



Characteristics of good user experience for meditation in virtual reality-enabled metaverse

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Abstract

The root of meditation goes back to the beginning of human evolution, and it is a term for variety of activities. In this chaotic world with bombarding from social media I believe that everyone should learn doing meditation and enhancing mental health at least once a week. On the other hand, metaverse is a new technology trend that got famous within just few years and still there are a lot of people who don't know what that is exactly. Metaverse mostly known with Virtual Reality world which is correct. Combination of meditation and metaverse can be a very interesting topic for study that includes many subsections and related things. In this research, I want to find that if we want to do a meditation in virtual reality-enabled metaverse, what is the definition of good user experience for that.

For this reason, I wrote a literature about the background of this phenomenon. Then I did an interview with 10 people who had experience and knowledge in both fields and at the end, I present a framework that can be useful for enthusiastic to this study and can address the research question clearly. The attractive topic and research question can grab any attention and the findings would be helpful for many similar topics.

Keywords

User experience, Meditation, Metaverse, Mindfulness

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Foreword

This research is a master thesis in field of Information processing science which contributes to find the characteristics of good user experience for meditation in virtual reality-enabled metaverse. My journey to this topic started by my curiosity to investigate in a field that I didn't have any previous knowledge. So, I started watching some videos and reading articles to get familiar with the topic. I am so happy that I experienced a lot of new challenges that helped me to grow. I learnt how to do real academic research by the end of it and I gained researcher approach for solving problems. It encouraged me to continue studying until PhD degree.

Through this research I benefited from guidance and support of my supervisors, and I am deeply grateful to them. Also, special appreciations to my parents who always supporting and proud of me. I need to say thanks to my friends who participated in the interviews and helped me to gather the data.

The result of a great deal of investigation, analysis, and thinking is this thesis. My goal is that the information and ideas shared here will help expand the collection of knowledge about user experience in the metaverse and be a useful tool for scholars, developers, and enthusiasts interested in this growing field. I'm interested to see how technology will develop in the future to further alter meditation techniques and deepen our comprehension of the human condition.

Regards,

Arya Yaghoubi

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1. Introduction

The physical world we live in is changing quickly due to technology in this day and age. Everyone has access to the shared virtual environment known as the metaverse. It is a general term that encompasses all things digital and virtual. (Mozumder et al., 2022) The practice of meditation is popular for enhancing mental health. With the development of technology, there are increasingly opportunities to improve on the traditional methods of meditation through immersive and interactive experiences. Since virtual reality technology has become more widely used, numerous studies have shown that using virtual reality for meditation can have positive health effects. (Wang et al., 2022) Immersion refers to the level of realness for which the motion and sensory input are aligned. A key component of the metaverse user experience is immersion. A user who is fully immersed in the metaverse can move between the metaverse and the real world easily. In the immersive virtual world of metaverse, users can manipulate and receive sensory feedback from their hands, eyes, or thoughts as they explore their surroundings. (Zhu et al. 2024)

Users can participate in meditation sessions that are enhanced with auditory, visual, and sensory stimuli using platforms offered by virtual reality and augmented reality. This can result in deeper states of mindfulness and relaxation. Virtual reality is not only used for gaming, and nowadays virtual reality can be used to help mental health. Also, virtual reality meditation helps people deal with the stress of everyday life. Virtual reality is mainly used for gaming, but meditation is one of the creative uses of virtual reality. (Mitsea et al., 2023) Technology and meditation are not new for everyone, but virtual reality offers different technologies than audio books, podcasts or meditation sessions. As an example, Tong et al. (2015) used virtual reality environment for pain treatment and reached to successful results.

A complex set of practices called Meditation, are used to encourage mental balance and relaxation. It is an effective preventive measure against conditions like post-traumatic stress disorder and has been shown to be therapeutic for a variety of mental and physical illnesses, such as chronic pain, depression, anxiety, and sleeplessness. (Shamekhi and Bickmore, 2015) The introduction of meditation into the metaverse marks a revolutionary turn that makes use of modern technology to craft unique and interesting experiences. In the article of Wang et al. (2022) mentioned from several papers related to virtual meditation that VR-based mindfulness interventions can be beneficial in reducing emotional states such as tension, anxiety, anger, and depression. Additionally, multisensory immersive VR is more adaptable than traditional meditation techniques because VR allows precise control over the auditory, visual, and even haptic senses of the environment. These facts pose significant questions about what makes for a positive user experience in digital spaces for meditation. The quality of immersive environments, customization possibilities, and the harmony of traditional and virtual components are some of the key factors that influence how beneficial and popular metaverse-based meditation is.

The Metaverse wants to be the next generation of human-computer interaction, enabling people to interact and physically exist in digital and digitally enhanced environments (Riva et al., 2021). Research on the interaction of meditation and the metaverse is an exciting, multidisciplinary area. After conducting a thorough analysis of the relevant keywords, I discovered an important gap in the existing literature regarding the description and attributes of an ideal user experience for meditation in the virtual reality-

enabled metaverse, so it can be a novel topic. This finding draws attention to a topic that has yet to receive enough attention, offering a priceless chance for further research. By concentrating on this gap, I hope to gain a thorough understanding of what makes for the ideal user experience in this cutting-edge setting and eventually contribute to the development of metaverse technologies and meditation techniques.

The purpose of this thesis is to investigate what specifications make a great user experience for meditation in virtual reality-enabled metaverse. Positive user experiences are not accidental, they have been planned to use a user experience design process that seeks to produce a solution that satisfies user and business requirements (Ross, 2014). This study uses a qualitative research design to identify the important components that improve user experience and any potential problems that may occur. It does this by conducting in-depth interviews with people who are familiar with traditional meditation and the concept of metaverse.

The research will explore a number of user experience topics, such as social interactions, personalization, audio and visual effects and guidance. At the end, this study will provide a framework for developers and practitioners looking to create powerful and attracting metaverse meditation applications by examining the insights collected from the interviews.

In conclusion, this thesis looks at the relationship between meditation and the virtual reality-enabled metaverse and offers suggestions for how immersive technologies might be used to make meaningful and productive meditation experiences. This research attempts to provide a thorough understanding of what makes a good user experience for meditation in the virtual reality-enabled metaverse by looking at user preferences and technological challenges.

It is important to establish the context and identify our primary areas of research before getting into the core of the matter. That saying, let us first establish the general question that can act as the foundation for my research. So, the main research question for this thesis is:

RQ1: What are the characteristics of good user experience for meditation in virtual reality-enabled metaverse?

Research starts with an in-depth investigation of current literature. I establish a solid foundation for the study by determining relevant keywords and looking through earlier works. In the next section, the methodology and data collection procedure are then completely described, giving readers a clear understanding of how the study is conducted. The next chapter, the interview findings then reveal the core of the study. Here, a thorough examination explores the experiences of the participants and discovers insightful information. Expanding on this examination, the discussion segment integrates the results into the framework of the available literature. This crucial stage results in the presentation of the main contribution of the research, which is a framework that describes a good user experience for the selected topic. In conclusion, the study acknowledges its limitations and outlines possible directions for future research.

2. Literature review

As I prepare the foundation for this in-depth research, I must first carefully identify and clarify the terms that are essential to the thesis's thematic foundations. Clarifying the used keywords turns into a fundamental stage that forms the theoretical cornerstone around which the rest of the literature review will be built. I continue our trip through academic discussions and empirical insights by developing a simple yet comprehensive understanding of these foundational concepts. From there, I systematically resolve the complex connection between user experience, the metaverse, and meditation. This systematic defining process guarantees a sophisticated understanding of the complex aspects involved in the combination of traditional contemplative practices and modern immersive technologies, in addition to offering a conceptual road map for the discussion that follows.

2.1 Definition of keywords

A new horizon for studying the domains of mindfulness and user experience has been opened up by the merging of immersive digital technology and meditation practices within the metaverse. Through the innovative integration of cutting-edge virtual and augmented reality technologies with age-old meditation practices, "meditation in virtual reality-enabled metaverse," is a novel connection that this research aims to shed light on. The purpose of this introduction is to clarify and provide context for four important terms that will guide our investigation: "User Experience", "Mindfulness", "Meditation " and "Metaverse".

2.1.1 User experience

In the paper of Berni and Borgianni (2021) they used the definition of user experience from Norman et al. (1995) and then expand it in their research. In 1995, Norman coined the term "User Experience" (UX) to refer to research and applications involving human interfaces (Norman et al., 1995). Berni and Borgianni (2021) mentioned when UX was first defined, it meant that it included the entire interaction between a user and a system, not just the "human interface" or "usability". According to Norman, the foundation of a great user experience is knowing what users need. Designers should meet those needs to ensure that users have a positive human-product interaction free from unpleasant emotions like frustration and anger. One way to achieve what Norman called "joy to use" is through simplicity of use. Based on Berni and Borgianni (2021) it will take an interdisciplinary approach and the combined efforts of professionals in the domains of engineering, marketing, industrial design, and graphics to achieve this goal. Due to its complexity and diversity, UX is a difficult-to-define field of study that requires interdisciplinary approaches. (Berni and Borgianni, 2021)

Also, another interesting definition was found in the article of Fagerholm and Münch (2012). User experience describes an individual's perceptions and reactions while using or anticipating to use of a system, product, or service. This covers the perceived usefulness, value, and desirability of the product. UX defines the word for experience, which is an encounter with a system with a beginning and an end, and the verb experiencing, which is a person's stream of views, meanings of those perceptions, and

resulting emotions during a meet with a system. Co-experiences, shared experiences, and group experiences—experiences that are socially constructed by multiple individuals—are also recognized by UX. There is ongoing evolution in the definition of UX, and different aspects are being identified. However, the UX idea is sufficiently evident to make comparisons with software developers' experiences. (Fagerholm and Münch, 2012)

UX is the study of technology that, by acknowledging its use as a subjective, situated, complex, and dynamic encounter, fulfills more than just instrumental needs. This, of course, provides an unlimited number of design and experience opportunities. (Konstantakis and Caridakis, 2020) In the article of Law et al. (2019), they mentioned that choosing a universal definition of user experience is challenging for several reasons. First reason, the term user experience suggests a wide range of fuzzy and dynamic ideas, such as hedonic, emotional, experiential, and aesthetic variables. Certain variables seem to be wildly included or excluded based on the author's experience and areas of interest. Secondly, the UX analysis unit is too flexible; it can cover anything from a single end-user's interaction with a stand-alone application to every end-user's interaction with the company and its integration of services from various disciplines. Third, a variety of theoretical models with varying aspects such as pragmatism, emotion, affect, experience, value, pleasure, beauty, hedonic quality, etc.—have divided and complicated the field of UX research. (Law et al., 2009)

Providing a positive user experience for products and systems is now more crucial than ever. User experience is important because the biggest and most successful companies now understand that prioritizing the user experience is essential for both success and innovation, something that was previously seen as a luxury or an extra cost. (Ross, 2014) Because people's feelings are constantly changing, and situations can differ both during and after a product interaction, UX is typically understood to be naturally dynamic. As such, UX needs to be considered evaluable not just following an interaction with an object but also prior to and during the interaction. It is crucial to understand how and why experiences change over time, even though evaluating short-term experiences is still relevant given the dynamic changes in user goals and needs related to contextual factors. Furthermore, users' experiences with products and services are influenced by their values; therefore, this relationship needs to be considered from the start of the design process. These arguments already make it clear that studying the temporal aspects of user experience—how UX evolves over time—is just as important as looking beyond its static elements. The foundation of UX evaluation is a detailed understanding of the experiences—both positive and negative—that users have with a product. (Vermeeren et al., 2010)

2.1.2 Meditation

One of the most well-liked and extensively studied mental training method nowadays is meditation (Matko et al., 2021). While searching for the academic definition of Meditation, the article of Bond et al (2009) was found that collected different basic definition of Meditation:

Definition 1: Any method that includes: (a) a precise, well-defined technique, or a "recipe" for meditation; (b) a moment of muscle relaxation; (c) a moment of logic relaxation; (d) a state that is self-induced; and (e) a self-focus skill or anchor "Not 'to intend' to analyse (not trying to explain) the possible psychophysical effects," "not 'to intend' to judge (good, bad, right, wrong) the possible psychophysical [effects]," and "not

'to intend' to creating any type of expectation regarding the process" are the authors' definitions of logic relaxation. (Cardoso et al., 2004, p. 59 as cited in Bond et al., 2009)

Definition 2: A unique, well-defined "thoughtless awareness" experience. Methods such as continuous sound repetition, visualizations, or other thought forms that do not produce the essential experience of mental silence or thoughtless awareness are frequently referred to as "quasimeditation". (Manocha, 2000, as cited in Bond et al., 2009)

Definition 3: Methods that appear to limit understanding to one ongoing source of stimulation for a set amount of time. (Orenstein, 1971, as cited in Bond et al., 2009)

Definition 4: An activity where the person focuses their attention or awareness on a single thing—an object, idea, sound, picture, or experience—in order to enhance their psychological well-being or obtain deeper spiritual or existential understanding. (West, 1987, as cited in Bond et al., 2009)

Definition 5: a group of self-regulation techniques that emphasize developing awareness and focus in order to better control mental processes voluntarily and promote mental development in general as well as the development of particular skills like relaxation, clarity, and concentration. (Walsh & Shapiro, 2006, as cited in Bond et al., 2009)

The main reasons people begin meditation are to improve their own well-being, relax, find clarity and happiness, or further their own personal development. Intense practitioners meditate primarily to reduce negative emotions, stress, and sleep issues; experts prioritize enlightenment, spiritual experiences, and developing compassion for others. The reasons for novice and expert meditation tend to be different. (Kermavnar and Desmet, 2024) Several popular meditation techniques today, such as mindfulness-based stress reduction, have their roots in Buddhist tradition. In the past, meditation has been seen as a practice that requires consistent daily practice over extended periods of time. On the other hand, short-term mindfulness programs or meditation have gained popularity recently as they can provide benefits rapidly. Few previous studies have examined how well-suited various meditation traditions, practices, and exercises are for VR implementation, despite the wide variety of options. (Kosunen et al., 2016)

In summary, I can say based on these definitions, meditation is a multifaceted practice with diverse definitions. These include targeted methods, careless awareness, focusing attention on a single thing, shifting focus to a concept or object, and self-control exercises. While there are differences, achieving more awareness and control, promoting mental health, and inducing a self-induced state are all common themes. These definitions are complex, reflecting the diversity and flexibility found in meditation practices from many traditions and viewpoints.

2.1.3 Mindfulness

When I was looking for the definition of Meditation, another related keyword was found, which is Mindfulness. Mindfulness is defined as intentionally focusing on the present moment without passing judgment or feeling attached to it. The self-regulation of paying attention to one's experiences in the present moment with acceptance, openness, and curiosity is known as mindfulness. (Navarro-Haro et al., 2017, p. 2) Banerji (2023) discussed that deep breathing and mindfulness exercises can give us more awareness and control over our thoughts and emotions, which will make it easier for us to block out distractions.

In another research Awasthi (2013) mentioned that meditation is frequently offered as a means of managing mental health conditions like depression as well as lowering stress and promoting relaxation. It is a common practice to conduct courses for classrooms, prisons, and hospitals under an assumption that most people are prepared for them and that they are beneficial and safe for everyone. Nowadays, mindfulness has been suggested as a cognitive-behavioural paradigm for meditation, instead of a physiological one. The goal of mindfulness is to raise awareness of the experience of visible mental processes in the present moment. Rather than focusing on a single object, like a mantra, it comprises teaching practitioners how to stay moment-to-moment aware while attending to a variety of moving objects of attention. Since this time, a number of techniques based on mindfulness have been created for use in clinical and empirical research on the subject, such as the Mindfulness-Based Stress Reduction (MBSR) program, which consists of eight weeks of daily homework assignments and three hours of weekly group sessions. Researchers have offered a variety of perspectives on the meanings and origins of mindfulness, and mindfulness and concentration are not always contrasted as separate practices, in certain Buddhist contexts, concentration meditation requires mindfulness. (Awasthi, 2013)

2.1.4 Metaverse

Metaverse is a modern technology that is developing quickly. People can interact virtually with businesses, 3D objects, the environment, and each other in the Metaverse, an online 3D virtual world. (Daşdemir, 2022) The term "Metaverse" was first used nearly thirty years ago in Neal Stephenson's science fiction novel *Snow Crash* in 1992, but the metaverse, an immersive replacement for the Internet, is still in its early stages of development (Cheng et al., 2022). The concept of the "metaverse" has gained a lot of attention from the scientific community as well as from a variety of industries and social groups. This creates a need for a thorough, widely recognized definition of the topic that is based on research. However, the metaverse is not so much a testable phenomenon as it is a developing vision. (Weinberger, 2022) With the use of this technology, users can engage and work together in a 3D space by connecting their actual existence. One could argue that a key element in collaboration and interaction within the metaverse is standardization. Standards-based equipment and function organization can organize metaverse interaction. Avatars that look similar to the users themselves allow them to communicate with each other in the 3D digital space that is the metaverse. (Jeong and Kim, 2023)

Growing interest in topics like creativity, entertainment, and socializing is driving growth in the global metaverse market. This is due to the fact that, while the metaverse may receive the majority of attention blockchain and crypto assets are essential for this technology to reach its full potential. An additional factor accelerating the market's expansion is the advantages of cross-company partnerships and cooperation in industries like gaming, marketing, business sharing, and others. This has confirmed the younger generation's preference to use metaverse software to produce original ideas and successful start-ups. (Kaur and Gupta, 2021) Numerous technology companies have entered the metaverse market. Regarding all the companies that have made investments in this field, Meta is certainly the most renowned. Facebook (then known as Meta) introduced Facebook Horizon, a social VR platform, in September 2019. Facebook announced in July 2021 that it would become a metaverse company in five years. Facebook renamed itself as Meta in October 2021 in order to reflect this vision. VR is seen by Meta as a foundation to build the metaverse. (Cheng et al., 2022)

Through the use of blockchain, Augmented Reality (AR), and Virtual Reality (VR) technologies, all online virtual worlds and content were combined to create the metaverse, a new reality universe and dimension where virtual and real can be experienced at the same time (Yemenici, 2022). Hwang and Chien (2022) agreed that the metaverse symbolizes the next evolution of social interaction. It applies to a created universe where humans are able to "live" according to the laws established by the creator. A metaverse may be entirely or partially virtual. For instance, it could be a fully virtual environment, such as that found in a VR system, or it could be partially virtual, such as that found in situations where AR is used in real life, I will explain the full definition of these terms soon. In the metaverse, people can socialize through playing games, talking about problems, collaborating on projects, and obtaining skills through experience or problem-solving. In the metaverse, friends and partners can be either real people or virtual characters. Moreover, just like in the real world, there can be a variety of events and activities in the metaverse, including political, social, and even natural disasters. People can only be stopped by their imagination in such a virtual world. Furthermore, the lifelogging feature allows for a complete record of daily activities within the metaverse. The term "Metaverse" may be used together with "VR" or "AR," but it refers to much more than that. (Hwang & Chien, 2022)

As these terms will frequently appear in the written environments of this research project, it is necessary to define the complex meanings of Extended Reality (XR), VR, AR, and mixed reality (MR) in order to promote full comprehension throughout the text, according to Mystakidis (2022):

The term "Extended Reality," also known as "cross reality" (XR), refers to a large category of immersive technologies, including electronic and digital environments where data is projected and represented. Augmented Reality (AR), Mixed Reality (MR), and Virtual Reality (VR) are all included in XR. Humans observe and interact in a fully or partially artificial digital environment created by technology in each of the XR elements listed above. (Mystakidis, 2022)

VR is a digitally generated artificial environment that is entirely different and alternate. In VR, users experience a sense of immersion, as though they are in a different world and behave similarly to how they would in the real world. The senses of vision, sound, touch, movement, and the organic interaction with virtual objects are enhanced by specialized multimodal equipment like universal treadmills, VR headsets, and immersion helmets. (Mystakidis, 2022) VR has so far been utilized in therapy for deceiving patients into believing that something that isn't actually there is real. However, predictive coding mechanisms that control our physical sensations can also be played by VR simulations of our bodies, leading people to feel "real" in situations that are not. (Riva et al., 2021)

AR approaches physical spaces differently, incorporating digital inputs and virtual elements into the real world rather than improving it. It creates a spatial combination of the real and virtual worlds. The end product is a layer of digital artifacts that are mediated and projected spatially over transparent surfaces like glasses, contact lenses, smartphones, and tablets. Furthermore, AR can be utilized in VR headsets that support pass-through mode by displaying data from integrated camera sensors. (Mystakidis, 2022)

Since MR is a more complicated idea, its definition has changed over time to reflect both the current linguistic meanings and narratives and current technological trends. Because the displayed digital data works in real time with the physical environment, mixed reality (MR) is sometimes compared to an advanced version of AR. In an MR game, for example, a scripted non-player character would be aware of its physical surroundings and would

hide behind a couch or under a desk, Like VR, MR calls for specific glasses. however, we will accept the idea of MR as any combination of VR and AR, along with some intermediate forms like augmented virtuality. This decision's rationale is the long-term technological development of AR, which has led to the inclusion of interactive advantages and disadvantages. As a result, AR and VR continue to be the two core technologies, and MR their combination. (Mystakidis, 2022)

2.2 The relation between Metaverse and XR

It's been suggested that metaverse is the NextG Internet and a novel kind of online social network. It would be the combination of VR for exploration and digital second life for "escape," simulating real-world user interaction. A more precise description of metaverse would be a global virtual environment that emphasizes social interaction and is linked by the Internet to other 3D virtual environments (a network of virtual worlds). I see the metaverse developing to smoothly merge the real and virtual worlds, for instance, through digital twins and digital economies (like cryptocurrency). The metaverse is capable of communicating with physical objects. By using 3D modelling, they are able to create their digital twins and maintain the consistency of their presentation with reality. On the other hand, the digital twin's physical state can change simply because of manipulation or processing within the metaverse. For instance, BMW built a fully functional digital twin of its auto factory using Nvidia's Omniverse10, which decreased production costs and increased output. It is widely accepted that the metaverse is based on and integrates technologies like 5G, XR, edge computing, blockchain, machine learning (ML), and HCI, even though there is disagreement over the precise definition. (Cheng, 2022)

Based on the paper of Park and Kim (2022), AR/VR/MR augment or supplant our view of the world and are a key to the success of metaverse. Players often have a feeling of "being there" in the VR environment. Sometimes, the terms "presence" and "immersive" for VR are used together to describe this sensation. (Dasdemir, 2022) VR guides users to a virtual and social VR is often considered as a crucial element within the metaverse. AR makes it possible to combine digital twins from the metaverse on tangible objects in a way that is noticeable, thereby bridging the metaverse and the real world. Because MR encourages more connections and collaborative interactions between users, virtual space, and the physical world, it enables users to interact with virtual objects. (Park and Kim, 2022)

The metaverse is different from AR and VR in three ways. First of all, while studies connected with VR focus on a physical approach and visualization, the metaverse has a strong point as a service with more sustainable content and social meaning. Secondly, AR and VR technologies are not always utilized in the metaverse. The platform may continue to work as a metaverse application even if VR and AR are not supported. Finally, the metaverse's scalable environment—which can house a large number of people—is crucial for confirming social meaning. The large-scale metaverse implementation required three things: (i) advances in hardware (GPU memory and 5G, for example); (ii) the creation of a recognition and expression model that allows for use of the parallelism in the hardware; and (iii) the availability of content that users could engage with and immerse themselves in. (Park and Kim, 2022)

To fully use the metaverse, a number of system design indications, such as high-reliability feedback, high-definition virtual object perception, and immersion, have been proposed and deeply accepted. Many efforts have been made by academia and industry to enhance performance using the suggested indicators. For instance, rendering scenes near real-

world points of interest is now possible thanks to the advancement of computational graphic software like Unreal Engine. Furthermore, improvements in hardware, like head-mounted displays (HMDs), can offer users long periods of high-quality virtual scene perception, resulting in an immersive metaverse experience. In the meanwhile, it is expected that in the near future, devices for extended reality will be able to further enhance the level of immersion. Advances in communication technologies, such as reconfigurable intelligent surfaces, mmWave, massive multi-input multi-output (MIMO) technology, and semantic communication techniques, can support massive data transmission efficiently. Also, wireless communication networks that are Sixth-generation (6G) and beyond fifth-generation (B5G) can offer real-time, ubiquitous, seamless, and extremely dependable communication to a wide variety of metaverse devices. (Du et al., 2023)

2.3 The challenges of metaverse

People started expressing concerns about the potential negative effects of XR world, such as decreased interaction with others and increased isolation, even before the metaverse emerged. The ability of audio-visual immersive, co-presence, and haptics to create a social presence is tangible enough that it isn't even affected by the fact that avatars just represent users expresses the ability of this technology to improve rather than reduce connections between people. (Heiskanen, 2022) Xi et al. (2023) mentioned in their article that many programmers and designers struggle to find effective ways to increase the perceived usability, simplicity of use, usefulness, and efficiency of XR technologies and systems because there is a shortage of theoretical guidance and detailed analysis of the actual workload.

Also, in the paper of Park and Kim(2022), by doing an empirical review, they categorized metaverse challenges into 3 sections: Medium selection, Ethical and security issues and Interdisciplinary research.

2.3.1 Medium selection

While VR requires more expensive and heavy gadgets for longer experiences, AR uses lightweight devices that are appropriate for quick experiences. Certain methods combine the benefits of AR and VR to seamlessly transition between AR and VR within a single piece of hardware. Although this method allows for the innovative use of AR and VR, it becomes larger and more costly than a single-model device. Conversely, holograms have potential but are currently an uncommon technology in the metaverse. (Park and Kim, 2022)

As an additional input method, the metaverse uses eye-worn lenses like Maya Lenz, Mirage, and Mojo Lenz. The lens tracks the direction of focus, blinks, winks, and eye movements in order to analyse the data that the user provides. For instance, Maya Lenz is a wearable gadget that looks like a contact lens, and Mirage allows users to express negative content by switching it out with positive ones. When used in together with a hearing aid used around the neck, Mojo Lens allows the wearer to seamlessly process a wide range of visual information into their field of vision, including data feeds, people's profiles, video calls, translations, and notifications. (Park and Kim, 2022)

2.3.2 Ethical and security issues

Privacy and security are critical issues because metaverse collects more precise behavioral data than user conversations and internet history. The most important tasks should be to secure transmitted data, mandate two-factor authentication for avatars, and increase our awareness of potential crimes happening in the metaverse. Additionally, the increase in users has led to monitoring actions (such as censorship, follow-up reviews, and inappropriate chat room surveillance) that highlight the significance of actual organizations acting as a sort of police and government. On rare occasions, some real-world individuals engaged in criminal activity due to their anonymity online within the metaverse. The metaverse may have different laws and regulations than the real world due to its post-nationalism and degrees of freedom. Young people with diverse social views make up the majority of users who are acquainted with the metaverse. Building a metaverse that is more than just a physical area is not enough; what is needed is a metaverse with a worldview and an ethical awareness where different avatars can currently live. (Park and Kim, 2022)

2.3.3 Interdisciplinary researches

Interdisciplinary research is required for this field because the metaverse comprises a world that is dynamic for a large number of users and NPCs (non-player characters). As an illustration of transdisciplinary research, metaverse makes use of concepts from cognitive science that are commonly used to create more immersive and long-lasting services, such as theory of mind, motivational systems, and episodic memory. In the current conversation, episodic memory happened a long time ago and naturally led to a conversation. An agent with intrinsic motivation can consistently complete several tasks as opposed to just one. One benefit of the theory of mind is that it can help to deepen conversations by helping to understand other people's perspectives. (Park and Kim, 2022)

2.4 Needed technology for virtual meditation

Several technologies need to be coordinated and integrated to produce an immersive metaverse experience (Zhu et al., 2024). To realize the metaverse, technologies other than the Internet, social networks, gaming, and virtual environments need to be taken into account. The basis of the metaverse is provided by the development of AR and VR, edge computing and high-speed networks, Artificial Intelligence (AI), and hyper ledgers, also known as blockchain. (Lee et al., 2021) VR concludes both gameplay and storytelling in an immersive environment (Bolger, 2021). The development of digital economy technologies like blockchain and multimedia technologies like VR and AR has helped in the rise of metaverse services. Even though many metaverse services are still in their early years, it is clear that they are progressing in a variety of ways. (Du et al., 2023) In Western societies, the use of digital technology to facilitate meditation is growing in popularity, particularly among newcomers to the practice who want guidance to improve the quality of their meditation. Technology for meditation is available in the form of physical devices that are frequently supported by apps as well as mobile applications. These include different kinds of lamps, EEG headsets, wearable biofeedback devices, audio-visual stimulation devices, and neurostimulation devices. Regardless of this diversity, apps seem to be far more common—possibly because of their accessibility. Apps are mostly used as "timers" by more experienced meditators, and they are frequently used as guidance by beginners who are just starting out. However, advanced meditation practitioners typically

stay away of meditation electronic devices completely seeing it only as a distraction. (Kermavnar and Desmet, 2024)

Tong et al. (2015) used virtual meditative walk for chronic pain and they got a positive result with the help of VR (Tong et al., 2015). Another similar example was for Hudlicka (2013) that generated a virtual meditation couch focusing on breathing and got positive feedback (Hudlicka, 2013). Li and Leshed (2022) in their article found that users adopt and appropriate various technologies like mobile apps, calendar, YouTube and Spotify playlist and Zoom for mindfulness practice. A few of these resources have been through evaluations for their effectiveness in promoting mindfulness, particularly specialized apps like Calm and Headspace. They also discovered that people integrate non-mindfulness-focused technologies into their regular mindfulness practices, such as productivity tools and platforms for streaming recreational media. As an example, Kosunen et al. (2016) mentioned a research from Chittaro and Vianello (2014) which they suggested designing a mobile app to assist inexperienced meditators in developing mindfulness. The users would enter their ideas into an application called AEON on a mobile device, which would then visualize them as ink on a piece of parchment covered in water. Next, the users can gradually dissolve the written thoughts by creating waves on the water with the touchscreen. The AEON system was found to be more enjoyable and simpler than traditional meditation in a user study involving 22 participants. Despite this, the system was still able to produce a higher level of decentring, an index of mindfulness. The similar topic research was for Simon et al. (2021), the authors worked on Virtual Companion for meditation application through chatbots and they tested it with their users.

Also, Kosunen et al. (2016) worked on the creation and application of the neuroadaptive and immersive VR meditation platform, called RelaWorld. The authors provide a novel method that makes use of neuroadaptive strategies to customize the meditation experience in reaction to users' real-time input on their brain activity. The system's objectives are to maximize user involvement and the benefits of meditation techniques in VR. This article explores the RelaWorld system's design concepts, technological features, and user experience concerns, offering insights into the combination of VR, neuroscience, and meditation. The study shows how neuroadaptive systems may be used to create individualized and powerful VR meditation experiences, and it adds important knowledge to the expanding area of immersive technologies like VR for mental health. (Kosunen et al., 2016)

Personal computers, smartphones, and tablets are relevant in terms of user equipment, especially in considering the fact that massively multiplayer online role-playing games (MMORPGs) are frequently categorized as examples of the metaverse concept because of their various social interaction options. Since VR headsets immerse users in an artificial reality and cut them off from their surroundings, it appears that they are viewed as real metaverse equipment. Like VR, both depend on headsets and preserve some aspects of the real world. Based on the findings, users are not entirely cut off from their environment as with VR. However, as it has been already stated VR uses headsets to provide a connection to the metaverse. (Kara et al., 2023)

Therefore, based on the mentioned examples and the articles of Wang et al. (2022) and Hatta et al. (2022), it becomes evident that VR serves as an indispensable tool for the practice of mental treatment including meditation within the metaverse. These papers have shown that virtual reality meditation offers advantages for individuals and the immersive and interactive nature of VR not only enhances the meditative experience by

providing a simulated yet deeply engaging environment but also facilitates a seamless integration of contemplative practices into the expansive and interconnected digital realm of the metaverse. In this research, I especially focus on this aspect of using VR which is a kind of enabler for the metaverse.

2.5 Usage of Virtual meditation for health

A lot of mental illnesses have been treated with VR-based systems (Kosunen et al., 2016). Numerous studies show that using VR for meditation can improve people's mental health. VR's immersive qualities may reduce outside distractions during meditation while encouraging engagement and attention to feelings. VR-based meditation primarily involves auditory and visual signals, with minimal active user input. Instead, user interaction with the virtual environment is largely dependent on bio signals, such as brain activity or heart rate. (Fu et al., 2023) In fact, VR has up until now been used therapeutically to trick people into thinking that something that isn't actually there is real. VR body simulations, however, can also trick the predictive coding systems that control our bodily perception, leading people to believe that things are "real" when they're not. (Riva et al., 2021)

The COVID-19 pandemic caused many limitations in the real world, such as social distance, but in response, the metaverse has enabled social connection by providing an environment for people with similar interests to gather and communicate (Rahman et al., 2023). Guertin-Lahoud et al. (2021) wrote a paper about treating the stress level during the pandemic in US, in stressful times, it has been suggested that mindfulness practices, which involves establishing a connection between our body and mind and focusing entirely on the present moment, will lead to happier emotional states. Earlier studies demonstrated the great potential for the therapeutic application of VR, a technology that simulates real-world sensory stimuli by immersing users in a simulated virtual environment. This is especially relevant given the current "mental health pandemic". The article offers insightful information about how to optimize technology-enhanced meditation for a more immersive and fulfilling user experience by looking at elements like user engagement, physiological and psychological reactions, and potential preferences for multisensory experiences. The results of findings provide a more understanding of how VR and meditation interact, which helps designers create virtual spaces that improve meditation as a whole. Regarding a related subject, Hatta et al. (2022) investigate the usage of VR as a therapeutic tool for mental health conditions made more difficult by the pandemic. During the pandemic, the review found and assessed a number of studies that used VR activities to treat mental health issues like stress, anxiety, and depression. Important conclusions from the review show that VR treatments were generally well accepted by participants and demonstrated the potential effects of decreasing their signs of mental health conditions. The authors came to the conclusion that there is a lot of promise for VR technology as a tool for treating mental health issues.

2.6 Artificial Intelligence and Gamification in metaverse

Since metaverse technologies have their roots in the same gaming logic, they are particularly affected by gamified experiences. Actually, gamification encourages activities for fun where users calm down, participate in competition, and frequently behave with greater spontaneity. (Nicola, 2023) A popular approach to digital learning and problem-solving in academic research is gamification. People can improve their problem-solving and problem-facing skills by using animations, simple narration, and

visual and auditory elements like music and sound effects. Gamification encourages people to enjoy solving problems, generate original ideas, and adopt new viewpoints through various approaches. In addition to facilitating easier social interaction, gamification fosters an engaged, user-experience-focused workplace. Gamification is the application of game design principles to enhance motivation in non-gaming contexts. It was first presented as a way to learn and solve problems. (Afacan, 2023)

The field of AI is founded on the theory that, each aspect of learning can be so precisely described. People are easily motivated to realize the metaverse by developments at AI in the real world. (Yang et al., 2022) AI has become an agent of change in many different fields. AI has the potential to completely transform teaching, learning, and developing methods because of its capacity to analyze enormous volumes of data, recognize patterns, and make skilled judgments. Researchers, educators, and policymakers have been paying close attention to the integration of AI in various fields in the past few years. (Kumar et al., 2023) Also Huynh-The et al. (2023) mentioned AI has demonstrated how crucial it is to improve immersive experiences and give virtual agents intelligence comparable to that of humans.

Gamayanto et al. (2024) did research about the combination of AI and gamification in the education industry and they mentioned universities must implement AI, gamification, and the metaverse in order to adapt to the current globalization and change. Their goal must be to develop a system that can work functionally in a variety of scenarios. AI and gamification have an unbreakable relationship. (Gamayanto et al., 2024)

2.7 Conclusion

Taking on our research of keywords and their contextual significance, I dived into the complex network of their relationships. By reading the connections between each keyword I realized how important VR is to the development of the metaverse, especially when it comes to meditation experiences. It's becoming more and more obvious that VR forms a change in how people meditate in the metaverse. According to Dasedmir (2022) in the metaverse, individuals may experiment, practice, and learn without any cost that comes with doing so in the real world. The industry of VR will allow us to enter this virtual world, it confirms that VR is the key of doing meditation in the VR-enabled metaverse world.

As I continue this research, UX is defined as the emotions and senses users get from interacting with the metaverse environment. In the metaverse, people can create their avatars, enter immersive environments, and participate in activities that simulate the real world and go beyond its physical limits. Meditation is a practice that aims to improve mental well-being. Furthermore, VR technology is an essential enabler, making it easier to practice meditation in the metaverse. VR can resemble and even improve traditional meditation experiences by putting users in a virtual world.

By combining these components, my research aims to understand how these technologies can establish the perfect environment for meditation, ultimately addressing the research question of what are the characteristics of good user experience for doing meditation in a VR-enabled metaverse. This investigation will focus on how the healing effects of meditation, the interactive potential of the metaverse, and the immersive aspects of VR can all come together to produce a smooth and productive meditation experience. The study looks at these variables in an effort to offer guidance to developers on how to make better, more user-focused meditation applications in the metaverse.

3. Research method

Through the usage of scientific method, research aims to find answers to questions. The primary goal of research is to uncover the truth that has been hidden and has not yet been found. Research is also regarded as the problem-solving application of the scientific method. It is a methodical, strict and structured procedure that continues the scientific method of analysis. There are numerous approaches for learning. They are observation, reasoning by illustration, logical manipulation of fundamental assumptions, revelation, and authority. The highly goal-oriented technique is one of the research branches that is referred to as empirical research. (Pandey and Pandey, 2021)

The metaverse presents itself as a dynamic canvas for the investigation of traditional mindfulness practices in the age of technological progress, where the virtual and the meditation converge. The convergence of meditation and the metaverse provides a world of possibilities that are yet not fully learned as society grows more and more dependent on immersive digital settings. The goal of this thesis is to explore the complicated subject of "characteristics of good user experience for meditation in the VR-enabled metaverse" and to show how cutting-edge virtual worlds and meditating traditions may live together peacefully by presenting a framework that shows all of the characteristics in different category. Through exploring this unexplored area, I want to understand not only the technological aspects but also the significant consequences for mental health and user expectations within the VR-enabled metaverse.

3.1 Research design

Starting a qualitative investigation into "Characteristics of good user experience of meditation in the VR-enabled metaverse" means looking deeply into the complex and subjective elements that characterize people's experiences with meditation in virtual spaces. Research methods can be widely divided into two main types: empirical and non-empirical. For this thesis an empirical approach is adopted. Communication studies use empirical methods in the hope of producing consistent and objective results. (Dan, 2017) Qualitative research emphasizes the rich patterns of human experiences and positions itself as a tool for in-depth understanding, in contrast to quantitative approaches that aim to quantify and measure outcomes. This qualitative design is well-positioned to explore the underlying emotions, preferences, and challenges that shape this transformative combination of cutting-edge VR and mindfulness practices, as well as the complicated components of user engagement, perception, and immersion in metaverse meditation. (Hennink et al., 2020)

The understanding that user experiences in metaverse meditation are naturally subjective and affected by a multitude of contextual, cultural, and personal factors led to the choice to employ a qualitative research design. The natural complexity of this research field is well-suited for qualitative inquiry, which enables a comprehensive analysis of the real-life experiences of those who practice virtual meditation.

The limitless opportunities provided by the metaverse are connected with meditation, a strongly private and personal practice. The focus of this qualitative study goes beyond numerical measurements or statistical trends to include the examination of individual narratives. I must capture the rich and complex nature of participants' experiences in the metaverse by giving priority to their voices, perspectives, and stories. The metaverse presents a unique context for meditation with its immersive digital landscapes. By using

a qualitative approach, I am able to contextualize and interpret the meanings people assign to their virtual meditation experiences, demonstrating minute details that might be difficult to measure quantitatively.

In addition to showing individual stories, this qualitative investigation must have the potential to guide the creation of metaverse meditation spaces and provide useful information for researchers, practitioners, and developers. In the changing field of digital mindfulness, I open the door for more individualized and impactful interventions by knowing the different aspects of user experiences.

3.2 Participants

In order to gain valuable insights into the meditation user experience in the metaverse, careful participant selection is essential. I used the method known as purposeful sampling to find participants with a variety of backgrounds in familiarity with metaverse and meditation techniques. Participants who had meditated in the metaverse had priority to do the interview sooner, and the requirements for admission may differ depending on demographics, level of meditation experience, and familiarity with the metaverse. As all of them had experience in meditation and knowledge about metaverse, I considered the one who did meditation in VR-enabled metaverse before or did some research about it as a professional participant, and participants with less experience in meditation are at beginner level. I could find four professional participants, four participants with medium experience and two participants with beginner level experience. Also technology proficiency of eight of them were high and they were familiar with most of the trends in this field. The purpose of this planned choice is to include a wide range of viewpoints so that the results of the study suggest the many different user populations that engage in meditation practices in virtual environments. Inclusive criteria are:

- **Metaverse Experience:** Individuals with varying degrees of experience navigating and engaging with AR and VR.
- **Meditation Background:** Participants with a different range of meditation experiences, from beginners to experienced practitioners.
- **Demographic Diversity:** Ensuring representation across demographics, including gender, and technological proficiency.

A variety of strategies, including targeted invitations within my personal network, the use of the snowball sampling technique, and consulting with experts in the field, were employed to recruit participants. Those in my current network who fit the inclusion requirements—friends, colleagues, and contacts with varied degrees of metaverse familiarity and meditation experience—received the first invitations. At the end of the interview, the recruited participants were asked to recommend other people who might be interested and qualified to participate in the study using the snowball sampling technique. The goal of this iterative process was to increase participant diversity by capturing a wider variety of viewpoints and experiences from the metaverse meditation community.

All study participants received a whole informed consent form (Appendix A) explaining the aim of the study, the procedures involved, and their rights before participation. It was highlighted that participation is voluntary and that participants are welcome to ask questions. In addition, the same consent procedure and information given to participants were referred by the snowball method.

This broad recruitment strategy aims at developing a varied and active participant community, adding to the range and complexity of information obtained through the research project into the metaverse user experience of meditation. It does so by combining expert collaboration, personal networks, and the snowball method.

3.3 Data collection

Numerous modern texts provide a loose distinction between unstructured, semi-structured, and structured qualitative interviews. Qualitative interviews have been categorized in a multitude of ways. Because structured interviews are a tool for producing quantitative data (DiCicco-Bloom and Crabtree, 2006), I used semi-structured and unstructured formats. For this qualitative study, in-depth semi-structured interviews with ten participants was the main method of data collection. The main technique for looking deeply into the perceptions, lived experiences, and details of users who are meditating in the metaverse is interviewing. Participants are able to share their insights in a flexible semi-structured format that guarantees important user experience-related topics are thoroughly covered.

An organized format was used for the questions in a standardized open-ended interview. Everyone who participated in the research received the same questions. Participants can give as much specific information as they would like because the questions were open-ended (Turner and Hagstrom-Schmidt, 2022), and then I could follow up by asking more questions in an effort to collect more information from them.

The pilot interview shaped the beginning of the data collection phase of my research, and it produced important insights that will help future participants get the most out of the interview process. The last question was found to be wildly complicated in its current form during the pilot interview. So, I chose to divide it into smaller segments with some pauses in order for optimal understanding and considerate answers. Furthermore, it looked like some questions repeated those from earlier rounds, which might have made interviewees feel repetitive. I updated the technical questions to improve clarity by taking these observations into consideration. With these adjustments, participants should be able to fully consider and answer each question without becoming overwhelmed or experiencing repetition. The goal is to make the process more focused and engaging for them and while I checked with the next participants, they confirmed it. Appendix B contains the updated interview guide with the questions after reviewing.

The interviews were planned to address a variety of subjects, such as the participants' experiences with virtual meditation, their backgrounds, their goal for doing meditation and using the metaverse, their engagement in the metaverse, their meditation practices, and their ideal type of meditation both in the real world and in the metaverse. Participants were encouraged to share personal experiences, insights, and any difficulties they may have had while on their meditation journeys and VR experience by using open-ended questions. Informal interviewing was used to improve participant engagement and encourage open discussion. Free expression of ideas was encouraged among participants, creating a welcoming and encouraging atmosphere that encourages candid and thorough answers.

Interviews were recorded in audio with participants' permission to capture the depth of their stories. As the research progressed, a detailed transcription of the recordings was made to enable a more thorough analysis. Confidentiality was guaranteed to participants, and the research findings were anonymized their identities. Before every interview,

the informed consent form was given to them to sign, focusing on the voluntary nature of participation and the freedom to leave at any time without consequences.

A pilot interview was performed with one participant that had a suitable background before the main data collection phase in order to test the interview guide, improve questioning strategies, and ensure clarity and relevance. Some changes that were required to improve the overall effectiveness of upcoming interviews were done after the pilot interview.

3.4 Data Analysis Plan

This study explores the various viewpoints and hidden insights of people who have direct contact with this developing topic. I did an interview on some participants' experiences, perceptions, and reflections in the metaverse through in-depth interviews with individuals who are actively involved in virtual realities and meditation practices until I reached to saturation of codes.

Interviewees were able to share their own perspectives, relate stories from their lives, and explain the minor distinctions between meditation and digital media on this platform. My main focus was investigating the elements that lead to a significant and life-changing meditation experience in virtual environments. In average, the duration of interviews was 30 minutes.

The interview questionnaire was divided into two sections and each of the sections had a different purpose in order to collect complete information from the participants. The first section included seven opening questions that were purposefully designed as a warm-up activity, checking the related background and experience of the participants with the topic and establishing a connection between the interviewer and the subject. The purpose of this section was to prepare the basis for a more in-depth discussion of the participants' familiarity with the concepts of meditation, metaverse, ideal experience, and VR technology in the next section of the interview.

In order to get a deeper understanding of the participants' insights, the second section focused on a set of five technical questions. These carefully considered questions were designed to investigate the complex details of their concepts that would directly address the main research question. In order to enhance the depth of the research findings, this section of the interview delved into the technical details that might clarify key aspects of the relationship between meditation practices and the metaverse. Questions in both sections were open-ended questions.

After the interviews, the recorded voices are converted to digital transcripts and then go through a careful analysis procedure. I took interviewees' narratives and used a qualitative data analysis program to identify and classify codes and themes that make sense. According to Vaismoradi et al. (2016), a theme can be described as an element, concept, attribute, or descriptor. As a hidden topic, it gives a set of continuing ideas structure, which aids researchers in answering the study question. By having codes with a high degree of generalizing and a shared point of reference, it connects ideas about the subject of study. It is regarded as a subtext of implicit underlying meaning that participants' subjective understandings and interpretative-level discoveries have identified. Subthemes can be contained within each theme to provide a more in-depth analysis of the data and identify any patterns in the participant stories. (Vaismoradi et al., 2016) I can recognize trends, differences, and important insights thanks to this methodical approach, which

guarantees a thorough comprehension of the different elements of meditation in the VR-enabled metaverse.

Interpreting the information gained from the interview process is the last step in the interview design process. In this stage, I organized the data into sections or groups of information, sometimes referred to as themes or codes, that must "make sense" of what has just been discovered. These themes and codes refer to words, phrases, or concepts that study participants used frequently. The ways in which researchers develop themes or codes are different. Based on their assessment of the interview transcripts, numerous researchers recommend hiring a third-party consultant to review codes or themes in order to ascertain the efficacy and quality. This reduces the effects of researcher biases or may even completely eliminate cases of unnecessary data analysis. (Turner and Hagstrom-Schmidt, 2022) After generating the codes and themes, I checked all of them with another researcher who was familiar with this topic to reduce any possible bias and they confirmed it.

For this research, I used thematic analyze method to gain a suitable insight from the interviews. Thematic analysis is a technique for examining qualitative data that involves looking through a data set for repeated concepts, or themes. (Riger and Sigurvinsdottir, 2016) In the next step, for analyzing the data, I used Nvivo 14 to generate codes from the interviews and categorize them into cases. In the first step, 35 cases were generated which had totally 220 codes. These codes contain the information about participants (demographics of interviewees) and the codes which are related to the research question. My target is to create a framework that describes a satisfying meditation experience in a VR-enabled metaverse by analyzing these interviews at the end of the research. Understanding the elements that lead to an efficient and enjoyable meditation experience in this new virtual world—such as the virtual environment itself, interaction techniques, and guidance systems—should be made easier with the help of this framework.

4. Findings

The results from the in-depth interviews with participants who have experience and are interested in meditation within the metaverse are presented and discussed in this section. The major themes and suggestions from this analysis show the benefits and drawbacks of incorporating meditation techniques into virtual settings. Through the analysis of participants' feedback, experiences, and preferences, I am able to determine the key components that make metaverse-based meditation a positive experience for users. These results shed light on the state of meditation in the VR-enabled metaverse today and offer insightful advice for advancing this cutting-edge field's future advancements.

4.1 Experience of participants

For this research, ten individuals who regularly practice meditation and have become familiar with the metaverse were interviewed and the data collected from their interviews. Table 1 has the list and the experience details of participants who did the interview.

Table 1: Participant demographics and characteristics

	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
Familiarity with meditation	10 years	2 years	Since childhood	17 years	4 years	5 years	4 years	10 years	12 years	8 years
Meditation routine	Each weekend	At tiredness	When needed	When needed	3 days a week	Daily	Once or twice in week	4 or 5 times per month	Daily	3 or 4 times per week
Meditation duration	10-15 min	2-3 min	10-15 min	5-10 min	More than 1h	15-30 min	10-15 min	Half hour to 1h	23 min	10-15 min
Familiarity with metaverse	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Have experience with VR technology	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Doing meditation in VR-enabled metaverse before	Yes	Yes	No	Yes	No	Yes	No	No	No	No
Highest university degree	Master	Master	PhD	PhD	Master	PhD	Bachelor	Master	Master	Master
Gender	Female	Male	Male	Female	Male	Male	Male	Female	Male	Male

From the first row which is “Familiarity with meditation”, I can see that all of the participants have at least 2 years of experience in doing meditation and mindfulness activities which is quite sufficient.

The second and the third rows show the meditation routine and duration of meditation which is acceptable for everyone.

The fourth and fifth rows prove that all of the participants are familiar with metaverse and VR technologies which are crucial for the research.

The sixth row mentioned that 4 of the participants had experience of doing meditation in the VR-enabled metaverse. However, the number of people who had exact experience before is not too much and as the participants know about the metaverse it is sufficient for the research.

The seventh and eighth rows show educational background and gender of the participants which has enough diversity.

Four of the participants knew more about the subject because they had previously practiced meditation in the VR-enabled metaverse. The remaining participants explained that they would like to give metaverse meditation a try in the future. Their personal interactions with meditation in VR-enabled metaverse enhanced our conversation and provided helpful perspectives on the topic to collect better information. It's important to remember, though, that none of the participants—even when taking into consideration the perfect user experience—preferred to constantly meditate in the metaverse over traditional methods. It is noteworthy fact that participants used podcasts and YouTube in a variety of ways, each representing their own meditation practices and preferences.

4.2 Analyzing the interviews

After generating the codes from the technical questions, it was clear that providing certain features and specifications and also, avoiding certain features were necessary to provide a good user experience of meditation in the VR-enabled metaverse. These results give an understanding of the complex preferences that support the connection between metaverse environments and meditation practices. To elaborate on this insight, it is crucial to define the fundamental "DOs" and "DON'Ts" that will direct the creation of meditation experiences in the metaverse. The desired functions, features, and design components that enhance a user's experience are represented by the designated "DOs". On the other hand, the highlighted "DON'Ts" represents the features that reduce the user experience and should be corrected. These findings will discuss in parts 4.3 and 4.4.

4.3 Essential features for good user experience

Here I will discuss about the most important things that participants mentioned that should be for better user experience. These subjects are themes which are generated from the interview codes.

4.3.1 Visual effects

9 out of 10 participants mentioned about the importance of visual effects and illustrations. As eyes are open, they expect a minimal environment with light colours (but not too shiny) for meditation that gives them the sense of immersion. One of the interesting findings on the visual side was that 6 of the participants mentioned that the forest environment is their willing to choose for meditation in VR-enabled metaverse. Visual side of the meditation in VR-enabled metaverse has a direct effect on user's expectations, 3 of them mentioned they like to have a kind of illustration that relates to their body or reactions, like inhale or exhale their breath with a floating ball. Also, several of them mentioned that a nice environment can make reaching to immersion feeling which is one of the goals of doing meditation. The next important finding was having interactive activities can enhance the user experience, like an interaction with a smartwatch or smart ring that can detect heartbeats and personalize the environment or create illustrations related to what they want to see. Here are some of their quotations:

Participant: Kind of the environment is beautifully created so that it's immersive so it's interesting it's high quality.

Participant: It would be important for me to dim the colours that it would be important for me to have the pre setups and as in length as in colour intensity as in like character of the support that would be interesting for me.

Participant: I imagine maybe some kind of visualization of my breath kind of like inhale or exhale, but as long as it's helping me focus helping me meditate, I guess anything works.

By reading the codes, I can imagine that the virtual environment should be very minimal with attractive elements of nature and light colours. Forest ambiance was in high demand requests, but it should be able for the user to choose their favourite environment. In the next step, some illustrations that have interaction with the user make the experience unique.

4.3.2 Audio effects

8 out of 10 participants mentioned about the audio that proves the importance of it. They expect a calming, realistic and light music in the background that helps the process relaxation and mindfulness. They agreed on that the sound of the nature, like ocean waves or forest ambiance are the best and they preferred to choose these kinds of sounds. However, they prefer to have this option to turn it on or off or switch the sound to another type which is related to personalization feature. Here are some of their quotations:

Participant: Listening to the music being able to release my ego being able to stop my overthinking and a combination of better deep breaths, I could simply feel that my body weight is lighter.

Participant: Background calming music and there should be the option to turn it off or on.

Participant: whether it be music or some nature sounds like forest or ocean or whatever calm you down.

By analysing the codes, a light sound option is necessary in the meditation setting. This auditory component can be relaxing music or ambient noise from nature, which creates a calming atmosphere that improves meditation. Furthermore, it's critical that users have the option to adjust the sound to suit their own tastes or mute it altogether. Because of this personalization, people can adjust the audio component to meet their own requirements, making their meditation experience more satisfying and unique.

4.3.3 Simplicity

Another important factor for good user experience were simplicity and minimalism. 7 of the interviewees talked about that they expect a very simple process for meditation in VR-enabled metaverse. They wanted start doing meditation with only few clicks and the story of doing meditation should be easy to learn with less distractions. It was interesting that most of them mentioned Headspace mobile application as an example of a friendly user interface and they expected if a simple process like that can be implemented. Here are some of their quotations:

Participant: It should be accessible and handy for example for my mobile phones I just tapped on my mobile phones, and I do meditation without doing anything but for VR I need to wear that I need to fix that then I will I need to choose, and these activities takes at least three minutes for me and in the morning always 3 minutes would be valuable for more than 3 minutes.

Participant: When I'm going to the application it has to be really easy to use.

Participant: So, I would say like a simple definition would be maybe have as simple as possible user interface and you get to the meditation very quickly like less click is the better.

By reading the codes, I can see that participants expect to have a very clear process and easy to start by few clicks. So it is better for the developers to ask about users preferences while they open the app for the first time, then use the same settings for next times unless user can adjust it from the settings in a very easy process.

4.3.4 Ability to personalize

6 out of 10 participants were interested to have a personalized environment. They were interested to adjust illustrations, environment, audio effects and guided possibility with less distraction. Also, it is worth mentioning that 4 of them expected to have a tailored environment and scenarios based on their mood like sadness, missing someone, etc. Another request by 2 participants was they like to have freedom to go anywhere or do anything during their meditation in VR-enabled metaverse. Other interesting finding was

an idea about using AI which can generate a better environment for users, it can make it personalized and tailored based on the mood of users and their demand about the environment. I mentioned about the features of AI for metaverse in 2.6. Here are some of their quotations:

Participant: Users having option in order to choose their desire environment. I can choose before; I would like for example go to the space.

Participant: If my heartbeat is too high it would show me a calming scene.

Participant: You can change the environment, you are like a forest or mountain you can move to sound off you can put the arrays in the kite and guided meditation off.

As it was one of the most important features mentioned by users in different aspects, the environment needs to be able to be tailored for each user. They should be able to adjust sound, visual illustrations, environment, scenario of the meditation and narrator. Another important finding is the importance of AI for developing a better environment based on user demand. By using AI, it is expected to have a more functional application that can have better detection from participants and create a more accurate and personalized environment.

4.3.5 Guided meditation

6 of 10 participants preferred to have a guided meditation through voice which is a very important factor, because it is combining visual and audio effects together. They like to hear kind of soft and warm voice that speaks slowly. Also, 1 participant mentioned that a deep male voice can make them feel better for guided meditation. It is worth mentioning that some of the participants who strongly liked to do a guided meditation, mention that they like to have the opportunity to choose between guided and unguided meditation which goes back to personalization feature again. Here are some of their quotations:

Participant: I imagine that VR glasses guide me into the seaside walk on the beach and then listen to the sea.

Participant: Maybe some like useful guidance in terms of like for example the patterns that should be playing out.

Participant: The voice of the yoga teacher leading us and guiding us in a meditation, and I like it to have in metaverse.

By reading the codes, I can understand that users like to have a narrator with a soft voice while doing meditation in VR-enabled metaverse. However, they prefer to have the ability to turn it on or off.

4.3.6 Realistic meditation

4 out of 10 participants expected something to be very realistic and without any delay in VR goggles. They expect VR goggles to be lightweight and fast to adjust on their head, it can make a feeling that there is nothing on their head and it is a real experience. They mentioned that delay in their visions can make them feel sick and won't do that again. However, this delay and weight problem can be related to VR hardware and the latest devices are getting more light that have only a few milliseconds delay which is acceptable. In the literature section (See 2.2 and 2.3) I mentioned the importance of realistic environment and the issues related to medium selection. Also, one of them expect to have meditation in VR-enabled metaverse without any time limits. Here are some of their quotations:

Participant: What you will see must be very real and you know realistic environment.

Participant: If it is real time that while I am rotating my head, I can see different stars different parts of the Galaxy for example.

Participant: Something that looks a bit like some real environment.

By reading the codes, I can understand that users expect a very high quality audio and visual effects. They are looking to gain the experience of real world in metaverse. Also, having delays in VR goggles can make them disappointed in using them again, so the hardware specification is important too.

4.3.7 Social aspects

3 out of 10 participants were interested to have the ability to change the meditation mode from solo to group. The ability of doing meditation alone or solo can be used as a tool for personalization. They were looking on a way that lets them to invite their family and friends from other places to have same activity together and share their experience. Here are some of their quotations:

Participant: If my colleagues, everyone would have from my research unit some kind of meditation movement every day or every week or something like that would be kind of nice like a collective meditation, I think that would be beneficial for many.

Participant: I mean it could also allow for your friends to join like in the metaverse friends or family so the social, there could be some social aspect of it as well.

Participant: Doing meditation with new people, taking part in some classes and being in new communities among new people since I'm a social person definitely it could be enjoyable for me and if I combine meditation with other.

By reading the codes, I can understand that doing solo meditation is more common between the participants, but they like to have the ability to add their friends too. So the environment should give the opportunity to the users to do the group meditation.

4.3.8 Mindfulness activities

3 of 10 participants wanted to have mindfulness activities while they are doing meditation in VR-enabled metaverse in order to enhance their user experience. They were looking for some deep experiences. They believed in the metaverse, designed and mindful interaction with virtual stimuli such as visual scenes, auditory signals, and interactive elements, is a common component of mindfulness meditation. Immersion technologies, such as VR headsets, can be employed by users to establish environments that enable deep states of relaxation and concentration. Here are some of their quotations:

Participant: I might have kind of mindfulness meditation moments like I might stand outside my front door when I leave my home to go to the university and kind of just stand there and breathe in and breathe out and sort of appreciate that moment.

Participant: Mindfulness exercise basically that's kind of like a very traditional mindfulness type narrated guided meditation.

Participant: I think the point with meditation to learn to trigger the state of mindfulness let's say even without any help and outside of the practice, so it depends like ultimately on how big is the transfer of the state through the rest of your life but as I said definitely I think it can be helpful especially in the beginning up to a certain point but at a certain stage I do think you need to kind of drop it and try to start meditate without it just because it's more difficult but who knows.

By reading the codes, I can understand that the goal of many participants is reaching to mindfulness and immersion. For this matter, a deep focus and sense of being at the moment is needed to define the experience. It can be possible by following all of the specifications that I mentioned so far.

4.3.9 Gamification

2 out of 10 participants mentioned about the terms of gamification for meditation in VR-enabled metaverse. They believe that by using the concept of gamification, it can encourage more users to join and create loyalty to the current users to do it regularly. I mentioned in 2.6 about the importance of gamification and development of AI in metaverse and how it motivates people to contribute more together. This can be proved by the findings from participants. Here is their quotation:

Participant: So going back to headspace app because I really like that one, I think it had kind of gamified way to indicate the user, so you get patches and stuff like this these, basic gamification features if you use the app like daily and you've got your week, kind of like Duolingo, you got your streaks and these kind of things.

By reading the codes, I can understand that using gamification concept can make loyalty and keep the users to use the system regularly and it is good to have this function among the process.

4.3.10 Data privacy

I had only one code for this section that mentioned the importance of data security, but I mentioned it in the literature part (see 2.3) and due to the importance of it, should mention it here. Here is their quotation:

Participant: I think about metaverse most important thing in that context especially when think about meditation would be for me data security like am I being recorded, how is the data that I produce while using it being used and also probably the flexibility of guided meditation in that context to adapt to my specific needs.

By reading the code, I can see that concern about the data security and privacy policies can be felt among the users. So, the clear consent form must be prepared and also vendors should use the high quality standards for increasing the security of user's data.

4.4 Features to avoid for good user experience

Now I can talk about some elements that might make participants' experiences with meditation in the VR-enabled metaverse less positive. This was not in the original purpose of the interview and participants shared their positive experiences and preferences. But as the interviews proceeded, some things became clear as possible obstacles to their general satisfaction with meditation in the VR-enabled metaverse. Based on these results, the participants made a list of several active steps to reduce their experiences with metaverse meditation.

4.4.1 Isolation

Although, some participants were interested to do it with their friends, some of them worried about being more isolated in this way. It can be the effect of doing always solo meditation and avoid talking with others.

Participant: Maybe technology would isolate me from the real world, with the headset replacing my entire visual field with something that is controlled, and where distracting stimuli can be avoided.

By reading the code, I can see some concern about isolation. It is good to encourage the users to do a group meditation after some solo sessions by gamification strategies and in the story of meditation, encourage users to do some outdoor activities.

4.4.2 Failure to use strong equipment

Doing meditation in VR-enabled metaverse needs some special equipment like VR goggles and its controllers which are expensive and can be heavy and distractive.

However, like the trend of any digital gadget they are getting lighter, faster, smaller and totally better in time and still they are in their initial stage.

Participant: meditation in metaverse needs equipment it needs VR glasses it may need some controllers.

Participant: When I'm wearing a VR it should be comfortable on my head I mean it should be light, and it was one of my problems while I was using VR and I felt that Oh my God what is that burden on my head and it is somehow would be against meditating because it's sometimes for many people it's heavy and it must be comfortable.

By reading the code, I can realize that the effect of weak hardware can directly manipulate the experience of users. So, it is better to use high-quality products which are mainly expensive.

4.4.3 Limited environment

The scenarios might not have a variety of options or freedom to do anything. It may not be possible to create an unlimited world. If users do the same type of activity every time, again and again, they might be at risk of losing attention.

Participant: In the metaverse or in the VR glasses, you are kind of a little bit constrained by the what the developer has made for that environment.

By reading the code, I can see that repetitive environments or scenarios can make users bored. Also, it is hard to make an unlimited world. So, by designing different elements and interesting stories, we can distract users from thinking about unlimited metaverse world. Even AI can be a helpful tool for this part to develop creative and tailored scenarios.

4.4.4 Complexity

From part 4.3.3 I mentioned that the process of the meditation and starting should be very simple, easy to understand and clear. Complexity can reduce the experience of meditation. Users expect to jump into the process in just few clicks.

Participant: I think in the meditate in the real world doesn't need very complex way, just to relaxing your eyes is the most important thing.

By reading the code, I can see that the best environment is a simple environment with a simple process to start. The metaverse environment should avoid having too many distractive visual elements or moving objects. The menus must have as few buttons as they can. I mentioned before (see 4.3.3) about how simple the environment should be.

5. Discussion

This section explores the meanings and effects of the results that were previously discussed in the sections before. In addition to addressing the research question explained at the beginning of this study, the discussion seeks to integrate these findings with the body of current literature and explore the significance of the findings. I can gain a better understanding of the opportunities and challenges involved in designing the ideal user experience for meditation in the VR-enabled metaverse by thinking back on the insights gained from the data analysis and interviews. There will also be a discussion of larger consequences for practice.

5.1 Categorizing themes for illustrating framework

So far, ten themes have been identified in the context of meditation in the VR-enabled metaverse that support a positive user experience, and four themes support a negative one. To successfully address the research questions and present a logical framework, it is now necessary to group these themes into related categories. Through categorizing these themes, I can offer a clearer understanding of the elements that either improve or reduce the good user experience in metaverse-based meditation.

5.1.1 Technical features

As mentioned in section 2.4 and Kara et al. (2023), a number of articles highlight that the realistic feel of the scenarios and the audio and visual effects are among the technical aspects of meditation in the VR-enabled metaverse. It means that I may consider the first set of elements "Technological Features", which includes Audio Effects, Visual Effects, and Realistic meditation. This classification highlights how important it is to design a sensory-rich, immersive metaverse meditation space. These kinds of features are essential for taking users in and improving the meditative experience in general by making it more interactive and vivid.

5.1.2 Content and guidance

The definitions given in the first few sections of the literature review must then be considered again. Section 2.1.3 discusses the definition of mindfulness and its effect on meditation. In considering this, I am able to create the category "Content and Guidance", which comprises Mindfulness Activities, Data Privacy, and Guided Meditation. This category emphasizes how important ethical issues and high-quality content are to offering satisfying meditation experiences. While data privacy continues to be a crucial concern in protecting user trust and security, high-quality content and complete instructions are necessary to guarantee that users can carry out meaningful and beneficial meditation sessions.

5.1.3 Usability and customization

The next category is based on the importance of personalization, which was discussed in section 2.4 and emphasized in the Kosunen et al. (2016) article. I may consider this category, which includes Gamification, Personalization, and Simplicity, "Usability and

Customization". This category emphasizes the requirement for flexible and simple features that fit personal preferences and improve the user experience in general. Users can customize their meditation experiences to fit their unique requirements and preferences with the help of personalization, which may significantly increase satisfaction and loyalty. Simplicity keeps the meditation process approachable and simple to use, while gamification features can add a fun and motivate to use it again.

5.1.4 Social and interaction

The last positive theme category is "Social and Interaction", which focuses on the social side of meditation in the VR-enabled metaverse. The importance of social elements in the metaverse discussed in sections 2.1.4 and 2.4 from the paper of Park and Kim (2022), provides additional support for this classification. Recognizing the importance of community and social connectivity in improving the meditation experience, this category was included. Users may feel more supported and connected when using social features, which improves the collaborative and expanding nature of meditation.

5.1.5 Technical limitations

On the other hand, there are four themes that should be avoided, as I have noted. Weak Equipment and Limited Environments are clearly technical aspects, so I can categorize them as "Technical Limitations".

5.1.6 User experience challenges

Since Complexity and Isolation are also user experience-related themes, I can combine them under the title "User Experience Challenges". This classification helps in locating and removing possible obstacles to the best feasible meditation experience. While user experience issues like complexity and isolation may decrease the simplicity and enjoyment of meditation, technical limitations can also make the experience less immersive.

5.1.7 Final framework

After all these explanations, I create a structured framework that captures the "should have" and "should avoid" features of meditation in the VR-enabled metaverse experience for users by grouping the themes in this way. This framework will help developers and researchers concentrate on improving features that are advantageous while reducing any possible disadvantages. Following our analysis of the interviews, I developed this framework, which is illustrated in Fig. 1. This methodical approach guarantees a comprehensive understanding and real-world application of the results. It offers precise guidelines for further research and development, providing that the metaverse can be used to improve meditation techniques.

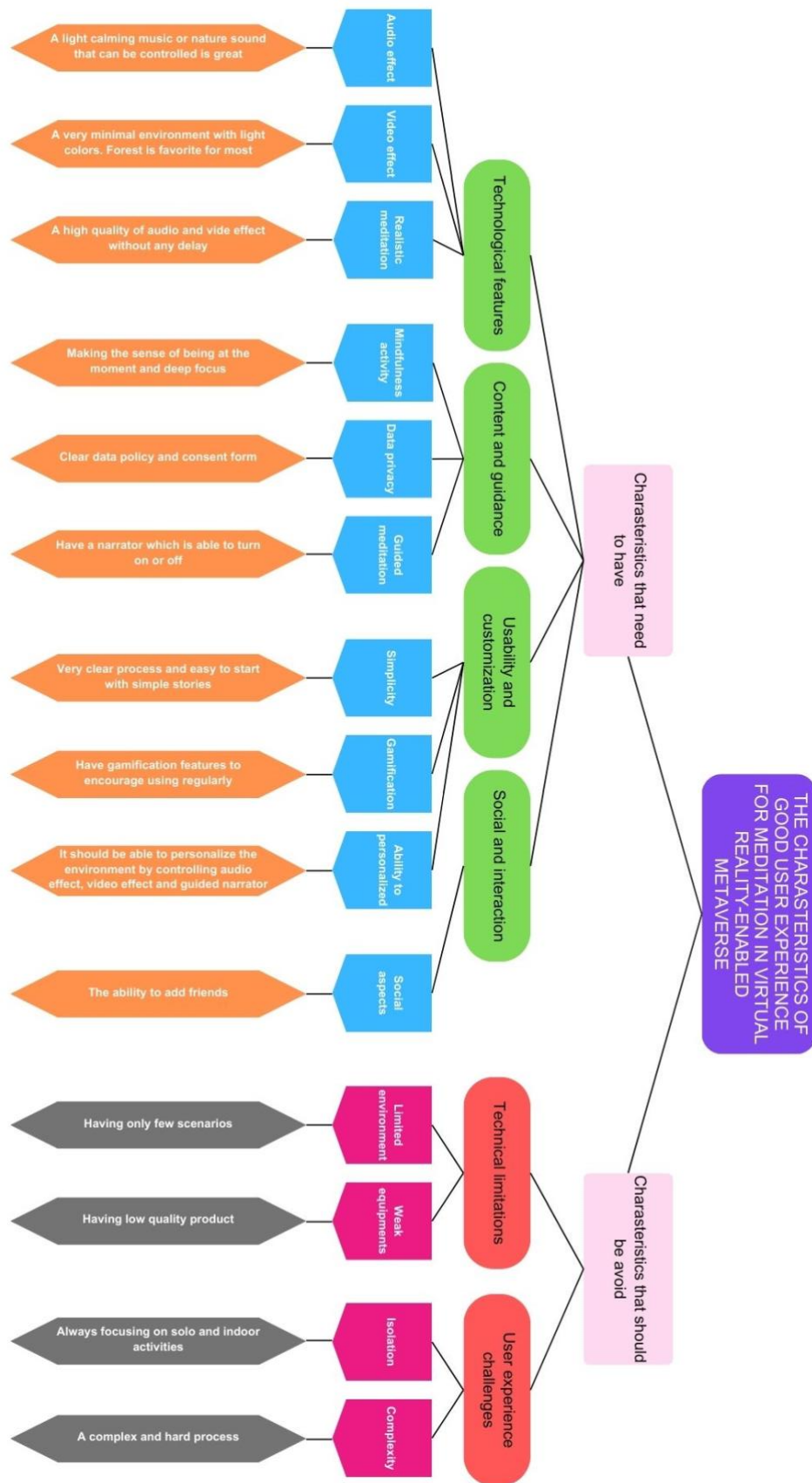


Figure 1: The framework of "Characteristics of good user experience of meditation in VR-enabled metaverse"

It is expected that the final environment for meditation within the virtual reality-enabled metaverse will achieve a high level of user experience and satisfaction by following this framework with the specified requirements. The comprehensive approach guarantees the precise integration of all crucial components, from technological features to content and guidance, usability and customization, and social interaction. Based on the definition of UX at part 2.1.1, the outcome of this framework can make a good user experience for meditation in VR-enabled metaverse. As a result, users will find that the meditation experience meets their needs and expectations by being both personally fulfilling and personally meaningful in addition to being effective and immersive. However, it is still not very concrete, but it can be a good tool for using as a test and evaluation in some cases.

5.2 Barriers of adopting metaverse

As was previously mentioned, Park and Kim (2022) identified three main issues related to the metaverse: importance for interdisciplinary research, ethical and privacy concerns, and medium selection. As described in Section 2.3, I have proved the validity of these challenges in a variety of contexts through interviewing and carefully examining the data. In particular, four participants expressed concerns about the weight and expense of VR equipment during our interviews, demonstrating the potential distractions that controllers may cause, as mentioned in Section 4.4.2. Also, a participant raised concerns about data privacy and emphasized the significance of strict regulations in that field. Furthermore, two participants emphasized the need for extensive studies including a variety of domains, such as the various types of meditation practices and the changing expectations within the metaverse environment.

5.3 Used technology for meditation

According to Li and Leshed's (2022) research, there is a widespread use of mobile apps like Headspace or Calm, as well as platforms like YouTube and Spotify, for meditation. Participants in the interviews confirmed that these tools are widely used for meditation practices. It's interesting to note that Headspace was the platform of choice for respondents every time they were asked to discuss excellent meditation apps.

Many articles mentioned that the main way of accessing to metaverse world is possible with VR technology, as it is a virtual world and can make immersion feeling. I also consider this fact for our interviews based on article by Dasedmir (2022) and Zallio and Clarkson (2022). While I was doing the interview, participants confirmed this and accepted that VR technology is the key to access to the metaverse and they told me about their experience with VR goggles. It is believed that humans may achieve things in the metaverse that are not possible in the real world. The articles mentioned that an immersive virtual environment known as the metaverse allows users to experience it in person. Moreover, it can be considered a social media or navigable internet page. This virtual world will be accessible to us because of to the VR industry.

5.4 Metaverse instead of real world

In the paper of Navarro-Haro et al. (2017), they proved that VR technologies have a positive effect on meditation and it is accepted by meditation experts. This fact was proved by our interview participants, but they did not eliminate traditional meditation

from their routine and I mentioned in part 4.1. This choice demonstrates how important and valuable traditional meditation techniques are to them on every day of their lives. Although the incorporation of metaverse technology presents new possibilities and can enhance their meditation practices, it is impossible to entirely replace traditional approaches. According to our research, users view metaverse-based meditation as an alternate to traditional meditation techniques rather than as a replacement for them at all times.

5.5 The effect of personalization

It became clear that personalization is an important component that influences multiple aspects of the meditation experience directly. A high demand for customization options was shown by participants in several areas, such as audio effects, visual effects, scenarios, guided meditation, and social aspects. They underlined the important role of customizing their meditation practices to fit with their specific needs and preferences. The previously mentioned feedback reflects the crucial role that personalization plays in enhancing users' satisfaction and engagement levels.

But vendors and developers might find it difficult to implement a high level of personalization. It takes significant resources and cutting-edge technology to develop customizable options. The noticeable need for customized experiences demonstrates the need for the sector to give this feature top priority, regardless of these possible obstacles. They will be able to develop more user-focused meditation apps that fulfil the various needs of their target market by doing this.

Furthermore, integrating AI technology to identify and recommend the best meditation techniques for users can greatly improve the overall experience. Some of the participants said they would like AI to sense how they are feeling at any given time and modify the meditation environment based on their willingness. Users can benefit from a more effective and individualized experience that provides to their unique needs at any given time by using AI to customize the meditation session to each individual's emotional state. However, it needs to do cognitive analysis for the users which might take some time, but definitely, the result would be satisfying for the user. With this advanced customization, the meditation practice can become more meaningful and impactful, leading to increased satisfaction and deeper engagement.

6. Conclusion

6.1 Summary

Meditation in a VR-enabled metaverse can be a wonderful experience for anyone who likes technology. For doing this experience, nobody doesn't need to be a geek; everyone can enjoy it and it has a great potential for growth within the next few years. So far, there are only a few applications that you can try meditation in a VR-enabled metaverse world, so it has a blue ocean market. Here I can mention about the summary of the research by focusing on the framework that mentioned in part 5.1.7. It is better to just mention the research question for the last time. Our research question was: What are the characteristics of good user experience for meditation in VR-enabled metaverse? I did 10 interviews with participants who did meditation regularly and familiar with the terms of metaverse and VR technologies. After analyzing their interviews, I reached some characteristics that should be in order to reach a good user experience for meditation in the VR-enabled metaverse and some other characteristics that should be avoided in order not to reduce the enjoyment of this experience. Fig. 1 illustrates all of these characteristics in their category. The figure shows that a perfect environment for doing meditation in a VR-enabled metaverse has light calming music, a minimal environment with light colors, without any delay, making a sense of mindfulness, a narrator, a clear data policy, with a very simple process, with some gamification features, with ability to personalize many of the features and ability to add friends. Also, it doesn't have complexity, limited environment, weak hardware, and encouraging isolation by solo and indoor activities. By following these features, it is expected to have a satisfying experience for users.

6.2 Implications for research and practice

This study highlights the potential and difficulties of this growing area while offering insightful information about the practice of meditation within the metaverse. By reading this study and its result, you can completely get familiar with keywords and their relation. The results of this study can be a valuable resource for developers and researchers who want to design metaverse environments that are both user-friendly and immersive for meditation. These insights are also helpful for practitioners and enthusiasts who want to know how they can integrate meditation techniques into VR environments. This study provides a thorough guide for anyone wishing to investigate or innovate in a combination of meditation and the metaverse by addressing the essential components that improve user experience and highlighting typical difficulties.

6.3 Limitations

The sample size and participant diversity could be one of the study's limitations. It is possible that the results cannot be applied to a larger population if the study's sample was small or similar. Ten members of my network were interviewed for the study, but a larger sample size of perhaps thirty or fifty participants would have produced far more trustworthy results. However, analysing the interview data in that the above scenario takes more time.

The possibility of participant self-selection bias is another possible limitation. Volunteers for the study may have had different experiences and views on virtual meditation than

non-participants because they may have had prior interest in technology or meditation. This bias may introduce unpredictable variables that could affect how the results will be understood and affect the study's internal validity. Future research can potentially address this limitation by utilizing random sampling techniques or putting strategies in place to reduce the bias caused by self-selection.

Another limitation was the familiarity of the participants with the topic. The percentage of the people who do meditation among the personal network was less than 20% and between these people, finding suitable candidate who know about the metaverse was hard. The concept of the metaverse is still quite new for many people and due to the access of people to VR equipment, the number of people who have experienced meditation in VR-enabled metaverse before was truly low.

6.4 Future work

It is necessary to validate this framework technically when I present a framework for enhancing the user experience of doing meditation in VR-enabled metaverse. For example, an environment for VR goggles with a perfect application should be created based on the result of this research. The various components of the framework should be evaluated for effectiveness through careful testing. This means that interviewing a wide range of participants and getting feedback on their experiences and feelings in this customized setting is crucial. Verifying the proposed framework's usability and efficiency in real-world scenarios and environments requires this empirical validation process. It is worth mentioning that if participants felt uncomfortable or felt bad during the virtual meditation sessions, that might cause concerns regarding ethics and collapse the study's credibility.

Integrating this experience with biofeedback electronic equipment like smart watches, wearable sensors, and heart rate monitors may also be very interesting for future research. An accurate technical implementation is required to measure various participant factors.

Also, the effect of AI can be a good topic for discussion. In this research I just mentioned about AI and its benefits few times, but it is good to completely investigate on how AI can do the whole process and helps to have a better experience.

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Appendix A: Consent form

Consent Form

Title of study: Characteristics of good user experience for meditation in virtual reality-enabled metaverse

PRINCIPAL INVESTIGATOR: ARYA YAGHOUBI

We would like to invite you to take part in a research study that looks into how people use meditation in the VR-enabled metaverse. It is crucial that you understand the goals of the study, the methods involved, and your rights as a participant before choosing to take part. Kindly ensure that you carefully read the following information. Please do not hesitate to contact the principal investigator if you have any questions or concerns.

Study Details:

Purpose: The purpose of this research is to learn more about the experiences and feelings of people who are meditating in metaverse, and the tools can be Virtual reality. Your participation adds insightful viewpoints that could improve our comprehension of the relationship between virtual technologies and meditation traditions.

Procedures: In the event that you consent to take part, you will be asked to answer questions about your meditation in metaverse in an interview. Topics including your background, metaverse participation, meditation techniques, and opinions on the user experience will all be covered during the interview. The data gathered will be anonymous and utilized exclusively for scientific investigations.

Risks: There is no foreseeable risks associated with participating in this study.

Benefits: By taking part in this study, benefits include contributing to the advancement of knowledge in the field of meditation in metaverse.

Voluntary Participation: There is no cost associated with your participation in this study. You are free to stop participating at any moment and without explanation. Your relationship with the researcher will not be impacted by your choice to participate or not.

Confidentiality: The highest level of confidentiality will be maintained for your answers. Only the research team will have access to securely stored personal data. Every effort will be made to protect participants' anonymity in any publications or presentations that come out of this study.

Compensation: There won't be any payment made in exchange for your participation in this study but we prepare a small refreshment for you as appreciation.

Duration of the study (how long will personal data be processed): Gathering the research material will be completed during winter and spring 2024. After that the research material will be processed and archived as it is for long-term research by INTERACT research group. Personal data will be processed in following the General Data Protection Regulation Article 6(1): participant consent. Material that can be fully anonymized may also be opened in an important national or international archive or storing service.

More information about the processing and archiving of the personal data can be found in the INTERACT research unit's data privacy notice: <https://interact oulu.fi/site/data-privacy-notice>

I have read and understood the information provided above.

Name and family name:

Date:

Signature:

We appreciate you considering taking part in our study. We appreciate your cooperation and support. Please feel free to get in touch with us through Email to Arya.yaghoubi@student oulu.fi if you have additional questions or concerns.

Sincerely,

Arya Yaghoubi

Appendix B: Interview questions

Initial questions:

1. How often do you do meditation? How long are you doing meditation?
2. How do you do meditation? Can you describe it? (like Solo/group, with/without tech devices, kind of tools)
3. What are your goals when you are doing meditation?
4. What are the benefits of meditation for you? When did you feel them for the first time?
5. How much do you know about metaverse? How about VR?
6. How often do you use metaverse? What are your goals for using it?
7. Can you describe your ideal type of meditation that you usually do and you like?
(Duration, tools, with whom, where)

Technical questions

1. Looking back on your experiences, what do you think is the most important meditation? How about metaverse?
2. How do you evaluate the quality of your meditation experiences? Let's ask in the real world and in metaverse
3. From your point of view, what is the definition of "good user experience" when talking about meditation within the metaverse?
4. Could you give some examples of playful features or enjoyable moments that have benefited your meditation routines? In both real world and metaverse
5. Last but not least, If you imagine a perfect meditation experience in metaverse, what would it be like? What would you do, how it would feel, what would be offered by technology?
6. And who can you introduce for this interview?