defence mechanism. Genheimer also stresses that fear and anxiety contribute to our survival but overreactions to threatening stimuli may lead to fear and anxiety disorders. It is possible to use VR in therapy and it has been done, but that is widely discussed in many publications and it would also be a subject of a different thesis. As mentioned before, the teacher simply needs to take into account that such reactions may occur and their actions have to be swift and decisive so as to avoid any mental damage and to protect his/her pupils. Outside of the frame of this study, I have seen a case of a first-time player who tried a multiplayer shooter with her partner and the instructor got busy with another customer. When the instructor finally noticed that something was wrong, the female user was already sitting on a sofa near the gaming area and crying. It took a fair amount of comforting and calming in order to get her to play a different game. I did not want her to have such a bad memory of VR and managed to show her that it is safe and beautiful. But this experience served as a very serious lesson. Next time, I may not be able to coax the user back into virtual reality and it might be harmful to the person's psyche. My hopes are that no teacher will have to make such a mistake to learn this lesson.

The experience that the user gets when playing a VR game is usually supported by the instructor. From the connectivist point of view, humans share their knowledge and the user can gain more by listening to the advice of a more experienced individual. When the user fails for example in a shooting game, the instructor may choose to give advice and share her knowledge. In such case they are a engaging in a key aspect of connectivist learning theory, making connections. The interception by the instructor may pose a threat to the narrative or spatial immersion, but if it is deemed necessary in order for the user to enjoy the experience, it has to be done.

VR experience issues and obstructions

There are many ways that immersion can be affected. The positive effect can be achieved via a captivating story in narrative immersion, a well thought out game offering reasonable logical challenges in strategic immersion, providing quick action making the player sweat in case of tactical immersion and showing the most beautiful and believable sights to create spatial immersion. Our brain processes information provided by our senses. That information is interpreted and allows us to understand our environment; that is perception. To be able to fool our senses, designers have to build stereoscopic vision into a two-dimensional picture. And the stereoscopic vision is the basis of VR and the first step to create spatial immersion. ("Making Reality Virtual: How VR 'Tricks' Your Brain")

But as hard as it is to create immersion, that much easier it is to break it. According to participant, there are several main issues. A truly prevalent distracter is the cable. If the technology was wireless, the users would not be limited by the length, constricted or even tripped by the tangled cable or kept aware of it simply by touching it. Having to deal with real-life issue breaks spatial immersion. This is mentioned in the study by Ching et al. "*The authors also did emphasize on the discomfort of cabled HMD used in the early version, this whereby suggest consideration on proper installation or advancement of HMD to achieve mobility."*

The motion sickness is another quite unpleasant side-effect of virtual reality. but in virtual reality, it is actually called cybersickness. "*Cybersickness is thought to result from this illusion, also known as vection. You might have experienced a vection illusion if you were ever on a train or bus and thought you were moving forward or backward when it was in fact the vehicle next to you that was moving."* ("Making Reality Virtual: How VR 'Tricks' Your Brain"). Those who have experienced that strange feeling of realizing, that the bus next to them is the one actually moving will know exactly how vection feels. Grijseels explains it as users not having any input from their vestibular system, which is the system responsible for our balance and spatial orientation. It has not been experienced by many participants during this research, but some of them felt it after the flight in Richie's Plank experience or when Google Earth VR crashed and the image froze and caused nausea. Chong et al. wrote about the HMD headsets: *"...the main issue is that users may experience*

motion sickness that will cause users to feel nausea especially with the devices that function at lower performance." This problem can only be solved by development and using more advanced technology. This is a solution for another issues mentioned by the participants, the graphics and thy physics. Again, the games need to be more advanced to be more believable and to provide full immersion.

There is also the language barrier. Unfortunately, not every user is equipped with language skills required to understand some aspects of games. This particular problem for example caused an uncomfortable complication with learning the controls of Google Earth VR. Unless explained in detail by the instructor and helping demonstrate it by pushing the buttons and aiming in a particular direction, the controls would never be learned in by this specific participant. The fact that the instructor has to breach the VR space is very disruptive and immediately breaks illusion. Another break comes when the user cannot remember some of the controls since there is just too much to remember or it is too complicated. This problem was also mentioned above, since it is connected to the issues with controls. The scaling of the language barrier is dependent on the user's knowledge and on the availability of translations of the game. Therefore it can be solved by teaching the user the particular expressions or by choosing a game providing the desired language.

And the last issue also experienced by some of the participants, technical issues. Since VR is still just a machine, it also experiences software or hardware issues. Nothing can break the immersion as well as the moment the game crashes. This particular issue can only be dealt with by updating the equipment and by taking care of it. Even then, it can never be completely avoided and therefore has to be taken into account by any potential VR teacher.

The interviews and observations gave very little information regarding the state of participants immediately after the use of VR. From the observations, some were sweaty or out of breath, others were relaxed or slightly tired. This state is entirely dependent on physical state of the user, the type of games he/she experienced, on the last game played, on the age of the user and of course on the length of the gaming experience. The longer they play, the more tired, sweaty and red they get. The more movement-requiring the game, the more the body gets tired. Most of the participants felt good after the experience,

one felt sweaty and one felt “strange”. None of them elaborated on their answers. But it seemed to have been a positive experience for all of them.

The Insider gives an overview of some of the problems arising from using VR too long: *“The complicated answer is that everyone experiences VR differently, and not all VR headsets or platforms are created equal, so certain games on certain headsets on certain people are going to cause more problems than others. The makers of the most popular VR headsets, the Oculus Rift and HTC Vive, recommend taking at least a 10 to 15 minute break every 30 minutes, even if you don’t think you need it."* There are several things that can happen to a person spending too much time in virtual reality such as loss of spatial awareness, dizziness and disorientation, seizures, nausea or eye soreness and trouble focussing. (Insider) The sickness in VR is also called *cybersickness*.

Department for Business, Energy & Industrial Strategy summarizes first the theories behind the causes: sensory conflict theory, postural instability theory and poison theory. They also list the factors of VR systems which can also lead to the symptoms of cybersickness.

Among the cybersickness mitigating approaches are for example additional VR system features, the use of vibrations matching the sensory inputs, rotational blurring, adjustable depth of field, oculomotor exercises, limiting VR to short sessions and habituation effect resulting from frequent use of VR. (Department for Business, Energy & Industrial Strategy)

There are many ways to mitigate the symptoms of cybersickness if that is the payment that some users give for the VR experience. Some of them lie in advancing the technology and some of them are about our attitude and approaches to the use of VR. Every teacher using VR should be aware of all of these factors of cybersickness and all the other issues mentioned in this chapter. But the prevalent safest solution seems to be a limited use of VR which could not be too difficult to achieve when using VR in regular lessons.

3.1.1 Comparison of the VR experience and experiential methodology

Learning as a process of gaining skills and knowledge in virtual reality in VR Dimension is usually not intentional. People go there to be entertained and to experience something new. Some customers seek distraction from the real world and some simply wish to have fun and relax. Many people come with many purposes, but all of them end up inevitably learning something new. What virtual reality provides is a specific case of situational learning and when compared with the experiential pedagogy, they rest on the same principle: learning by doing. It agrees with **Jarvis's** main premise, that every experience in virtual reality leaves us changed. None of the observed customer said that they felt nothing and all of them learned at least something. Even if the learning was just about the controller in their minds, it was still learning a new skill. And according to Jarvis, they put the helmet on as one person and took it off as a different individual.

When compared with the **Kolb cycle**, the VR experience starts as a Concrete Experience, which is the first step. The next stage is Reflective Observation. There is a good example with Participant 4 and Participant 9 when it comes to reflection and reviewing. Both of these users play the shooting game Serious Sam. In this game, there are four stages to save a planet and they have to beat the stage to move on to the next one. Id, however, they die during the stage, they have to repeat it again. If they do not reflect on their actions, strategy and choices, they will not be able to move on from this stage. They both managed to reflect on their novel experience, learn from their in-game death and move to the next stage. From this point of view, I am led to believe that the reflective observation took place. At the same time, if they have learned something from their reflection and they planned ahead before trying the next stage (which can be seen when they choose a different selection of weapons in the shopping phase) and even improved for the next time, they also passed the third stage of Kolb cycle: Abstract Conceptualisation. The last stage and the one again illustrated by the game mentioned earlier is Active Experimentation. If the participants die in the second in-game stage but manage to learn from their failure and proceed to beat it and continue to the third stage of the planet, they employ active experimentation where they use what they have learned without truly realising it.

Comparison with the experiential lesson plan models

If we were to compare the virtual reality session in VR Dimension with the experiential pedagogy models mentioned in the theoretical part, we would find out that they both start with the **introductory stage**. The VR centre and games are introduced, the controls are explained and the first game is slowly showed and guided through.

The playing itself is the **exploring, experiencing and activity** part of the models. (exploring the bottom of the ocean, shooting aliens on foreign planets etc.)

The **sharing stage** is not the usual part of the experience in VR Dimension. There are customers which welcome advice and help from the instructor and require almost constant attention at first. There are others who wish to explore the game system by themselves unbothered by the outside world. The users might choose to share or they might wish to continue on their own. If they choose the path of a lone warrior, then the sharing stage is omitted. If they describe their strategy and at which point it might have failed, they participate in this stage. (the user dies in the first stage of the shooting game and wishes to find out what he did wrong). During this stage, however, the instructor usually gives advice and tips as quickly as possible to save the customer's time and let him/ her experience the games as much as possible. While when we teach intentionally, we refrain from giving the answers and let the students come up with them instead. This is the main difference between the VR Dimension experience and experiential pedagogy model when it comes to the third stage of sharing.

The next stage follows the third one but does not necessarily require it. If the sharing is omitted, then the **processing stage** of experiential learning is done individually. If it is included then there is space for a short discussion and reflection upon the experience.

The **generalising stage** which is quite necessary in experiential teaching is undesirable in the immersive type of virtual experience that the gaming centres try to provide. In some games, it might be helpful. For example, in Job simulator, where users try out different jobs, it is based on reality and referring to the real world is the basis of this game. When considering what to do next in this game, users use their real life knowledge and experience to find solutions in the problem-solving virtual reality game. But in games, such as the shooter or some sensual games, the real world is the last thing the game

designer wants user to think about. This is a rather complicated stage to explain since some virtual games would provide the possibility of having it and some would deny us that opportunity.

The **application stage** is also only relevant in educational games or games that teach us intentionally. There isn't much that children can use in the real world from playing the shooting games. They might learn some reflexes, to be less afraid in some cases, or they might learn new vocabulary if the game is in another language. But none of this is actually discussed at the end of the experience.

What is discussed is how the customers enjoyed it, what they liked and what was difficult. Therefore, the **assessment or evaluation stage** mentioned in most models as something to remember to do is certainly reached at the end of the virtual experience to some degree. The customers can talk about their experience freely and provide feedback. They might even have some opinions on how they could enjoy it more and which issues o deal with. The customers often mention for example the cable that leads from the headset to the computer. They lament that it was annoying or distractive at times and that it would be great if the equipment was wireless. Sometimes they talk about the games themselves and they often asses their overall feeling from this gaming session.

In conclusion, the experiential learning model is something that can certainly use virtual reality to provide the experience and exploration stage. But the VR experience as observed in VR Dimension would have to be modified to fit the stages and the games would have to be carefully selected or even designed for this particular purpose. The games would have to be chosen with a specific aim in mind and the teacher would have to be able to work well with both the technology and the methodology to reach the maximum effect. But I believe that using virtual reality in education and especially in experiential teaching would definitely be beneficial to both teachers and students.

Conclusion

This work explored the experience in virtual reality perceived by a first-time user. The research was conducted in VR Dimension gaming centre and the researcher used her 3 years worth of experience to establish research objectives and areas of interest. Unfortunately, there have been many complications owing to the outbreak of covid-19 and the limitations the VR centre has been placed under. The research has been cut short and delayed which put a strain on the whole process. But in the end, the necessary data was gathered and analysed.

This thesis used the data from observations and semi-structured interviews to find the answers to how the first-time user experiences virtual reality, how does the user learn and what are the obstructions to this process that a teacher using this technology should be aware of. The data was analysed using open coding and creating categories based on the codes and then interpreting the VR experience in comparison with more traditional teaching methods.

There are many ways in which the user may react when encountering VR for the first time. The teacher needs to be prepared for all of them, especially the fearful ones. It is recommended to start with a game described as calm and mostly visual. Starting with the fall of a skyscraper may not bring a very positive result.

Every teacher also needs to be aware of the types of immersion and how they can be achieved and broken. Narrative immersion is established via a good and engaging story and destroyed with awkward dialogue and lack of logic in the plot. Spatial immersion can be broken with bad graphics and a lack of logic and consistency to the world around. Tactical immersion needs flawless user interface. And strategic immersion needs to be challenging enough for a logical thinker but not challenging too much to be too difficult. This aspect reminds us of the difficulty of tasks given when teaching regular lessons. To be able to learn and to believe the world around them, users also need to reach a certain degree of cognitive presence, but not too much to be under the effect of cognitive dominance. That would render any learning in VR useless, since the knowledge would not be used in real life.

The teacher using VR should also be aware of any issues that might arise while providing the experience. Be it cybersickness, troubling controls, the borders, physical discomfort, graphics, the cable or any other issues the users may head, the teacher needs to be prepared to explain the need for them, such as safety of borders, better connection and feedback via cable, complicated controls to allow more functions in the game, the need for the headset to be firmly fixed to the head or the fact that this is still a developing technology and they need to wait for better equipment.

As is obvious from the list of issues that might arise, the instructor has to be aware of them and prepare for them. There should never be a question of *if* the problems occur, there should always be *when* and how to manage them. This thesis does not only focus on the issues but also explores the experience itself. Therefore, devoting the text solely to the issues and their solutions could be a topic for another research. Delving deeper into cognitive presence and especially cognitive dominance could also prove useful for education.

This thesis brought together the experience of an instructor and a student of pedagogy to shed light on using VR in education. It shows the experience of the observed users using 10 participants of various ages and occupations along with over fifty observed customers. It explores the problems and offers solutions rising from relevant literature and instructor's experience. In a way, this thesis may serve to provide a guide for any teachers, who plans to use this technology in their lessons and to give them a place to begin their search and studies.

Bibliography

Books:

Auer, Michael, et al. Teaching and Learning in a Digital World: Proceedings of the 20th International Conference on Interactive Collaborative Learning – Volume 2 (Advances in Intelligent Systems and Computing (716)). 1st ed. 2018, Springer, 2018.

Adams, Ernest. "The Designer's Notebook: Postmodernism and the 3 Types of Immersion." Gamasutra, 9 July 2004, www.gamasutra.com/view/feature/130531/the_designers_notebook_.php.

Barfield, Woodrow, and Thomas Furness. Virtual Environments and Advanced Interface Design. 1st ed., Oxford University Press, 1995.

Brown, Kate. "Theorizing Learning Process: An Experiential, Constructivist Approach to Young People's Learning about Global Poverty and Development." International Journal of Development Education and Global Learning, vol. 7, no. 1, 2015, pp. 53–70. Crossref, doi:10.18546/ijdegl.07.1.04.

Chong, Hwei Teeng, et al. "Challenges in Virtual Reality System: A Review." AIP Conference Proceedings 2016, 2018. Crossref, doi:10.1063/1.5055439.

Ciesielska, Malgorzata, et al. "Observation Methods." Qualitative Methodologies in Organization Studies, 2017, pp. 33–52. Crossref, doi:10.1007/978-3-319-65442-3_2.

"Cognition." *APA Dictionary of Psychology*, APA, dictionary.apa.org/cognition. Accessed 9 July 2021.

Furht, Borko. "Immersive Virtual Reality." Encyclopedia of Multimedia, 2008, pp. 345–46. Crossref, doi:10.1007/978-0-387-78414-4_85.

Garrison, D. Randy, et al. "Critical Inquiry in a Text-Based Environment: Computer Conferencing in Higher Education." The Internet and Higher Education, vol. 2, no. 2–3, 1999, pp. 87–105. Crossref, doi:10.1016/s1096-7516(00)00016-6.

Genheimer, Hannah. Fear and Anxiety in Virtual Reality: Investigations of Cue and Context Conditioning in Virtual Environment (BestMasters). 2015th ed., Springer, 2014.

Gutierrez, Mario, et al. Stepping into Virtual Reality. 2008th ed., Springer, 2008.

Holland, Norman. Literature and the Brain. The PsyArt Foundation, 2009.

Hufnal, Daniel, et al. “The Impact of Controller Type on Video Game User Experience in Virtual Reality.” 2019 IEEE Games, Entertainment, Media Conference (GEM), 2019. Crossref, doi:10.1109/gem.2019.8811543.

Kolb, David. By David A. Kolb - Experiential Learning: Experience as the Source of Learning and Development: 1st (First) Edition. White Lotus, 1984.

Lewis, Linda H., and Carol J. Williams. “Experiential Learning: Past and Present.” *New Directions for Adult and Continuing Education*, vol. 1994, no. 62, 1994, pp. 5–16. *Crossref*, doi:10.1002/ace.36719946203.

Nunez, David, and Edwin Blake. “Cognitive Presence as a Unified Concept of Virtual Reality Effectiveness.” Proceedings of the 1st International Conference on Computer Graphics, Virtual Reality and Visualisation - AFRIGRAPH ’01, 2001. Crossref, doi:10.1145/513867.513892.

Sălăvăstru, Dorina. “Experiential Learning and the Pedagogy of Interrogation in the Education of Adults.” Procedia - Social and Behavioral Sciences, vol. 142, 2014, pp. 548–52. Crossref, doi:10.1016/j.sbspro.2014.07.664.

Sebastian Deterding; Dan Dixon; Rilla Khaled; Lennart Nacke (2011). From game design elements to gamefulness: Defining "gamification". Proceedings of the 15th International Academic MindTrek Conference. pp. 9–15.

Seibert, Jonmichael, and Daniel M. Shafer. “Control Mapping in Virtual Reality: Effects on Spatial Presence and Controller Naturalness.” Virtual Reality, vol. 22, no. 1, 2017, pp. 79–88. Crossref, doi:10.1007/s10055-017-0316-1.

Shelstad, William J., et al. “Gaming on the Rift: How Virtual Reality Affects Game User Satisfaction.” Proceedings of the Human Factors and Ergonomics Society Annual Meeting, vol. 61, no. 1, 2017, pp. 2072–76. Crossref, doi:10.1177/1541931213602001.

Šňupárková, Markéta. “Zážitková pedagogika a možnosti její aplikace ve výuce hudební výchovy na víceletém gymnáziu | Kultura, umění a výchova | Odborný recenzovaný

časopis." OlomouckéWeby.cz, 11 Dec. 2013, www.kuv.upol.cz/index.php?seo_url=aktualni-cislo&casopis=5&clanek=29.

Švaříček, Roman, and Klára Šeďová. *Kvalitativní Výzkum v Pedagogických Vědách*. Portál, 2007.

Wheatstone, Charles. Contributions to the Physiology of Vision. Abingdon, United Kingdom, Taylor & Francis, 1838.

Zhang, Chenyan, et al. "Spatial Immersion versus Emotional Immersion, Which Is More Immersive?" 2017 Ninth International Conference on Quality of Multimedia Experience (QoMEX), 2017. Crossref, doi:10.1109/qomex.2017.7965655.

Websites:

Barnard, Dom. "History of VR - Timeline of Events and Tech Development." Virtual Speech, 6 Aug. 2019, virtualspeech.com/blog/history-of-vr.

Bhat, Adi. "In-Depth Interviews: Definition and How to Conduct Them." QuestionPro, 3 Mar. 2021, www.questionpro.com/blog/in-depth-interviews.

Brdička, Bořivoj. "Konektivismus - Teorie Vzdělávání v Prostředí Sociálních Sítí." Spomocnik, 25 Aug. 2008, spomocnik.rvp.cz/clanek/10357/KONEKTIVISMUS---TEORIE-VZDELAVANI-V-PROSTREDI-SOCIALNICH-SITI.html.

Chatti, Mohamed Amine. "The LaaN Theory." Mohamed Amine Chatti's Ongoing Research on Knowledge and Learning, 11 Jan. 2013, mohamedaminechatti.blogspot.com/2013/01/the-laan-theory.html.

Department for Business, Energy & Industrial Strategy. "Safety of Domestic Virtual Reality Systems." GOV.UK, 2 Oct. 2020, www.gov.uk/government/publications/safety-of-domestic-virtual-reality-systems.

Downes, Stephen. "What Connectivism Is." HALF AN HOUR, 5 Feb. 2007, halfanhour.blogspot.com/2007/02/what-connectivism-is.html.

Grijseels, Dori. "Your Brain Isn't the Same in Virtual Reality as It Is in the Real World." Massive Science, 10 Feb. 2020, massivesci.com/articles/virtual-reality-vr-real-world-limitations-touch-smell-visual.

"Here's What Happens to Your Body When You've Been in Virtual Reality for Too Long." Business Insider, 4 Mar. 2018, www.businessinsider.com/virtual-reality-vr-side-effects-2018-3?international=true&r=US&IR=T.

"History of Virtual Reality." The Franklin Institute, 19 Dec. 2019, www.fi.edu/virtual-reality/history-of-virtual-reality.

HTC VIVE. "Buy VIVE Hardware | VIVE European Union." HTC VIVE, 2011–2021, www.vive.com/eu/product/vive/#vive-spec.

Kerr, Bill. "Which Radical Discontinuity?" BILL KERR, 10 July 2021, billkerr2.blogspot.com/2007/02/which-radical-discontinuity.html.

"Komparace modelů zkušenostního učení Davida Kolba a modelu zážitkové pedagogiky Petra Jarvise - Edukační technologie - Bc. Karel Šimeček." it.pedf.cuni.cz/, 2014, it.pedf.cuni.cz/strstud/edutech/2014-Simecek_html_edu/#obs1-1.

"Making Reality Virtual: How VR 'Tricks' Your Brain." Frontiers for Young Minds, 25 May 2018, kids.frontiersin.org/articles/10.3389/frym.2018.00062.

Martin. "VR History: 10 Major Milestones of VR Evolution." *Swag Soft - Mobile App Development Company in Singapore*, 5 Feb. 2020, swagsoft.com.sg/blog/vr-history-10-major-milestones-of-vr-evolution.

Mcleod, Saul. "Kolb's Learning Styles and Experiential Learning Cycle." Simply Psychology, 5 Feb. 2017, www.simplypsychology.org/learning-kolb.html.

Technology, GlobalData. "History of Virtual Reality: Timeline." Verdict, 15 July 2020, www.verdict.co.uk/history-virtual-reality-timeline. Accessed 25.11.2020.

To Vr, Road. "2019 Was a Major Inflection Point for VR—Here's the Proof." Road to VR, 25 Feb. 2020, www.roadtovr.com/2019-major-inflection-point-vr-heres-proof.

Virtual Reality Society. "History Of Virtual Reality." Virtual Reality Society, 2 Jan. 2020, www.vrs.org.uk/virtual-reality/history.html.

Wiltz, Chris. "14 Milestones in the History of VR/AR." *Designnews.Com*, 22 June 2020, www.designnews.com/electronics-test/14-milestones-history-vrar/gallery?

Online video:

“Cognitive Presence.” *YouTube*, uploaded by RCSJ Online CTL, 19 July 2018, www.youtube.com/watch?v=6ZoXs97N6wI.

The list of attachments

Attachment 1 – Semi-structured interviews