Immersive virtual reality in business higher education: An experience with students.

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ABSTRACT,
This research investigates the potential of immersive virtual reality as a tool for enhancing business higher education experiences. Findings indicate that immersive virtual reality holds significant promise for transforming higher education by providing immersive and engaging learning experiences, bridging the gap between theoretical knowledge and real-world applications. A total of five business students from higher educations from the University of Twente located in Enschede, The Netherlands, engaged in an immersive virtual reality experience, while traveling to Brazil, specifically Complexo do Alemão, one of the favelas in Rio de Janeiro. Students were asked to create a business idea that would improve one aspect of Complexo do Alemão's quality of life by physically moving in the immersive virtual environment and wearing virtual headsets. This exercise aimed to promote deeper understanding and skill development. After the trip, participants were interviewed, assessing their experience and feedback. Immersive virtual reality has the potential to enhance higher education experience by promoting learners' motivation during collaborative learning. Immersive virtual reality environments can also help users train their skills, such as soft skills and communication, and facilitate group activities, team projects, and discussions. However, immersive virtual reality environments can also make students lose awareness of their senses, potentially leading to addiction. Business students fear that immersive virtual reality may make humans lose their human touch, which is essential for interaction in the business world.

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Immersive virtual reality, metaverse, education, virtual reality, business students.

1. INTRODUCTION

The Metaverse is a new computer-mediated environment consisting of virtual "worlds" in which people act and communicate with each other in real-time via digital representatives referred to as avatars" (Hennig-Thurau et al., 2022). This innovative technology has been growing exponentially, due to aid by parallel advancements in AI, the IOT, Clouds of Things, Big Data, and other technologies, for instance virtual reality (Allam et al., 2022). With the virtual reality headsets, users can fully immerse in virtual environment through simulating, where they interact with the virtual environment as they would do in the real world. It provides the feeling of presence, which is the illusion of being inside the virtual world.

The metaverse, accessed via virtual reality headsets, brings out a competitive advantage, which is the social presence in the real-time multi-sensory social interactions (Hennig-Thurau et al., 2022). Real-time multisensory social interactions (RMSIs) are defined as interactions between two or more people that occur synchronously and involve multiple senses (e.g.,sight, hearing, touch). When this interaction happens via avatars, in the metaverse, it gives the users a social presence that facilitates the exchange of arguments, thoughts and feelings (Newton, 2021). Some scholars have drawn on media richness theory to argue that because virtual-reality environments are "rich," users are able to exchange social cues, eye gaze, facial expression, vocal tone to name a few, as well as multidimensional visual. The Covid-19 pandemic showed that virtual reality came to stay in education.

The 2023 graduate students had to overcome Covid isolation at universities and studying online, there was a lack of face-to-face networking. They were very exposed to the 2D internet virtual space, after spending one academic year studying through 2D internet, for example zoom meetings. By identifying emerging trends, in this case, collaborative learning in the immersive virtual reality, also comprehending, knowing what the students think of them, universities can enhance their reputations while developing innovative approaches to make learning more engaging and interactive. Students are the ones who benefit the most from the education, as they turn the knowledge grasped at the educational institutions into reality. The virtual reality metaverse brings a new potential of application in learning, as there are more physical touch and a representation through avatars. Most of the articles only evaluate app features or usability of VR but not the learning outcomes, let alone applications that reflect the users 'need from the perspective of both teachers and students (Radianti et al., 2020). Therefore, this paper aims at helping to identify this new likely future way of teaching in metaverse, so they can boost training by reflecting the students 'needs, not only on the usability of VR headsets, but on listening to their needs and preferences. There is presently a gap in the research about rates of adoption of virtual reality technology across a higher education institution by their students (Kaminska et al., 2019).

The next subsection chapter explores the contribution of this research to academic and practical relevance.

1.1 Goal/ relevance

Continuing the investigation, the relevance of this research is, being that after Covid-19, the educational system has been going through some significant changes, for instance, the collaborative learning via 2D internet, google teams. There is an increased interplay between education and technology. As technology is part of education teaching methods nowadays, it is essential to identifying the new upcoming technology trends, along with their implications on the educational system. As well as understand how the main stakeholders feel about them and their adoption. The metaverse, being a novelty in the technology world, it brings many new paths for learning process, blending the learning process with the technology. Thus, it is important to identify the likely future application of metaverse in higher education and its advantages, for example the immersive virtual reality. As it is reported, one of its advantages applied in the education is that it can significantly increase learners 'motivation (Kaminska et al., 2019). "Studies suggests that virtual-reality environments are "rich" due to its high levels of social presence, users can exchange social cues as well as multidimensional visual" (Hennig-Thurau et al., 2022), which facilitates the exchange of arguments, thoughts, and feelings as individuals caused by the feeling of being together.

Immersive learning is different, and potentially more powerful than real world learning, as it allows to create interactions and activities in a designed experience that is not possible in the real world. For instance, "teleporting within a virtual environment and a distant person to see a real-time image of your local environment or interacting with a business`s production process" (Dede et al., 2017). Also, immersive virtual realities technologies "increase students' remembering of the concepts learned" (Buttussi & Chittaro, 2018; Meyer et al., 2019), transfer of knowledge (Chittaro et al., 2018), and "increase their emotional performance affecting learning outcomes" (Cheng & Tsai, 2020).

There are a few considerable articles about the Immersive virtual reality in higher education, most of them are about its adoption across engineering, architecture, and medical students. Very few of them includes the business field. On top of that, most of the articles only evaluate app features or usability of virtual reality, but not the learning outcomes, let alone applications that reflect the users' needs, from the perspective of both teachers and students (Radianti et al., 2020). They don't address the students or teachers 'needs, how they feel about this future technology and how they would like it to be implemented. Therefore, for a good implementation of this promising technology, it is important to ensure that all main stakeholders 'voice of this potential technology are heard. To anticipate future problems that might arise from this possible change. Also, it will help teachers to better design the program and content, as they will know what the students think about it and how would they like this to be implemented. As not to happen the same that happened with the 2D technology.
The following subsection will be dealing with the research objective.

1.2 Research objective

Expanding upon the previous discussion, the first part of this study identifies the possibility of teaching in the future metaverse, two or more people learning together in an immersive virtual reality through representation of avatars, as well as its advantages and implications. Most articles about the immersive virtual in high education are about the usability of virtual reality, authors only evaluate app features or usability, but does not reflect the users 'needs from perspective of both teachers and students (Radianti et al., 2020)

Therefore, the second part of this research is focused on reflecting the students 'needs, not only on the usability of VR headsets, but on listening to their needs and preferences. For instance, how this could be used to increase their learning environment experience, in which situations they would like to have this technology in learning. This will be done through an experience with students and interviews afterwards.

In line with the evolving nature of the research, the next subsection delves into the research question and the sub questions.

1.3 Research question

What are the opportunities of immersive virtual reality via metaverse on collaborative learning along with its adoption among business students from higher education?

To respond to the core research question more effectively, the questions are broken down into two sub questions. Each sub question is derived from the main research question and addresses a distinct aspect of this research objective. The first sub question, *how students can be supported before and during the activity to make learning productive?* It seeks to explore how students would like to be assisted in the immersive virtual reality learning environment, to create an effective and seamless teaching experience. Moreover, the second sub question, how *do teachers capitalize the advantages of immersive virtual reality to support learning in virtual environment focus on students?* It investigates how teachers may make use of immersive virtual reality`s advantages, to ensure that the method is feasible, workable and that students benefit from learning in a such setting. Which are elements that fit the key concepts in this study.

This first chapter and its subchapters introduced the study topic of immersive virtual reality in business higher education and provided the rationale for the study. It discussed the significance of immersive virtual reality in higher education, how this study is conducted along with the research questions and the sub questions. The next chapter examines the issue from a new angle, it addresses the literature review.

2. LITERATURE REVIEW

This section describes the main concepts of this study and how they overlap, more precisely, the metaverse, and virtual reality and immersive virtual and education.

The aim of this study is identifying possibility of collaborative learning in the immersive virtual reality via metaverse in higher education, firstly relevant literature reviews were collected. Data about the metaverse, immersive virtual reality and education were assembled, therefore, to have an overview of the topic. To obtain the literature the search engines such as Google, Google scholar and Scopus, Springer, IEEE Xplore were used to find general information and scientific articles. Moreover, search terms such as "Metaverse," "Education", "Immersive virtual reality", "virtual reality", "high education", "Learning", were used to find the information needed. Information that was considered the most relevant was selected out of the articles and websites and were used for the literature review.

2.1 Metaverse

"The metaverse is a hypothetical, immersive 3D environment where we can experience life in ways, we would not be able to in the physical world" (Gupta, M. 2023). "The so-called Metaverse is accessible by input devices such as cameras, augmented reality, virtual reality, and biometrics" (McStay, 2023b). It is said that metaverse is taking AR/VR to the next level (Gupta et al., 2023). In addition to that, of the technologies that have been exponentially growing, the most prominent is virtual reality (VR) which has been aided by parallel advancements in AI, the IOT, Clouds of Things, Big Data, and other technologies (Allam et al., 2022). One of the main abilities of metaverse is its social nature as it enables the real-time multi-sensory social interactions (RMSIs). RMSIs is defined as interactions between two or more people that occur synchronously and involve multiple senses (e.g., sight, hearing, touch). This metaverse`s ability have captured the attention of global executives. For example, Meta CEO Mark Zuckerberg consider the metaverse "the holy grail of social interactions" (Hennig-Thurauetal., 2022). In "the metaverse, based on the perfect degree of freedom, users can experience various things in the real world, such as study, shopping, performances, exhibitions, and tourism" (Kye et al, 2021). The metaverse is not just about online games. There are multiple possibilities for using metaverse in the real world and mainly in education.

Furthermore, this next subsection chapter extends the discussion on the metaverse and virtual reality.

2.2 The metaverse and virtual reality

Virtual reality in the metaverse is a world where users feel that they are entirely in a virtual reality (Kye et al., 2021). In another words, users can act and communicate with each other in real time through their avatars. Also, the metaverse accessed via virtual reality headsets brings out a competitive advantage, which is the social presence in the real-time multisensory social interactions (Hennig-Thurau et al., 2022). Some scholars have drawn on media richness theory to argue that because virtual-reality environments are "rich," users are able to exchange social cues as well as multidimensional visual. Accordingly, virtual reality enables high levels of social presence. Current virtual-reality headsets provide realistic and vivid illusions of environments and people in those environments, which produces higher levels of social presence for interactants via the metaverse (Hennig-Thurau et al., 2022). Virtual reality increases the efficiency of the learning process, as it allows students to adapt to new conditions occurring, thanks to its three-dimensional environment (Zinchenko et al., 2020). The main difference between immersive virtual reality and the metaverse is that immersive virtual reality is used as a tool for creating and assessing the metaverse. Immersive virtual reality is focused on providing an immersive and realistic experience in a specific virtual environment. In the immersive virtual reality, one can simulate realistic and interactive environments which can be used for learning and teaching strategies. With the help of a head-mounted display (HMD), immersive virtual reality creates a fully immersive sensory experience in which the user feels a sense of being present in the designed environment. Due to this, immersive virtual reality has been attracting attention with its potential impact on education and the science of learning (Chiquet et al., 2023). Whereas the metaverse is focused on creating a shared virtual space, where users can interact with each other's and others and create their own experiences through the representation of an avatar.

Moreover, it is critical to comprehend how immersive virtual reality and education interact.

2.3 Immersive virtual reality and education

The "concept of education refers to the process of facilitating learning, acquiring knowledge, skills, or positive values with the aim of preparing students for life, work, and citizenship" (Kamińska et al., 2019). The use of digital technologies has increased at all academic levels, with educators adopting them to improve the learning experience of their students (McGovern et al., 2019). In education, we already have metaverse implication such as "today's teaching practices focus on creating an engaging an immersive environment, where students can learn concepts better" (Takyar et al., 2022). Specially after the pandemic, one of the metaverse practices, in education, which has been used a lot is the possibility of learners attend virtual classes remotely while experiencing elements of the real classroom (Srivastava, 2023b). "Virtual Reality enables the creation of immersive learning

experiences that can help enhance student understanding of a topic" (Driscoll, 2022). This new phenomenon, immersive virtual reality, brings excitement, motivation and mindful engagement in education and training (Hennig-Thurau et al., 2022). User can interact with objects surrounding him/her in the environment, thanks to the VR headset it allows users to see new views of the visual world, when they move their head wearing a VR headset, it is possible to see the simulated world as like in real world. "This increases the users 'identification with the topic at hand" (Scott, 2020). Collaborative learning in immersive virtual reality will allow students to work on projects and attend classes in a virtual world. As they would in real time through the representation of avatars. Also, it has been reported that, the educational use of immersive virtual reality can significantly promote learners' motivation during individual learning (Jong, 2022). Psychologist says that due to Metaverse`s unique, attractive, and game simulated visualization, students can be more enthusiastic to learn, as they can explore many things, ask questions, and understand answers better (Onggirawan et al., 2023).
Participants can gain skills and knowledge through interacting with each other, due to the power of creating immersive, extended experience with problems and contexts similar to the real world, providing the capability to create problem-solving communities. This makes immersive learning different, and potentially more powerful than real world learning, for example, one can teleport within a virtual environment, a distant person can see a real-time image of your local environment, or interacting with it (Dede et al., 2017). Immersive virtual reality is described as one of the most promising technologies to be widely adopted in higher education in the 2020s or 2021s.

This second chapter reviewed the existing literature on important topics this study addresses such as metaverse, immersive virtual reality and education. Now, the following chapter moves forward to the methodology.

3. METHODOLOGY

This chapter outlines the selection of participants, data collection methods, research instruments and procedures used to gather and analyses the data. The study was guided by the research objectives and literature review found on articles. It also, provides an overview of the research setting in which this study was conducted.

3.1 Research design

The primary objective of this paper was to examine the effects of immersive virtual reality on students and have the student`s perspective. For this study, five current business students from higher education from the University of Twente in Enschede were asked to participate in this study. Students were informed about the study and its topic. To get students' perspectives, perceptions, regarding the use of immersive virtual learning in higher education, qualitative data such as interviews were conducted. The interviews were audio-recorded and transcribed for later analysis. The experience set up study took 2 hours and 6 minutes. The students engaged in immersive virtual reality, as they travelled to Brazil, specifically to Complexo do Alemão, one of favelas in Rio de Janeiro. Also, students worked on a small task based on their trip to Brazil. After the trip and the discussion of the task, the students were interviewed, assessed their experience and their feedback.

The study was conducted at the University of Twente located in Enschede, The Netherlands. The study focused on a bachelor course, more specifically international business administration. The study took place within the campus facilities of University of Twente. The University offers virtual headsets that can be borrowed at the interaction lab. This facility provided a calm and silent room where the experience set up was done.

Additionally, this research explores its data collection process.

3.2 Data collection

This subchapter describes the collection process during the study. It outlines the methods, apps used to gather the qualitative data.

The exprience was conducted in a designed environment, to simulate the experience of a classroom setting, however with the help of virtual reality headsets. Using the app Wander, which utilizes 360-degree images from all over the world, students travelled to Brazil, specifically to Complexo do Alemão, Rio de Janeiro. First, the small project was briefly introduced to students. After receiving the brief overview of the project and travelling to Complexo do Alemão, students were required to come up with business idea that would enhance an aspect of the quality of life in the favelas. The students were placed in the meta horizon workroom, a virtual office meeting room app where students could work on the project`s task and collaborate in an immersive environment, while wearing virtual reality headsets. This virtual reality experience was made more productive and collaborative by the means of the virtual reality headsets. The meta horizon workrooms provided the metaverse experience, as it is dedicated to creating a shared virtual space, where students could interact, collaborate with each other's and others and created their own experiences through the representation of an avatar.

Additionally, this made it possible to access important immersive virtual reality and learning environment design elements, including sensory, actional, narrative and social that were found in the literature review.

The interview questions were divided in two parts. The first part of the interview was about the key design features to ensure that the experience environment was as real as a school study setting. The second part of the interview was about listening to the students 'needs and getting the new knowledge needed. The first part of the interview was important to ensure that the second part is dependable and simulates real time experience as students would have in real life, therefore the data would be more accurate. All interviews were recorded with the consent of candidates, and they will be erased when the study is accomplished.

In addition to the previous findings, the next subsection delves into a conceptual framework.

3.3 Conceptual framework

This subsection discusses the authors work on identifying specific design features for IVR which are elaborated below. A concise description of each design feature and how is implemented in the data collection.

Won et al. (2022) documented how IVR-based learning activities can be constructed and executed for different learning objectives, and how they contributed to creating unique learning experiences, which identified the key design features that would contribute to productive educational experiences in immersive virtual reality environments. Immersive interface design, which includes sensory, actional, narrative, and social features.

The authors Won et al., (2022) adapted a framework based on Dede et al., (2017) interface design. The framework includes 2 pedagogical aspects and 2 technology aspects. Pedagogical aspects being narrative-task content and social- constructive support, and technological features the sensory- representational fidelity and actional-interactions. Another key pedagogical

decision is how to support learning as learners interact in virtual environments (social—constructive support). This research study was based on these four key design features (two technological and two pedagogical).

For narrative-task content the learning content should be engaging. Business students are fascinated by business and how businesses impact our society. That´s why, it was important to the project`s task involved business. After the experience, the students were asked, how engaging was the experience, it was possible to measure the engagement. It was crucial that users feel emotionally and intellectually connected when completing the task. As for a "meaningful learning, the content and the nature of the tasks play a critical part in drawing users' attention and engaging them" (Barab, 2010). A narrative can be a story or scenario that represents the learning content and the tasks ahead. In this case, the story scenario happened in Rio de Janeiro. Students were introduced to the immersive virtual environment, a new country, Brazil. After completing the task, which was to come up with business that would improve one aspect of the favela`s quality life, based in Rio de Janeiro. The students were asked to think on their experience so, they reflected on the skills they acquired, and, applying the knowledge they have obtained throughout the business curriculum in classes in a real-life case.

Social-constructive support. it is crucial to ensure that learners will learn in the virtual environment as they would in a real-life environment (Won et al., 2022). "The constructive *social interactions* in a virtual environment enable learners to feel part of a virtual community, engage and exchange of ideas" (Dede, 2009). For instance, in this research, the main point was to incorporate elements that represented social constructive into this specific experience. There was an active engagement, social interaction, and knowledge among students in the immersive virtual environment, which enhanced learning. Students were gathered into a group, where they had to create a business that improved an aspect in Complexo do Alemão`s quality of life as a team. They collaborated, communicated, and shared ideas between each other. They were in a multiplayer simulation which promoted teamwork, collective problem-solving. Students shared insights, offered suggestions for improvement, therefore learnt from each other. I was the virtual mentor that provided guidance and support for the students with questions related to virtual reality or additional resources.

For the sensory- representational fidelity to make sure that virtual environment and objects are as real as it is in real life (Won et al., 2022). There is a concept called physical presence which is the perception of being in a virtual environment (Lee, 2004) and "it can be induced by various sensory-motor stimuli" (Dede et al., 2017). In another words, the users being on top of a skyscraper they would be afraid to take a step forward because they would fall. In this experience, the aim was to create a realistic and immersive environment that engages multiple sense and represents the real world along with the learning content. Thanks to the app Wander that uses realistic 360º photos from around the world and transport users to a chosen country. The gestural interactions were important for students to feel as they were interacting with the environment such as eye tracking and interact with objects and body movements. The students were in a contextualized learning environment. The essential point of this high representational fidelity was that high level of fidelity enhanced presence, increased learner engagement and facilitates deep learning and understanding.

Actional- interactions- the learners should be able to act as natural and genuine as they would do in the real life. The main point was that students forget they are interacting in a made-up world, and become involved in their interactions in the virtual world (Dalgarno & Lee, 2010). The task created, is a typical business case project group from the international business administration (IBA) curriculum. In this research study, students were asked to come up with a business idea that would improve one of Complexo do Alemão`s quality of life. Students were encouraged to physically move in the virtual reality environment, as walking and explore the streets. They were working together and toward the achievement of shared goals, this led to a group problem solving activities. The main point was that students could actively engage with the content, applied their knowledge and skills. In the hope that this exercise would promote a deeper understanding, skill development and transfer of learning to real world context.

Table 1: Key design features which would contribute to productive educational experiences in IVR environments (Won et al., 2022)

Design features	Descriptions
Sensory	Representational fidelity. The presented virtual environment is representationally sound for learners to feel that the virtual objects and places are authentic or real.
Actional	Intuitive interface design. The actions in a virtual environment feel natural and intuitive for learners to feel they are making real changes in the environment.
Narrative	Engaging content and task. The content and tasks are relevant and meaningful for learners to feel emotionally and intellectually engaged.
Social	Constructive support. The learners and learning are supported through social interactions.

This chapter detailed the research design and methodology of this study. It discussed the selection of participants, the description of the task, the literature that the study was based on and the data collection methods. The research is further elaborated upon in the following chapter by presenting the data collection's findings.

4. RESULTS

This chapter presents the findings of the study on the use of immersive virtual reality in higher education. The qualitative findings offer a comprehensive understanding of this research topic and supports the subsequent discussion and conclusions` chapters of this research paper. This analysis of the outcome is divided in two parts. The interviews` code can be found in chapter 8 appendix.

4.1 Outcomes of the first part of the interviews

The first part of the interviews was focused on the key design features found on the literature review. It was important to ensure that the study would be conducted in an environment as similar as a real classroom, so reliable results, findings and conclusions could be drawn upon. The students were asked questions about the 4 key designs such narrative, actional, representation fidelity and social interaction.

For the representation fidelity, aspects such as audio effect, realistic graphics were important to be considered. As for representation fidelity, the students had to be in an environment as realistic and accurate as reality, for instance the objects needed to be as real and authentic as reality. Overall, the candidates stated that during the experience the graphics were convincing. Candidate 3 mentioned that the graphics were ok, but she could not see her full avatar version when she was in the workrooms, she was only able to see her avatar from the waist to the top part. On her point of view, it would have been nice if there was a small screen where she could see her avatar interacting along with its facial expressions. Another important point, which was pointed out by Candidate 4 was that people`s privacy was respected,

more specifically in the wander app, where one could not see the locals 'faces nor their cars license plate. Also, Candidates 3 and 4 stated that they could clearly see the details when they travelled to Brazil, for instance, the streets and the building. Regarding, the audio effect, it had divided opinions. Candidates 1 and 2 said it was very ambient, the audio effect, they could hear what was happening outside. Candidate 3, on the other hand, pointed out a critical aspect, she was only able to know who was talking because the other candidates 'voices were familiar to her. However, she would not have known who was speaking if she had been in a stranger setting, as the people´s voice would not be familiar. Candidate 3 also brought up an important point, while travelling with the app wander, she couldn't listen to her surroundings, while she was at the beach, she was unable to hear waves, which in her opinion would have enhanced much more her experience, regarding the audio effect. Towards the experience of touch, it varied considerably between the candidates.

Regarding actional aspect, all candidates reported the word immersive very often. Candidates felt really immerse in the environment. Candidate 2 said that she felt she was walking in the streets of Brazil. Another critical point mentioned by candidate 3, was that she could feel someone was next to her when they were in the meta horizon workroom settings. On the other hand, Candidate 3 and 5 shared that they would have liked if it had been possible to interact with people when they travel to Brazil, in order words, to hear people speak and engage in conversations rather than just viewing the photographs. But they both recognized that, perhaps in future it will be possible, as technology advances. Also, Candidates 3 and 4, mentioned the life conditions they noticed people in favela live in, as they have a low-quality life condition. Therefore, they came up with a solution that would help people there.

As to narrative characteristic, all participants mentioned they felt engaged with the environment and the task. Candidate 1 and 2 stated that it was remarkably close to reality, they thought they were in Brazil for a certain period. Candidate 4 mentioned that immersive virtual reality tricks your mind, to the point you feel you are in that country. In addition to that, Candidate 4 said it was possible to get the cultural and social awareness of the Brazilian people living in the favela. *"For example, in the case we went to favelas in Brazil, just from looking at the food kiosks or how they live, what they're wearing, what they choose to wear when they're walking around, the streets, the businesses there*." Cited by Candidate 4. Furthermore, candidate 5 displayed his preference by saying it was better to see the images of Brazil in an immersive virtual environment than on a computer. Moreover, candidate 3 demonstrated her excitement and interest in the interaction with the immersive virtual reality by mentioning that it was very interesting and engaging coming up with a solution to improve one aspect of quality of life in the favelas. She said that since it was very engaging, there were many distractions, looking at each other's avatars, travelling to Brazil and perhaps you want to explore more than just staying in Brazil.

Finally, in terms of social aspect, all candidates mentioned that they were able to discuss the project with each other. Important points were pointed out by Candidate 3 and 4. The former said that it was very interactive *"nobody was left out of the discussion,* and we managed to come up with a business solution". The latter stated that *"it is kind of finding the words difficult. It's a new way of conducting an easier life, with a virtual reality headset. I can literally do all my work when I'm in place. And it feels as if I am literally sitting with those people in real life" (See* Figure 1 in appendix).

Additionally, the description of outcome of the second part of the interviews is expanded in the next subsection.

4.2 Outcomes of the second part of the interviews

The second part of the interview was focused on extracting students` perspective of this possible way of teaching in the immersive virtual reality environment, based on their experience in the immersive virtual reality environment.

"*It is great for an educational purpose. If I educate people through virtual reality, I can take them to this company. Give them an actual insight and practical knowledge. It's purely different from the way we're learning which is purely theoretical" mentioned* by candidate 4. Additionally, candidate 5 mentioned it would be a great asset to have this technology in classes, particularly in subjects that require graphs visualization. As it is easier to understand a concept, when you can visualise the graphs and their interaction throughout the calculations, because you can see and interact with it, for instance subjects as data analysis. Furthermore, Candidate 3 mentioned that the travelling experience, as well as solving the small project in the meta horizon workrooms, by means of wearing the virtual reality headsets was an amazing experience. Therefore, it would be very useful for project meetings and settings. Also, candidate 3 stated that this technology would have been better for online classes that she had in her very first bachelor year, the Covid year. She would have felt more connected with the people, as in the immersive virtual reality, she can see people's avatars and perhaps initiate an interaction with them. However, she would like to have some rooms for physical interaction, in other words, face to face interaction, thus she would like to have the immersive virtual reality on a group project setting, but not for classes. Because, during her bachelor course she had many project meetings online, and if the meetings were in the immersive virtual reality, they would have been more realistic and closer to real life meetings. Candidate 1 also stated that for project meetings, the immersive virtual reality would be very helpful and interesting to work on. Also, the travelling experience will be insightful, so students can see the place and the companies they will work on, their operations and so on. As well as, if someone wants to open a business, they will have an idea of how the place is. Candidate 4 pointed out that immersive virtual reality has impeccable benefits, as it allows the users to travel, to multi-tasking. He also states that down the line, it will be difficult to distinguish from reality. However, he would like to have it for meetings, since it is interactive and engaging, it allows to travel to a certain company, have a picture of how things are run there, on top of that it is a time saver.

Moreover, Candidate 5 and 2 both remarked that it would be important that students only access the content that it is intended to, the content the teacher desired. Because the immersive virtual reality is a very interactive, engaging reality with many distractions, therefore, the students will be easily distracted by the numerous fascinating characteristics, advantages, and features that are presented by the immersive virtual reality. Because virtual reality allows you to travel to different country, get an idea of the country where your project is, it is very useful feature of immersive virtual reality to investigate, observed by candidate 5. Also, for session that involves going to the immersive virtual reality, it would be useful to have teacher assistants or IT professional, that can assist students with problems that may arise, said candidate 1. Further, candidate 3 mentioned the need for a guide or tutorial before wearing the virtual reality headsets, as there are many characteristics and features of virtual reality headsets that she is not familiar with yet, as well as the immersive virtual reality environment. On top

of that, candidate 3 remarked the need student service department focused mainly on virtual reality headset problems that might arise between students. This way, students would be able to call or email the department about the current problems, they are facing with virtual reality headsets. Finally, candidate 3 mentioned that travelling experience, as well as, solving small project in the meta horizon workrooms wearing the virtual reality headsets were an amazing experience. Therefore, it would be very useful for project meetings and settings. (Figure 2 in appendix).

This chapter presented the results of the data collection done through interviewing students. This next chapter takes the research a step further by analyzing the outcomes.

5. ANALYSIS

The aim of the analysis chapter is to extract the richness and depth findings within the interviews, giving voice to the experience and perspectives of students, precisely business students from higher education. Interviews questions can be the appendix chapter.

Candidates, throughout the interview, emphasized how virtual reality environment was engaging and interactive, to the point that they got distracted easily from the task and the experience. Important key point found on literature review, according to Wei & Yuan, (2023) "applying virtual reality to online learning provides students with more motivation and enjoyment and improves the learning experience." Additionally, "the use of avatars in co-located multi-user virtual reality for collaborative tasks could enhance the experience and sense of presence" (Prasolova-Førland et al., 2021). Candidate 3 along with other candidates, remarked important features that were not found on the literature, they felt as if the person was sitting next to them, which helped on discussion and engaging more on finding the solution for the project`s task. However, Candidate 3 stated that she was only possible to recognize who was talking, because candidate`s voices were familiar to her. But if she had been in a meeting environment that she didn't know other candidates, she would not have been able to recognize or identity who was talking, important aspect that was not found in literature review. Another crucial point mentioned by candidate 3, was that one who is shy or lack communication skills will be able to train their communication skills, when presenting their work in an immersive virtual reality. Once people will not be looking at you, but to your avatar, it will reduce your levels of shyness and anxiety. Another advantage pointed out by the candidates 4, is the possibility of customizing your avatar as you would like. Wei & Yuan, (2023) found that "students can engage in diverse activities, build their own digital identity, show off their interests, skills, etc., interact with students from different regions and cultures, and develop communication, teamwork and leadership skills as they engage in collaborative processes". To finish, a key advantage that was not found in the literature, but mentioned by Candidate 3, was that immersive virtual reality can reduce discrimination based on your physical appearance, as when you are in the immersive virtual reality, you have the possibility to customize your avatar as you want and be presentable according to the standards of the meeting. In this way, people will pay attention to what you have to say and contribute to the project, instead of your physical appearance as in the business world in many situations, it is noticed discrimination because of one 'physical appearance. Below on table 2, is an overview of the consideration and challenges of the immersive virtual reality found on the interview`s outcome/ results.

Table 2: overview of the consideration and challenges of the immersive virtual reality found on the interview`s outcome/ results.

Considerations	Challenges
The ability to travel to different countries being on the same country and get an idea of its culture, while wearing a virtual reality headset	Not being able to identify who is talking during the meeting
The ability to customize and being seen as your avatar, switching the audience's attention to what you are saying and not how you look like	Fear of losing awareness of the reality
The ability to one`s train and improve their skills, as immersive virtual reality environment simulates the reality	Different apps do not work on different headsets, for instance meta-apps do not work on HP headset
The ability to provide engaging and interactive experiences for students, that enhances their learning process	Not having noise cancelation option, as one is able to listen its surroundings while being on the immersive virtual reality

This chapter provided a comprehensive overview of the findings, precisely the qualitative insights from the interviews, as well as analyzed these results, contextualized them within the existing literature of the study on immersive virtual reality in higher education. The final chapter of this study discusses and consolidates these insights and provide a concise summary of the key findings, limitations, and suggestions for future work.

6. DISCUSSION

In the discussion chapter, it will be interpreted the findings, discuss their implications, and provide insights into the effective implementation of immersive virtual reality in the context of higher education based on business students 'perspectives.

6.1 Key findings

In this paper, the potential of teaching in an immersive virtual reality as tool for enhancing business higher education experiences was investigated. The findings indicate that immersive virtual reality holds significant promise for transforming higher education by providing immersive and engaging learning experiences, not only on the engineering, architecture, but also on the business field. Immersive virtual reality technology allows students to explore realistic virtual environments, interact with objects and simulation and engage in active learning experiences through the representation of an avatar. This enhances students 'engagement, motivation, and interaction. One of the key benefits of teaching immersive virtual reality for the business is its ability to bridge the gap between theoretical knowledge and real-world applications.

As students will be able to travel to places where their projects are based on, they will get insightful information about the country, such as the population`s habits and culture, population`s living condition, the country`s infrastructure, the building`s location and so on. These are useful information for the business field. moreover, through a representation of an avatar, people will be judged and assessed on their contribution to the necessary

work. As your real appearance will not be relevant, but your avatar`s, and with the possibility to customize one`s avatar, everyone will be able to make it look accordingly with the meeting`s standards and requirements. As a result, the attention will be more on the speaker`s real argument, skills and so forth, not based on their look, appearance, or background. It will be judged more on the content wise than on the physical aspect. Especially in the business field, that standard appearance plays a critical role, thus this avatar representation will decrease drastically the discrimination based on physical appearance. Another key point refers to shy people. Being represented by an avatar means that people will not be looking at that person. Therefore, someone that lacks confident or is shy, will be able to tackle this issue or obstacle they encountered when they must speak up and share their thoughts. Avatar stimulates them to express freely their thoughts, opinions, and to be self-confident, as people will assess him or her on what he or she is sharing.

Another benefit is that it helps user training their skills, as immersive virtual reality simulates the real world, the senses so close to the reality, the user can train their soft skills and communication skills. It is particularly useful for the training domain. Additionally, managers can get an idea of their product with the customer interaction in the virtual reality and receive direct feedback before introducing the product in the market. This will increase the likelihood of the product`s success because the manager will be already aware of what the customers think and have their input. It offers many possible items for changing the settings of the meetings to a more relaxed one, near the beach or near the desert, which can facilitate the interaction and perhaps ease the environment.

However, the immersive virtual reality can make one loses the awareness of their senses, as students will be so immersive in the environment, they may lose their awareness that reality is not their reality. It can also result in issues such as addiction and students be trapped in that world, since they chose to be there, whereas in this world they did not have the possibility to make that choice. They may also start interacting more with the immersive virtual environment than with the real environment. Another significant factor is that business students would prefer to have some space for physical interaction, because they worry that this new knowledge might cause them to lose their consciousness and become trapped in the immersive environment. Business students, fear that immersive virtual reality may deprive people of their ability to relate and interact with one another that identifies them as being human. Therefore, business students would like to have this technology as a complement to their studies, but not to switch entirely to the immersive virtual reality environment. Firstly, is that immersive virtual reality requires the development of immersive educational content, requires time, expertise, and resources. Secondly is the need for adequate technical support and infrastructure to provide a smooth immersive virtual reality experience. Such as system compatibility, connectivity, software. For instance, in this research it was not possible to use google earth VR app as the GPU of few participants ‘computers were not compatible or do not have the required characteristics for the specific app. It can affect the effectiveness of immersive virtual reality in the learning process.

Finally, this paper displays the potential of immersive virtual reality as a valuable tool for enhancing higher education experiences, it has been reported that, the educational use of immersive virtual reality can significantly promote learners’ motivation during individual learning (Jong, 2022). It offers opportunities for engaging, immersive and experiential learning, bridging the gap between theory and practice, as it will be able to travel, simulate real world events, portray new products along with its interaction with the consumers. By promoting active learning, collaboration and application of knowledge and immersive virtual reality.

The next subsection summarizes the main findings and contribution of this study by addressing the research question and the sub questions.

6.2 Synthesizing the key findings.

Taken together the data collection and literature review, it permitted to break down the main research question of this paper in two core sub questions, in order to answer the research question.

RQ:What are the opportunities of immersive virtual reality via metaverse on collaborative learning along with its adoption among business students from higher education?

Sub-question 1. How students can be supported before and during the activity to make learning productive? From the findings, following conclusions were drawn:

- Students want to have a department focused mainly on solving issues related to virtual reality, so they can reach out to the department, explain their problem, and receive assistance. Or, given that there were a few issues that required further help during the experience, the virtual reality headsets could come with an AI system that explains why something isn't functioning and how to fix it.

- Students want an IT professional present during the sessions so they may get assistance as soon as they need it. Also, a teacher with expertise will be needed because he will guide the students. In preference, group shouldn’t be of large number as problems will arise frequently.

- There are many distractions in the immersive virtual reality environment, it is very engaging and an interactive environment, students may can get distracted or end up doing things they are not supposed to. Thus, teachers need to ensure that students can only assess the content they want to.

Sub-question 2. How do teachers capitalize the advantages of immersive virtual reality to support learning in virtual environment, focused on students? From the findings, following conclusions were drawn.

- The immersive virtual reality gives the opportunity to bridge the gap between theoretical and practical knowledge. Students will be able to apply the knowledge they learn at universities in an environment close to reality.

- Traveling is beneficial as very often business projects involve launching or implementing in another country. As a result, it is helpful to get an understanding of a place, culture, and its people, to have better project results and increase the project`s chance of success.

- It benefits students ‘training, as it permits students to develop their skills and train them.

- It is useful to represent a business, so students can get an idea of how operations in a specific business are run.

It is helpful for prototyping, since businesses may design and recreate their product, in this way clients or students can use it and provide feedback or spot potential issues.

- It can decrease discrimination in the business field, as very often businesspeople are discriminated and not given the same opportunities. As individuals pay more attention to what others have to say than to their background or looks when they are being represented by an avatar.

The final subsection explores potential avenues for future research and the limitations encountered during the data collection.

6.3 Limitations and future work

During the data collection, many challenges were faced, for instance, one needs to download the metaverse horizon workroom app to their virtual reality headset in order to function. Trying to access the metaverse horizon workrooms while wearing a virtual reality headset via a website or Google will not work. Instead, one must use the meta horizon workroom app, which is available in the meta-apps store. Another issue was that the HP virtual reality headset does not support meta-apps or accounts. As a result, universities will need to develop their own software or design their own virtual reality headset in the future, because different virtual reality headsets are incompatible with one another, their programs, or features. While this study explored immersive virtual reality on business higher education, it is important to mention another shortcoming. The sample size used in this study was relatively small, consisting of only 5 business students from a single university, University of Twente located in Enschede. This limited sample size may restrict the generalizability of the findings to a broader population of business students from higher education. In addition, this study`s sample was limited by the resources available, the Univeristy`s supply of virtual reality headsets is yet insufficient for a large-scale study. Future reasearch should aim to include a larger and more diverse sample to increase validity and generalizability of the findings. Moreover, it was also noticed that collaboration between educators and technologists will be crucial for designing and integrating immersive virtual reality experiences, that align with learning objectives and meet the needs of students. How programs can be developed that the students will only assess the content that teacher want them to, as students may distract easily in the design environment, needs to be thought. Future research should focus on how educational programmes can be designed to assess the students' learning outcomes. For instance, comparing the performance outcomes of students who engage in immersive vritual reality based learning experiences with those who receive traditional intruction. This would help measure the extent to which immersive virtual reality aligns with the learning outcomes and objectives of the business study programme. Another key point to explore if one can conduct a class or create business scenarios they aim to simulate. Examining the long term effects of immersive virtual reality expriences on students skill development, application in real world business contexts, such as the group projects`cases or the study field. In this way, researches can gain insights into durability and reliability of immersive virtual reality based learning. Collaborate with multiple business higher education instutions to study on the validity and reliability of immersive virtual reality. This would allow to compare findings across different student, program structure which will lead for a more comprehensive understanding of the generalizability of immersive virtual reality effects in business education.

How can learning outcomes be measured in the immersive virtual reality?

Till a certain point, it will be possible to guarantee that students won't become addicted to virtual reality because they forget about it or they become too immersed in it?

How can teachers be assisted and trained for teaching in the immersive virtual reality?

By adressing these shortcomings, further studies can provide a more comprehensive understanding of the effects of immersive virtual reality in business higher education.

This chapter provided a comprehensive discussion of the findings, their implication, addressed the research and sub questions and the conclusions drawn from the study. It also suggested future research directions and pratical recommendations.

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8. APPENDIX

In this chapter, the first two figures represent the interviews 'codes, also the interviews 'questions can be found in this chapter.

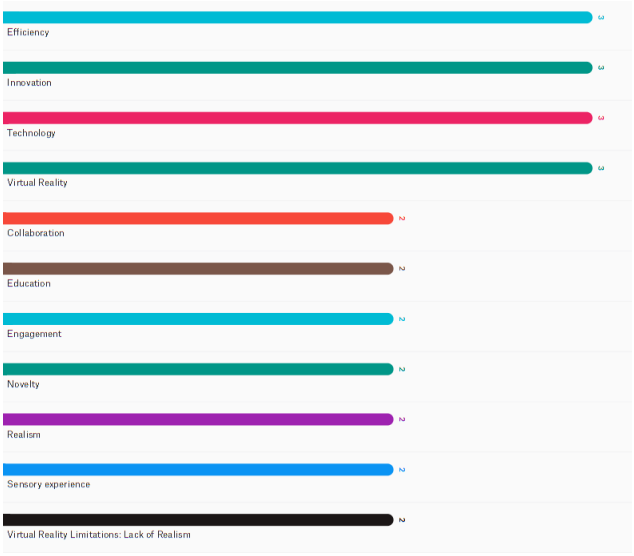

Figure 1. First part of interview analysis`s code. Made and retrieve from Atlas.ti website.

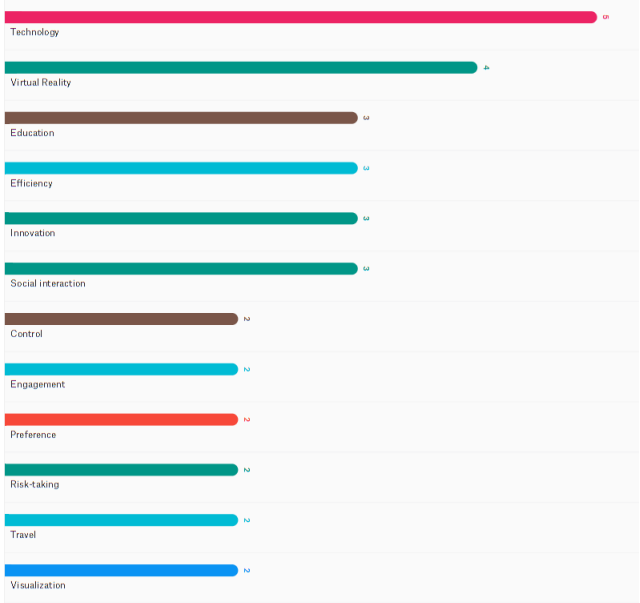

Figure 2. Second part of interview analysis 'codes. Made and retrieve from atlas.ti website.

First part of interview question about the key design feature of IVR

Q1: Sensory:

Q1.1. How was the sound effect?

Q1.2. How were the graphics?

Q1.3. To what extent did you experience vibrations? Did it have an experience of touch?

Q2.: Actional:

Q2.1. How would you describe your interaction with the virtual reality environment? why?

Q3: Narrative:

Q3.1: What did you learn from the experience?

Q3.2: How engaging was the experience? Why?

Q4: Social:

Q4.1: To what extent did you have a social interaction a discussion among your peers during this experiment?

Second part of interview question about students´ needs, after their experience and how they would like to have this possible technology.

Time: the duration of this project will allow me to say if till that time students felt some discomfort. Therefore, teacher will know that till that certain time students didn't experience any drawbacks.

Q5: Based on this experiment, how would you like it to be implemented in universities?

Q6: What subjects would you like to have on Immersive Virtual Reality, based on UT IBA 2022-2023 curriculum program. And why?

Q7: How do you think this experiment should be supervised in a study environment?

Q8: What did you like the most about this experiment? Why?

Q9: Anything more to add?