IBRAHIM SERAY KHAN

PERCEPTIONS OF UNIVERSITY STUDENTS ON THE INTEGRATION OF METAVERSE IN HIGHER EDUCATION

MASTER THESIS

NICOSIA
JUNE,2023

NEAR EAST UNIVERSITY

INSTITUTE OF GRADUATE STUDIES

DEPARTMENT OF COMPUTER INFORMATION SYSTEMS

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June, 2023

Approval

We certify that we have read the thesis submitted by Ibrahim Seray Khan titled **"Perceptions of university students on the integration of metaverse in higher education"** and that in our combined opinion it is fully adequate, in scope and in quality, as a thesis for the degree of Master of Educational Sciences.

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Declaration

I hereby declare that all information, documents, analysis and results in this thesis have been collected and presented according to the academic rules and ethical guidelines of Institute of Graduate Studies, Near East University. I also declare that as required by these rules and conduct, I have fully cited and referenced information and data that are not original to this study.

Ibrahim Seray KHAN

10/ 06/2023

Acknowledgement

I want to start by saying how appreciative I am to my diligent advisor and supervisor Professor Dr. Fezile Ozdamli for her unflagging support, direction, and provision of all the necessary knowledge and research resources to enable me to complete my thesis within the allotted time.

In addition, I want to thank the Department of Computer Information Systems at Near East University and Prof. Dr. Nadire Cavuş for their support during my academic career. I also like to thank the jury for their insightful comments.

A particular thanks to my aunt, Mrs. Mariama Lahai for her unwavering financial assistance throughout my academic career.

I would also want to thank my wife, Makalay Fofanah, my kids Seray Ibrahim Khan and Humarr Khan for their courageous words and inspiration, as well as my whole family for their contributions in helping me achieving my goal. I want to express my gratitude to my brothers and sisters for their support and unwavering affection, as well as to my father, who taught me to learn through challenging situations, and to understand the importance of learning for its own sake.

Finally, I am grateful to my colleagues that I met along this challenging path. They had always been there for me when I needed them. Thank you very much for all of your help. I am grateful to everyone who contributed to the success of this adventure.

Dedication

This study is dedicated to Mrs. Mariama Lahai, who has served as a source of reliance for me, and to my late mother, Miss Mary Juana-Kamara, who was there to see the realization of my aspirations.

Abstract

PERCEPTIONS OF UNIVERSITY STUDENTS ON THE INTEGRATION OF METAVERSE IN HIGHER EDUCATION

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Professor Dr, Fezile Ozdamli (Supervisor)

June, 2023, 91 pages

In order to understand how college students in the Turkish Republic of Northern Cyprus feel about using the Metaverse as a teaching tool, a descriptive survey design is used using a close-ended questionnaire to gather data. 383 students took part in the research, which was carried out throughout the school year 2022–2023. Five sections of a survey were given to these participants: demographics, Metaverse tools and devices, Metaverse use proficiency, advantages of Metaverse apps, and accessibility of Metaverse-based applications.

The majority of students, according to the research's findings, had never used the Metaverse before, but they were enthusiastic about its potential for use in education. Students recognized the Metaverse's potential in a variety of academic fields and thought it may improve their comprehension of certain concepts. Additionally, students claimed that incorporating the Metaverse into their classes might improve learning, motivate students more, and have other positive effects on education. They also believed that the Metaverse will someday be integrated into traditional schooling.

Nonetheless, students identified a number of problems linked with the Metaverse. These include the likelihood of complicating the learning process, serving as a distraction, creating a distance from real-life events, and weakening classroom discipline. The study's conclusions recommend allowing students' access to the Metaverse while also integrating Metaverse-related apps into the classroom to teach them about cutting-edge technologies.

Keywords: augmented reality, higher learning, metaverse, mixed reality, students' opinion, virtual reality.

Özet

ÜNIVERSITE ÖĞRENCILERININ YÜKSEK ÖĞRETIMDE METAVERSE ENTEGRASYONUNA ILIŞKIN ALGILARI

HAN, İbrahim Seray

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Haziran 2023, 91sayfa

Kuzey Kıbrıs Türk Cumhuriyeti'ndeki üniversite öğrencilerinin Metaverse'yi bir öğretim aracı olarak kullanma konusunda ne düşündüklerini anlamak için, veri toplamak için kapalı uçlu bir anket kullanan tanımlayıcı bir anket tasarımı kullanılmıştır. 2022–2023 eğitim-öğretim yılı boyunca gerçekleştirilen araştırmaya 383 öğrenci katıldı. Bu katılımcılara bir anketin beş bölümü verildi: demografi, Metaverse araçları ve cihazları, Metaverse kullanım yeterliliği, Metaverse uygulamalarının avantajları ve Metaverse tabanlı uygulamaların erişilebilirliği.

Araştırmanın bulgularına göre, öğrencilerin büyük çoğunluğu Metaverse'i daha önce hiç kullanmamıştı, ancak eğitimde kullanım potansiyeli konusunda hevesliydiler. Öğrenciler, Metaverse'nin çeşitli akademik alanlardaki potansiyelini fark ettiler ve belirli kavramları anlamalarını geliştirebileceğini düşündüler. Ek olarak öğrenciler, Metaverse'i sınıflarına dahil etmenin öğrenmeyi geliştirebileceğini, öğrencileri daha fazla motive edebileceğini ve eğitim üzerinde başka olumlu etkileri olabileceğini iddia ettiler. Ayrıca Metaverse'nin bir gün geleneksel eğitime entegre edileceğine inanıyorlardı.

Bununla birlikte, öğrenciler Metaverse ile bağlantılı bir takım problemler belirlediler. Bunlar, öğrenme sürecini karmaşıklaştırma, dikkati dağıtma, gerçek hayattaki olaylardan uzaklaşma ve sınıf disiplinini zayıflatma olasılığını içerir. Çalışmanın sonuçları, öğrencilere en son teknolojileri öğretmek için Metaverse ile ilgili uygulamaları sınıfa entegre ederken aynı zamanda öğrencilerin Metaverse'e erişmesine izin verilmesini önermektedir.

Anahtar Kelimeler: artırılmış gerçeklik, yüksek öğrenim, sanal evren, karma gerçeklik, öğrencilerin görüşü, sanal gerçeklik.

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List of Abbreviations

AR: Augmented Reality

BAU: Bahcesehir Cyprus University

CIU: Cyprus International University

ELEM: E – Learning environment

GAU: Girne American University

HMD: Head Mounted Display

MR: Mixed Reality

NEU: Near East University

NFT: Nonfungible Tokens

NPC: Non Playing Character

SL: Second Life

SPSS: Scientific Package for Social Science

STEM: Science Technology Engineering and Mathematics

TRNC: Turkish Republic of North Cyprus

VLC: Virtual Learning Community

VR: Virtual Reality

XR: Extended Reality

2D: Two Dimensional

3D: Three dimensional

CHAPTER I

This chapter provides information about the topic at hand, the study's goal, its importance, its limitations, and its historical context. It also explains the problem at hand. It further provides a summary of the thesis.

Introduction

A new kind of social media network and internet application called Metaverse integrates a number of cutting-edge technologies. An immersive augmented reality experience is created by the seamless blending of the physical and digital worlds within the framework of the social, economic, and identification systems. It duplicates a virtual reflection of the actual environment with cutting-edge digital twin technology. In order to create an economic structure, the platform uses blockchain technology. This gives users the ability to create content and customize the virtual environment to their tastes. The notion of the metaverse is constantly changing, and individuals are actively contributing important contributions through many new techniques. Human communication is constantly evolving from a technical perspective, which has resulted in the development of new technologies, the confluence of several technological developments, and the advent of internet applications (Ning, 2021). The phrase "metaverse" also implies a space in which normal interactions between people and businesses take place (Pande, 2021). As a result, it is critical to understand the concept of the metaverse, its many manifestations, and prospective applications in the field of education.. (Karacan, 2021).

The incorporation of immersive technologies like Virtual Reality (VR), Mixed Reality (MR), Augmented Reality (AR), and Extended Reality (XR) can be credited with the increase in popularity of the Metaverse in many educational contexts. Due to this development, students may now take part in virtual courses and encounter components that are similar to those seen in traditional classrooms. The ability for students to communicate with their instructors and connect with their peers using avatars is one of the benefits of the Metaverse. The possibility for immersive learning has the ability to boost students' academic motivation. (Kye, 2021).

Both Second Life and the hugely well-liked online role-playing game World of Warcraft had already achieved substantial reputation and were highly regarded. (Wiederhold, 2022). In the months that followed Mark Zuckerberg's original presentation of the idea in October 2021, the Metaverse attracted a lot of attention and acquired enormous popularity. Many educators and academics have started implementing the concept into their teaching methods, providing diverse implementation strategies and future goals. The immersive virtual environment that provides accurate portrayals of people, strengthening the social elements of teaching and learning, is one of the causes contributing to the growing popularity in the educational sector. The Metaverse has undergone several definitions and analyses since it was first introduced, covering ideas like embedded Internet, spatial internet, global mirror, and collaborative virtual space. (Lee et al., 2021), an innovative Internet application and social structure that makes use of several modern technologies (Ning, 2021), The post-reality world is a persistent, interactive place in which physical reality and digital virtuality coexist endlessly for various users (Mystakidis et al., 2022), Omniverse: a collaborative and interactive environment (Lee et al., 2021).

Audiovisual-based education is a key Metaverse use with a lot of room for expansion. Experiential learning is important because it bridges the gap between what you read and how you feel when you encounter something. It is possible to observe the effects on schooling that are considered while technically and scientifically assessing and interacting with radioactivity in the Metaverse through the use of the Metaverse (Sung, 2021)**.** Both what is taught and how educators educate have been significantly changed by technological advancement and innovation. All colleges will need to reconsider where, what, when, and how students study if they want to stay ahead of the latest trends. It is crucial to modify the way pupils learn. In order for to engage learners in studying in a particular way that is much more active and independent, teachers must adopt a more pluralistic and entrepreneurial approach (Gonzalez, 2013).

Background

A significant change has occurred as a result of the widespread usage of the internet and the adoption of internet-based technology in our daily life. The kind,

volume, and applications of information have evolved. A number of new technologies were also brought about by the internet and associated technologies. Among these is the technology known as Metaverse. The concept of the virtual world was developed, and this technology has permeated our lives (Dionisio et al., 2013). Neal Stephenson initially discussed the "metaverse" in his science fiction book Snow Crash, which was published in 1992. In the video game Snow Crash, the heroes change into avatars and live in the metaverse, a three-dimensional (3D) virtual environment. (Kye et al., 2021).Since its inception, the idea of the metaverse has undergone different definitions, including that of a second life. A well-known online virtual environment in three dimensions as "Second Life" was created in 2003 and was influenced by the science fiction book Snow Crash. Users could communicate with other players, move around in a virtual world with their avatars, and carry out acts in the game that they couldn't carry out in the real world. The gamers have purchased a plot or engaged in other activities, such as selling digital relics, since they believe they have a second life (Şahin, 2022). Second Life was founded in 2003 by Philip Rosedale.

It’s worth to students and instructors was clear from the start (Moro, 2017). Second Life, Zepeto, Roblox, Minecraft, Gather Town, and Fortnite might be regarded as the most well-known virtual worlds on metaverse platforms. These systems offer users access to virtual worlds using cutting-edge 3D (3D) visuals (Park & Kim, 2022). Since then, the metaverse has manifested itself in numerous ways all around us, but interest in it has been rising globally in recent years (Narin, 2021). This phenomenon is due to four factors. First, the visuals have improved thanks to technology developments like 5G and 3D rendering, giving the metaverse a more realistic sense. In addition, faster Internet connections have made it possible for users to enjoy the metaverse immediately. Second, there is a higher need for non-face-to-face services resulting from the continuing COVID-19 epidemic. Third, the influence of the digitally native Generation Z has grown, leading to shifts in cultural consumption habits. Fourth, accessibility to the metaverse is now possible at any time and from any location because to the widespread use of mobile devices and changes in content kinds (Suh., 2022).

The transformation and improvement of human contact, communication, and social ties has a huge influence on everyday life. From the viewpoint of end consumers,

three major waves of technical advancement have been noted: the introduction of personal computers, the Internet, and mobile devices. Spatial, immersive technologies like virtual reality (VR) and augmented reality (AR) are driving the fourth generation of computing innovation right now (Mystakidis S. , 2022). The communities Education, learning, and growth are all ongoing processes. Searching for new ways to combine platforms like the Metaverse with current pedagogical approaches.. Perhaps more than any other sector, education and training require innovation. Because of how educational institutions operate like schools and colleges actively mold young people for futures that go beyond the job (Mustafa, 2022). An environment with multiple users that combines virtuality and reality is called the Metaverse. This tidal wave has the capacity to revolutionize (online) knowledge, commerce, distant jobs, and amusement. Despite technological advancements, Learning is a vital component as implementation strategies are concerned, for society and the economy stay constant. The Metaverse solves the inherent drawbacks of 2D online educational resources on the internet. (Friesen, 2017)**.** In reality, there isn't much of a gap between the notion of bringing people into the virtual world and the usage of computers at home. In comparison to today, computers and the Internet were in a rudimentary state from the 1980s, when personal computers first entered our lives, to the Web 1.0 era, during the 1990s and 2000s (San, 2022).

A Piece of history of metaverses

We'll look at a range of activities and developments that have occurred in the Metaverse at various stages across time.

Prior to the 1990s, a 3D picture was produced from two single images using lenses that incorporated depth perception. That theoretical idea is applied by VR headsets. Pygmalion's Spectacles, a 1935 novel by Stanley Weinbaum. A character in this story put on glasses for a made-up world's sight, sound, taste, experience, and contact (Jovanovi¢, 2022). A virtual journey of Aspen called “The Aspen Film Map” was produced by MIT in the 1970s. VR first used as a means of human transportation (Anable, 2012). In the 1990s, the word "Metaverse" was introduced in the 1992 book Snow Crash by Neil Stevenson. The Metaverse was a tool that Stevenson's characters utilized to flee totalitarianism. In 1998, Sportsvision aired The first NFL game in which

a yellow yard banner was used. Since then, many sports commentators have begun to use images to overlay on top of real-world imagery. (Taylor, 2015). Another vivid environment created is in the 2011 film "Ready Player One" (Cline, 2012). In 2018, Steven Spielberg turned the book into a movie (Spielberg, 2018). VR headsets were presented by Sony, Samsung, and Google in 2014 (Muensterer, 2014). Affordable Google Cardboard, VR viewer for smartphones. Hololens headsets from 2016 provided both AR and VR. Hololens uses augmented reality to produce and manipulate holographic pictures. In 2016, people all around the world used Pokemon GO to capture Pokemon (Evans, 2017). For use with MR and AR headsets, Apple incorporated Lidar to iPhones in 2020. Two other businesses have introduced Wearable equipment (Ray-Bans Stories) and virtual reality headsets that resemble eyeglasses (Ray-Ban Stories and HTC Vive Flow). To underscore its dedication to becoming a leading force in the creation of the Metaverse, Facebook formally In 2021, it was renamed Meta. (Rodriguez, 2021).

Problem statement

Understanding these students' perspectives on usage of this technology in learning is the major goal of a study project on how university students perceive the integration of higher education uses metaverse technology in learning. In addition, the project will investigate how these impressions change depending on demographic and technological elements including age, gender, past technological experience, access to, and familiarity with, virtual reality technology. The results of this study will provide important light on the opportunities and difficulties that come with the prospective deployment of metaverse technology in higher education.

Aim of the study

This research will look into university students' perspectives and give guidance for the use of metaverse-based learning in higher learning. This study's contribution is to identify the benefits and drawbacks of the metaverse -based learning for learners. As a result, researchers and educators may find this study useful in furthering their research into metaverse-based teaching (Grant, 2012). It will be able to gain insight into how educational surroundings may be used more effectively as a result of the opinions

gathered. The study is crucial for educating pupils about the Metaverse. Once more, by understanding the challenges students face while in the Metaverse, a more optimal teaching environment may be created (Talan, 2022).

To meet the study's goal, the response was to look for the following research questions.

1. What are the metaverse tools usage levels of higher education students?
2. What are the metaverse technology usage levels of students?
3. What are the perceptions of students towards the metaverse?
4. Is there a difference between male and female students' perceptions towards metaverse applications in education?

Significance of the study

The metaverse has the potential to change a wide range of business sectors, including online distance learning. To facilitate rich, blended formal and non-formal learning experiences on online 3-D virtual campuses supported by the Metaverse, new metaeducational models may develop. In this way, being physically present in a classroom will be unnecessary due to online education in the Metaverse.

- **Researchers:** People who are interested in conducting research in this area may find this study useful because it offers pertinent information that can support their research.
- **Users:** the authenticity of body language and facial expression, as well as virtual engagement, are said to be guaranteed by the avatar (Kye, 2021). By utilizing the mixed social reality of the Metaverse, it may be possible to incorporate a variety of interactive teaching techniques that foster a deeper and longer-lasting comprehension. More significantly, it guarantees equitable access to education for all people by fostering a democratic atmosphere devoid of regional boundaries.

  The education industry is anticipated to make extensive use of the metaverse and its components. It is noted that in the Metaverse reality, Ideas like race, gender, and physical incapacity should be diminished (Kuş, 2021).

  It should be noted that, it is also anticipated that this method may be used to overcome the challenges faced in education throughout the Covid-19 process

(inability to focus, inability to follow teachings, inability to speak properly, inability to engage in class, lack of evaluation, etc.). The knowledge, attitudes, and awareness of our educators and other practitioners of education about the notion of the Metaverse must be ascertained in light of this (Eşin, 2022).

The research's Limitations

This study has a number of limitations. The following are the limitations identified in this study:

- The study was completed in a short amount of time during the spring semester of 2022-2023. However, further recommendations for a longer time of research are suggested.
- The study solely looks at active students who are enrolled at the aforementioned universities.
- This study's results are constrained by the author's resource constraints.

Overview of the thesis

The research was separated into various chapters, each of which is discussed in further detail below:

Chapter one is an introductory chapter that introduces readers to the research and provides a full summary of the study's key components. These components include the study purpose, problem statement, importance, and a succinct overview of the findings in the ensuing chapters. It also describes the target audience and underlines the potential benefits and interests connected with participating in this research project.

Chapter Two provides a comprehensive elaboration on the subject matter, delving into its intricacies. This chapter assumes the role of the study's core section and holds significant importance in grasping its central thesis.

Chapter Three includes a detailed discussion of the conception of the research project, including an in-depth explanation of the participants and their selection procedure. It also includes the data gathering instruments, data analysis techniques, and a complete explanation of the study timeline.

Chapter Four reveals the results of the research. The findings are then compared to the major objectives of the study.

Chapter Five provides a complete assessment of the whole study, with an emphasis on the collected results and significant insights into future research prospects. The researcher elaborates on the research findings, emphasizing their relevance and ramifications. Furthermore, emphasis is placed on admitting some limitations inherent in the study, as well as ideas for how these flaws might be addressed in future research endeavors.

CHAPTER II

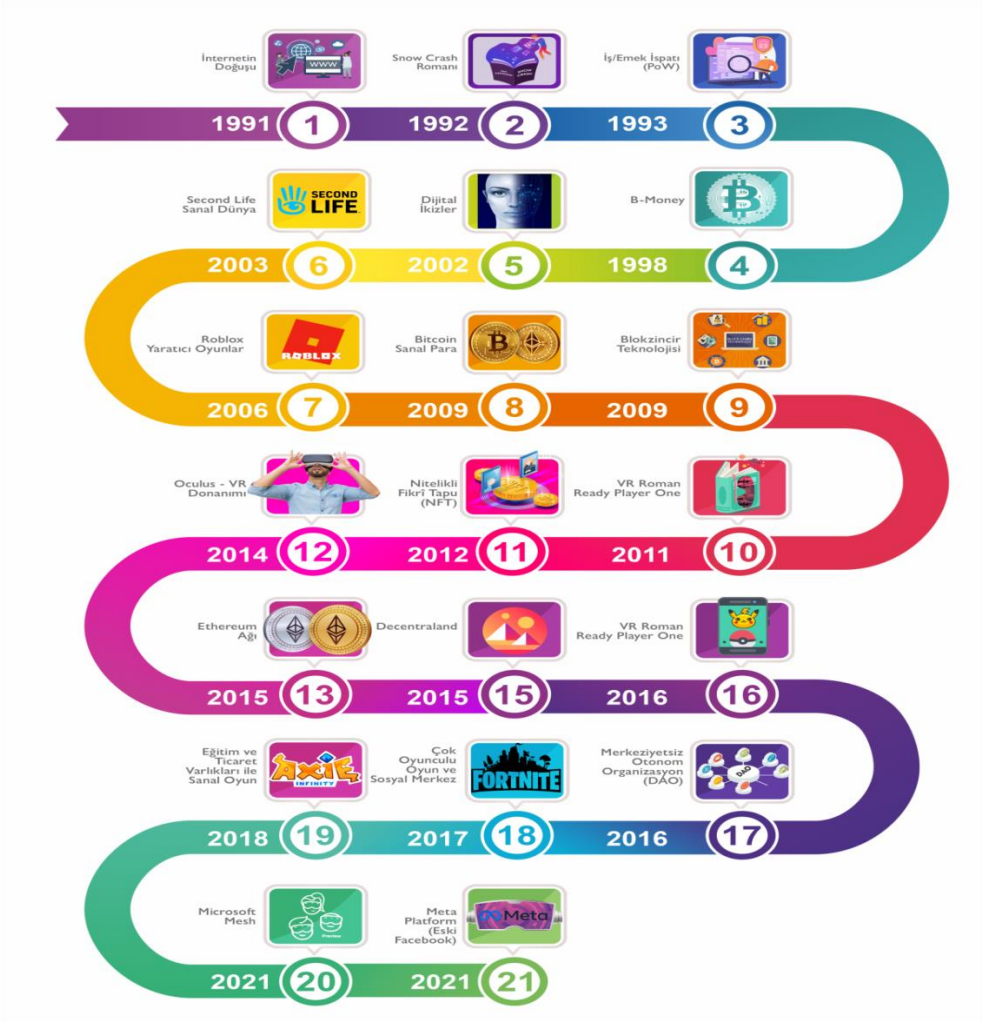
Theoretical Framework and Literature Review

This chapter provides a description of the study's theoretical foundation. The usage of the metaverse in education is covered in this chapter. Additionally, this chapter discusses analogous studies that have been carried out by other researchers and make use of the same ideas.

Theoretical Framework

Figure2.1:

History of the metaverse from the era of widespread Internet use until the present (Göçen, 2022)**.**



Metaverse

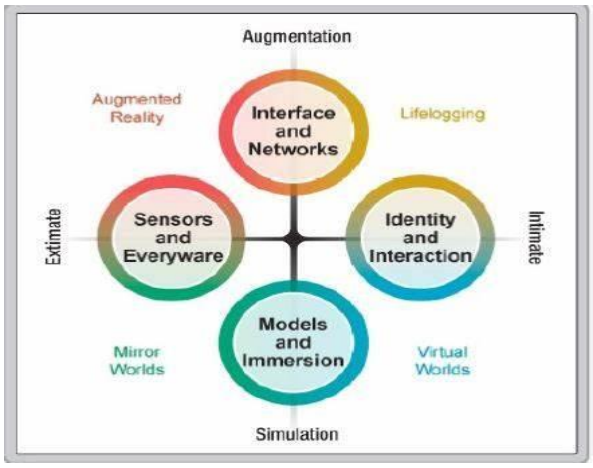
The phrase "Metaverse" is used by Wang et al. (2022) to describe settings and other computer-generated components where users (represented by avatars) may interact, collaborate, and socialize using any smart device. The three realms of the physical, human, and digital worlds are united to create the metaverse. A number of cutting-edge technologies are integrated into the metaverse (Duan et al., 2021). To make the metaverse a reality, we must take into account technologies like the Internet, social networks, gaming, and virtual worlds. The metaverse is being built with the help of the emergence of augmented reality and virtual reality, as well as blockchain, edge computing, high-speed networks, and AI (Lee et al., 2021). The Metaverse is vast and evolving, and there are many definitions and associated concepts. According to whether the implementation is taking place in a virtual or reality-centered environment, and whether the data which is being utilized is categorized into four groups: life-logging, mirror world, augmented reality, and virtual world. These groups are focused on either the self or the external environment. (Lee et al., 2011).

In order to categorize the many types of the metaverse, the metaverse roadmap included two axes. These are "augmentation vs. simulation" and "intimate versus exterior," respectively. Simulator and augmented reality technology may differ further depending on whether the data will be utilized for virtual reality or real-world applications.. The use of augmentation technology adds extra information on top of the world around us. By simulating reality, simulation technology creates a distinctive world. It uses a variety of ways to make the virtual environment a place where people may engage (Kye, 2021). The inner world and the metaverse are the two primary realms in virtual reality. The primary subjects of the inner world are who a person or thing is and what they do. The user is often the center of attention while discussing the external environment. This additional dimension for categorizing programs based on whether they provide information about the user's internal or external surroundings is provided by these internal and external frameworks (Smart et al., 2007). By creating a metaverse, a university can create a campus or a virtual replica of its campus. With its classrooms, cafeterias, and faculty quarters... Students, professors, and other center personnel may interact and communicate instantly using video calls or videoconferences, just as if they

were in the room together. (Moolenaar, 2015). Today, In their everyday work, all educators employ a variety of digital technologies, whether it is for online learning, material sharing, or exam administration, among other things. The usage of augmented reality in the classroom, where students can wear augmented reality glasses to access virtual content while in class, is one example of how cutting-edge technology is already used in other contexts (Touraine, 2005). Figure 2 displays a novel kind of metaverse based on quadrants. The vertical axis shows how technology and reality are related to each other, while the horizontal axis shows how technology and users are related to each other. (Yu, 2022).

Figure 2.2

Diagram illustrating the four forms of metaverse (Kye, 2021).



Blockchain

Blockchain technology makes it possible to move assets, be transparent, connect, and create decentralized digital possession evidence. With cryptocurrency, individuals may work and socialize while transferring money in three dimensions. The virtual territories of Decentraland may be purchased using bitcoin. Players can purchase 16 16-meter nonfungible tokens with the in-game cryptocurrency (NFTs). Blockchain technology can protect the ownership of digital land. Cryptocurrency may in the future act as a motivator for people to engage with and contribute to the Metaverse (Sandrone, 2022).

Virtual Reality (VR)

The atmosphere created by virtual reality is distinct and utterly artificial. Virtual reality (VR) users act as they would in the real world because they are absorbed in the experience and feel as though they are in a new place. (Slater, 2016)**.** The most notable aspects of completely synthetic perspectives belong to Virtual Reality. Commercial VR headsets offer the standard methods of user interaction, such as head tracking or physical controllers (Kelly, 2021). User interaction methods are used to allow people to engage with virtual items while they are positioned in entirely virtual settings. Additionally, the term "the furthest end from reality on the Reality-Virtuality Continuum" refers to VR (Milgram, 1995). Through the use of specialized apparatus like immersion helmets, virtual reality headsets, and omnidirectional treadmills are all examples of cutting-edge technology. the total sensory experience is enhanced across several modalities including sight, sound, touch, movement, and scent. It feels really natural in this situation to interact with virtual items. (Pellas, 2020). Users of VR headsets must thus concentrate only on the virtual environments and withdraw from the outside world

Augmented Reality (AR)

With regard to actual locales, augmented reality has a separate approach; it integrates improving the physical world using digital inputs and virtual components (Ibáñez, 2018). It spatially integrates the physical and virtual worlds. A layer of spatially projection of the products of digital artifacts that are mediated by items like glasses, contact lenses, smartphones, tablets, and other transparent surfaces is the end result. (Mystakidis S. C., 2021). This makes it possible to display images of objects that appear to be things on the screen as 3D objects hovering over the real surface, such as people, animals, objects, and spaceships. Additionally, virtual reality headsets with pass-through mode can combine augmented reality by displaying data from built-in camera sensors. As a result, spectators will feel as though they are taking part in a "genuine" event. In Figure 3, two instances of AR are displayed (Pellas, 2020).

Figure 2.3

Photos showing examples of Augmented Reality.

(I)

(II)

Mixed Reality (MR)

MR being a more complex idea, throughout time its definition has evolved to reflect both contemporary technology developments and the primacy of linguistic meanings and narratives. MR is sometimes referred to be an improved form of AR when the actual world and projected digital data interact. (Speicher, 2019). Thanks to MR, a brand-new category of wearable technology, people may now walk with one foot in the actual world and the other in a virtual one. It does away with the fundamental division between reality and fantasy. MR could change how people live, work, and play in today's society and might enhance how we relate to others around us.

Figure2.4

Photos showing examples of Mixed Reality (Kamenov, 2017)

Extended Reality (XR)

The words "cross reality" and "extended reality" are used interchangeably. A wide range of immersive technologies referred to as (XR) are utilized to create electronic, digital environments for data representation and display (Milgram, 1995). Users of the XR system may produce soundscapes that are more realistic All three XR technologies—Virtual Reality (VR), Augmented Reality (AR), and Mixed Reality—involve users engaging with fictitious digital worlds that have either been entirely or partially created using technological advancements beyond those made achievable by VR and AR. The user may watch the high-resolution XR display from a broad angle that can be between 90 and 180 degrees. It draws the interest of individuals who use it and is a useful tool for traversing the metaverse. Through the use of motion controllers, the XR system allows for direct engagement with virtual items. Users can use the controls that were previously explained to touch, hold, manipulate, and operate virtual things. Researchers are presently focusing their efforts on wearable electronic gadgets such as touch-sensitive jackets and gloves (Pellas, 2020). Particularly, there are significant ethical concerns surrounding XR and Metaverse technology, such as intellectual property, privacy, equality, and accessibility. Businesses and money seem to be influencing the growth of the Metaverse and its use across several social structures.. Ethical issues might not be front of mind when an intervention is meant to generate revenue. An illustration of it in recent years is the widening digital divide. We may have to deal with a fresh "Metaverse split" when the globe is still trying to close the digital divide (Wang et al., 2022).

Figure 2.5

Photos showing examples of Extended Reality (Yadav, 2022).

Mirror World

Mirror World was influenced by the 1992 release of Mirror Worlds by David Gelernter. The mirror world mimics the look of real-world structures or items while having its own unique traits and functionalities. Although they are conceptually similar, the words "metaverse," "multiverse," "digital terraforming," and "mirror world" all refer to quite different things depending on the situation. (Grimshaw, 2014). A "mirror world" is a virtual environment that accurately represents the physical one (such as Google Earth or Microsoft Virtual Earth). Together with other simulation data, a computerized replica of the actual neighborhood where people live is used. Alternatively put, simulates how a structure or object might seem in the real world. (Areepong, 2022)Everything that is done in the real world might be done online or through a smartphone app. Mirror worlds are used in education in many ways, such as through "digital labs" and "virtual educational environments," which were created in various mirror worlds. (Smart, 2007).

Life-Logging

The term "lifelogging" describes the practice of transmitting data and actions from the real world to the virtual one. (Park & Kim, 2022). Augmented technologies are used in lifelogging to record the states and biographies of individuals and things. Life Log (lifelogging) makes it easier for people to share their previous or present status updates, moments, and diaries with others. User life logs, which document users' lives, and object life logs, which document the environment and status of the physical world, have now

Avatars

The term "avatar" derives from a Hindu idea that refers to a Hindu god manifesting as a person or animal in the real world (Kasapakis, 2017) Our digital personas in the metaverse are represented by avatars. To express one in virtual settings, users would rely on their avatars. Even while current technology can automatically create an avatar using the characteristics of our physical appearance, real-time control of avatars via mobile sensors is presently not achievable. The micro-expression and non-

verbal expressiveness of the avatars need more research. Another difficult issue would be how avatars should be designed ethically and how their activities and representations in cyberspace should be handled (Lee et al., 2021). An avatar serves a social function in the metaverse that is suitable for a persona or career. Many high-end apparel companies are aware of this and are selling costumes and other items. The younger generation regards the social relevance since they believe that their identity in virtual space and reality are the same, they value the virtual world as highly as the actual world (Park & Kim, 2022).

The Metaverse's focus, Avatar, is comparable to the virtual world's digital doppelganger and "Me" The digital twin differs from digital me conceptually in that it examines the true self objectively rather than subjectively.. Digital twins are employed in applications to solve present-day issues and predict future events. Digital me, on the other hand, act as a substitute for the real-life self by projecting one's identity (Digital Twin, 2021).

DIGITAL TWINS: Digital twins are exact replicas of real-world interaction between physical systems or things with a high level of integrity and awareness. Using simulations of potential real-world scenarios, digital twins are used to build virtual agents that resemble actual objects and forecast events beforehand. The system, which was initially presented by General Electronics, incorporates data and information that explain the settings and workings of various physical entities in order to understand operating situations from the past and present. The phrase "Digital Me" refers to a symbolic expression of ego in a digital environment that is different from the real world. (Fuller, 2020).

Generational Changes in the Metaverse in Education

Although it might be challenging to set precise age boundaries or definitions, some research provides separate names, dates, and analyses for each generation type. (Moore, 2017). Each generation lasts an average of 15 to 20 years, depending on factors including demographics, historical events, and scholarly consensus. (Center., 2015). The rapid advancement Regarding technology and its incorporation with education, particularly for generations to come such as Generation Alpha, makes it crucial to define

generational groupings (Tootell, 2014). As a result of changes in the environment and expectations, universities and educational institutions have seen a variety of generational shifts. The second generation of universities prioritized "research" over "education" in the same way that the previous generation did. Universities of a third generation concentrated on "entrepreneurship" traits. With significant technological advancements and the introduction of the new metaverse realm, the fourth generation of colleges was formed with a focus on "community" (Hassanzadeh, 2022).

Table 2.1

Generational changes in the metaverse in education. Source (Tlili, 2022).

GENERATION TYPE	**YEARS RANGE**	**NEW TECHNOLOGY**	**LEARNING STYLE**
Baby Boomer	1946–1964	Television	Rote, hands-on
Generation X	1965–1980	Computers	self-driven, combining conventional and modern methods
GenerationY/ Millennial	1981–1994	Internet	Groups, lots of tests
Generation Z	1995–2010	Smart phones	groups, several quizzes, and "gamification" online
		Virtual and	Virtual or augmented reality.

Generation Alpha	2010–2025	augmented realities	Digital and hybrid "gamification"

Metaverse in Education

The term "education-based metaverse" refers to the usage of a platform built on the metaverse to improve educational activities. (Wood, 2018)**.** The educational metaverse cultivates a learning environment by creating an engaging setting that pulls in pupils. (Reisoglu, 2017). According to academics; one of the most major uses of the metaverse is in education, which has a bright future. We think that the metaverse's existence can create a fresh environment for teach (Suzuki, 2020). Beyond gaming and entertainment, it is expected that the Metaverse will alter our everyday routines and our economy. The Metaverse has boundless potential as a cutting-edge platform for social interaction and for application in educational settings. (Lopez, 2022). By examining the technical possibilities connected with each part of the metaverse for education, it is feasible to clearly understand how the metaverse may alter education. This envisions how the metaverse may aid in supporting human learning and education. (Suh, 2022).

The metaverse-based learning environment offers a range of unique AI-powered jobs, including intelligent non-playing character (NPC) employees, intelligent non-playing character students, and intelligent n0n-playing character professions (Huang, 2021). systems might be a big help in educational settings when it comes to decision-making, arbitration, and simulation. It suggests that in the metaverse reality, students may receive tutoring, ask for assistance, have conversations, or practice skills with non-playing characters; at the same time, teachers can do the same or mimic teaching with students who are clever non-playing characters (Hwang, 2022).

All parties enter the educational field in the virtual world to collaborate on educational activities while interacting and communicating in the virtual teaching environment thanks to the establishment of digital identities for teachers, students, managers, and other personnel involved in educational activities. This meets the demands of teachers and students for instruction in both the real and virtual worlds. The

features of the metaverse itself can enhance the difficult-to-achieve teaching design linkages in order to get over the restrictions of teaching in the actual world in a specific dimension.. These characteristics also play a practical and effective role in the unique field of the educational metaverse (Liu, 2022).

Smart Wearable Accessory

Headsets or head-mounted displays (HMD), smart glasses, and other such goods are examples of smart wearable. These goods can be categorized as not seeing through, seeing through optically, and seeing through visually. (Kang, 2021). The smart wearable is a simple technological advancement that connects the physical and digital worlds. Thanks to the smart wearable technology that teleports students there, they can simply transition between the actual world and the metaverse (Park & Kim, 2022).

Student identity

No matter if they are participating in a video conference or an actual classroom setting, students come to class using their own names. In the metaverse, students may present themselves entirely differently. They use customized, realistic, and dynamic avatars, or digital identities, to attend courses. Avatars are virtual representations of player characters from the real world in the metaverse. When students interact with the metaverse, they may control and modify their avatars in a unique, enjoyable, and fully immersive way to feel like they're there. (Prieto, 2022).

Educational activity

In the era of epidemics, it is difficult to begin the aforementioned actions. Learning takes place in a real classroom, where students may interact with their classmates and participate in a range of learning activities in addition to hearing lectures from instructors. (Almahasees, 2021). Due to the limits of video-conferencing technologies, lectures are often the main focus of remote learning through displays. However, this method only has a limited ability to support more complex learning activities, such as cooperation, leading to an experience that is primarily passive. (Ko, 2022). These wonderful and colorful learning scenarios seem to contextualize the

metaverse learning activities at first, and by allowing users to engage with virtual things from 3D viewpoints, they can significantly enhance their cognitive representation (Dionisio, 2013). The ease with which students can collaborate in real-time with their peers via virtual platforms like meet-ups, conferences, knowledge sharing, group deliberations, presentation panels, or debates is another noteworthy feature of learning in the metaverse. Beyond the passive experience of gazing at a grid of screens, this enables a higher level of emotional support from peers. (Koo, 2022). Additionally, the metaverse can promote creative learning activities where students can produce virtual works by providing a decentralized and editable production area (Ayiter, 2019). Nevertheless, it also suggests that throughout the learning process, students might change their minds and stop doing something, in line with the idea of learning from mistakes (Prieto, 2022).

Scene of learning

Digital twins, VR, AR, XR, and other modeling and rendering technologies may be used to imitate and construct a variety of realistic learning situations in the metaverse (Duan, 2021). Based on the learning materials, the sceneries, especially those that are difficult to view in the real world, such as the universe, the marine environment, the forest, the historical site, etc., can be built as partially or entirely virtual landscapes. The scenarios may be reproduced in 3D to seem like real classroom designs (Choi, 2017). Furthermore, the design of the learning scenes emphasizes the minor elements more, such as texture, color, ornamentation, etc. (Zhao, 2022).

Educational resource

Because of modeling and rendering technology, items in the metaverse can be viewed, particularly for unseen or hypothetical objects, ideas, or events that really occur (Wu, 2013). Additionally, educational tools that rely on interaction technologies like sensors, VR, AR, or XR may be presented in a multimodal form and allow students to engage in some way with their bodies, giving them rich physical experiences and in-the-moment feedback (Chen, 2011). When teaching astronomy, for example, utilizing augmented reality (AR) to depict the lunar system enables pupils to interact with the virtual lunar (Yen, 2013). The metaverse should also make it possible for students to

edit, publish, and exchange educational materials because of the decentralized technology. (Zhao, 2022)

Learning evaluation

Due to the difficulties of documenting students' performance and gathering their learning data, teachers frequently summarily evaluate students in traditional learning environments using their learning outcomes such as tests (Parmaxi, 2020). In this scenario, test results would be the only measure of students' learning, which would have detrimental implications including fostering educational inequity (Almahasees, 2021).. In the metaverse, teachers may more thoroughly evaluate students' Utilizing learning logs and learning analyses, performance is evaluated using both formative and summative data.. More importantly, it goes beyond some of the constraints of traditional evaluation by focusing more on learners' progress than outcomes (Bork-Hüffer, 2021).

Learning Result

The subjective feeling that a user has while immersed in a virtual world might be considered immersion, which is a general psychological notion or experience (Reiners, 2018). In the metaverse of education, effective temporal immersion in virtual teams is typically linked to better performance. (Thorne, 2018).

Virtual Reality in Education

Higher education institutions will be the first to deploy virtual campuses and virtual classrooms; higher education institutions that generate and use these technologies must become more prepared for the Metaverse world than other educational institutions (Göçen, 2022). Virtual reality in the modern day has increased the potential of learning has been improved by technology since these systems have been more accessible to colleges. The constructivist learning theory, which may be adapted to new technologies, provides the pedagogical basis for the desire to develop instructional resources for use in virtual reality. This is true because learning occurs when people engage in meaningful

experiences and actively construct their knowledge by engaging in certain activities. (Moro, 2017). Educators should consider the educational implications of virtual reality while learning about the acceptable educational uses of the metaverse. A simulated hands-on demonstration that takes place in a digital environment, for instance, risk management training sessions that concentrate on managing fires and aviation flying training. It frequently costs a lot the actual world. As opposed to that, having a flight a fire training simulator integrating virtual reality (VR) might easily be a more affordable alternative. Students engage in virtual reality using a head-mounted display. to enter a 3D simulation of reality. Their analogous digitally created auditory and visual stimuli are used in place of the real-world ones. They can immediately engage with surrounding digital things as they move about them (Phakamach P. S., 2022).

Augmented Reality in Education

Through use of augmented reality, digital representations of actual items may be created and then displayed in three dimensions. Through the use of educational effect, users can look into a range of metaverse apps for learning or for studying in augmented reality. For instance, AR can help locate components that might otherwise go unnoticed and speed up the process of solving difficulties. Augmented reality can be used to power detailed content summaries. This greatly simplifies the process of reading and comprehending literature. Reading and writing interactive tasks can help develop memorable experiences and promote active learning. (Phakamach P. S., 2022).

Metaverse and E-Learning

In the area of e-learning, which encompasses instructional software, and learning tools like E-Learning, M-Learning, Blended Learning, Virtual Learning, Distance Learning, and Online Learning, the use of the metaverse might be a useful solution. The metaverse has enormous potential as a workable educational tool, especially in fields like engineering and medicine where perfect convergence is necessary and conventional online or distant learning techniques may fall short. (Dahan, 2022). Through the use of services that don't necessitate face-to-face connection, the COVID-19 quarantine has made it feasible to get over physical time and space constraints. (Kim, 2021). For

remote education, there are several technologies accessible. In addition to others, popular systems include Zoom and Microsoft Teams. However, educators should choose the tools that would best encourage engaged learning among their students. Courses taught (particularly if they involve laboratory activities), the students' prior knowledge, and other factors should be taken into account (Barry, 2021). The fundamental advantage of employing the metaverse for eLearning is its ability to make the online learning environment livelier. The only limitation on how a teacher may create a space is how far they can take their ideas. At the same time, fully customizable avatars help students apply theory while interacting with actual items. It creates a distinct sense of realism in the virtual classroom to increase student satisfaction, learning engagement, and life skills acquisition (Phakamach P. S., 2022).

Table 2.2

Comparison of distance learning via screens, face-to-face instruction, and learning using the metaverse. Source (Zhang, 2022).

Factor	Face-to-face learning	Distance learning via screen	Metaverse-based learning
The individuals with whom students interact	Actual instructors and classmates	Actual instructors and classmates	Avatars of actual instructors and students, or intelligent NPCs that serve as virtual instructors and students
how students can engage in class at what time and where	at a predetermined time that corresponds to the real classroom's class schedule and academic calendar.	Only accessible if a teacher initiates a video-conferencing meeting	Without being constrained by space or time

Identity	actual identity	true identity	individualized and flexible digital identity (avatar)
educational resource	either textual or multimedia instructional tools with which students cannot normally interact	either textual or multimedia instructional tools with which students cannot normally interact	Primarily interactive, graphical, or dispersed learning materials that enable learners to engage
Instructional setting	actual learning scenarios	actual learning scenarios	sceneries that imitate instruction
Educational activity	Initially based on lectures by the teacher. Learners can take part in a variety of educational activities, excluding pandemics. Permit kids to cooperate with their classmates unless there is an outbreak. .	Heavily influenced by instructor lectures. difficult to allow students to engage in some sophisticated learning tasks difficult to allow students to work with classmates	A primary collection of learning activities offered in 3D learning environments. Give pupils the chance to participate in a variety of online activities that can promote distant teamwork. Start more projects that focus on problem-solving or inquiry-based learning. Encourage creative educational initiatives

Educative experience	centered mostly on face-to-face interaction	Visual and audio interactions conducted primarily online.	centered mostly on bodily engagement and multi-sensory input
goal of education	targets low-order cognitions development in particular	targets low-order cognitions development in particular	Higher-order cognitions can be developed more readily. primarily attempts to fulfill broader learning goals
Evaluation of learning	Pay attention to the results of learning. Using summary statistics	Pay attention to the results of learning. Using summary statistics	Combine both summative and formative evaluations, and focus more on learning progress

The Metaverse's Educational Potential

The metaverse's impact on future research, particularly its implications for education, is the final point to consider. The focus of this analysis is on how the metaverse could affect educational systems. Notably, the emergence of well-known educational metaverse applications will fundamentally alter how we view the metaverse. (Dionisio, 2013).

Creating Principles for Responsible Use:

The metaverse unquestionably provides many great benefits, especially in terms of bringing various concepts to life. Students may discover new opportunities to use the metaverse responsibly in the long term with the help of blockchain identification, but there are also serious problems related to illicit use.

Engaging Guides:

Teachers are no longer required to display images, films, or read writings from the metaverse. In fact, instructors may show students how to construct certain molecular devices or procedures. Because of the immersive educational setting, more students will retain the information.

Inventive and sharing freedom:

Contrary to what some students may think, the metaverse in education is more than just an educational form of online gaming. They are capable of achieving the objectives of the game's missions. Instead, they may create and share learning experiences with others that expand the freedom and flexibility of learning.

Integrated Education:

Education through the usage of the metaverse will be greatly aided by the capacity to move between the various virtual worlds it offers. For instance, reversing how electrons go through human bodies won't be a concern while investigating conductivity. The integration of several academic fields in a single setting might be improved with the help of the metaverse, leading to more thorough educational opportunities (Phakamach P. W., 2021).

The metaverse facilitates language acquisition

Since the beginning of the twenty-first century, learning a language attaining bilingual or multilingual fluency for K–12, higher education, or professional careers has been essential (Peters, 2013). Nevertheless, due to a number of issues, including a dearth of chances for real-world application and a lack of participation both inside and outside of the classroom, conventional language education has continued to be unproductive (Liang, 2021). The development of the metaverse has the ability to significantly advance language acquisition (Park J. , 2021). The metaverse is being used in language acquisition for a variety of reasons. Learning a language at initially necessitates a rigid learning environment, especially for sessions in hearing and speaking (Parmaxi, 2020). By having students have a conversation about collecting flight information in an airport setting. One speaking course, for instance, tries to help students

hone their spoken abilities. For instance, it would be absurd to require airport personnel to accompany a class of students to the school in the actual world. Students may participate in a variety of educational activities in the metaverse, such as role-playing and dialogue practice in a realistic airport setting, with avatar partners or a designated intelligent NPC air hostess or airport staff. (Lin, 2021).

Related Research

Related research on Augmented Reality

A pioneering initiative to include educational goals into experiences, according to Sánchez-Lopez et al. (2022), was the development of the Minecraft education edition. Its unforeseen usage as an educational tool was aided by "the ease sharing of worlds, creations, revisions, lessons, and experimental setups with instructors and researchers throughout the world without significant software constraints." ,The current study highlights some of the opportunities for utilizing Minecraft Education to foster learning in a networked, immersive environment.

A smartphone app for augmented reality learning called Photomath was studied by Saundarajan et al (2020). Their findings suggested that using AR into mathematics instruction might improve students' learning outcomes.

Rai et al. (2022) claimed that, for students at any educational level, The efficacy might be improved through augmented reality and immersion of their learning. In an interactive setting, this will aid students in understanding topics, which will simplify concepts and make learning simple. The researchers created an app utilizing Unity and the AR-Core Software Development Kit to more effectively demonstrate remote sensing data for instructional purposes. However, a platform for interacting with the information was supplied via multi-spectral band pictures, Digital Elevation Model, animations, audio, and point clouds in the form of a multi-scene multimodal strategy for learning utilizing augmented reality. The produced software demonstrates how successfully augmented reality can be utilized to deepen users' comprehension of remote sensing in a fun way, and how people who are not as familiar with this subject may learn about it quickly using augmented reality.

Related research on Virtual Reality

The idea of a 3D experience utilizing a Google Cardboard VR headset and a smartphone was offered by Kanematsu et al in (2022), and the verification of its educational impact was covered. Content from YouTube was utilized as a video in this project. The cardboard VR headset was really easy to use and didn't require any fancy equipment. It was a practical and simple-to-use tool that made it possible to implement the idea of 3D whenever and anywhere.

Kim and Nevelsteen (2017) defined a virtual world in detail, along with full definitions of all concepts that are connected. The concept is then used to categorize different technologies according to their distinct features while also suggesting additional traits that may be utilized to distinguish virtual worlds**.**

In a research project by Moro et al (2017) Virtual reality is an excellent way to enhance anatomy teachings for students studying health sciences and medicine, according to research comparing both on a computer (Oculus Rift) and a mobile device (Gear VR) medicine and health science teaching using virtual reality. Virtual reality on a mobile device is just as useful as virtual reality on a desktop and can be set up for a lot less money. Shorter virtual courses are necessary, though, because mobile virtual reality programs can worsen cyber sickness and have more negative impacts than desktop-based ones.

Garrido-Iigo and Rodrguez-Moreno (2015) presented their findings from evaluating 108 tourism students at Madrid, Spain's Universidad Rey Juan Carlos are being taught the French language through the use of the OpenSim platform, which is a creative tool. Some theoretical views on student behavior when utilizing a virtual platform via an avatar as well as remarks on how, when using virtual worlds for education. The doubling of identities is really their greatest advantage. Psycholinguistic components have helped to facilitate the development of virtual worlds, but their application and longevity are dependent on technological characteristics, particularly theoretical and pedagogical foundations that are currently being developed.

According to Shermatovna and Azamovna (2022) even more amazing achievements will be possible with 3D technology in the future. The 3D multimedia electronic textbook stands out among new pedagogical technologies because it is

fundamentally different from the conventional (usual) textbook in that it is the teacher's closest methodical support tool, manifests various information in action, has science-related practical programmed available, is data compact, can impart a lot of information in a short period of time, and students feel as though they are in a positive learning environment.

According to Barry (2018), primary school instructors of young children successfully participated in a virtual workshop for creative education in Second Life (SL). Engaging and inspiring to pursue academic goals, particularly in the STEM fields, by learners (of all ages (science, technology, engineering, mathematics) fields, requires creative teaching methods. In order to compete on a worldwide scale, creatively address difficult challenges, and produce the scientists, engineers, and other professionals of the future, countries require a supply of skilled STEM graduates.

González et al. (2013) offers a thorough analysis of the possible benefits that virtual worlds may have for boosting motivation, learning, and teamwork, and ultimately for boosting students' academic accomplishment. Gonzalez et al. reiterate how novel interactions that take into account how quickly technology is evolving can make it possible for virtual worlds to offer fresh platforms for experimentation. In this virtual setting, teachers will be present all the time, interacting with pupils. The experience has already gathered all instructor and student comments.

Barry et al. (2021) claimed that the pandemic of the coronavirus has significantly impacted schooling. Due to this situation, educators all around the world were forced to fast adapt and switch to online instruction. Numerous technologies are available to support and improve in-person learning as well as remote teaching. Blackboard, Microsoft Teams, Zoom, and other well-known platforms are examples. However, educators should choose the tools that would best encourage engaged learning among their students. Class size, student age, courses taught (particularly if they involve laboratory activities), and students' prior knowledge are a few factors to take into account.

Related research on Mixed Reality

According to Mystakidis (2021), social media's connectivity and the distinctive benefits of immersive VR and AR technologies may be combined in the framework of MR. If their interaction is permitted to progress; it might alter a variety of market segments, including distance learning. New types of meta-education may develop on online 3D virtual campuses, propelled by the metaverse, to provide rich, hybrid formal and informal learning experiences. Online education in the Metaverse will dismantle the final barrier separating formal and informal learning. It will no longer be advantageous to learn in-person in a classroom. The effectiveness of virtual involvement will be balanced out by telepresence, accurate avatar body language, and realistic avatar facial emotions.

Siyaev and Jo (2021) looked at the application of MR in industrial maintenance to create an enjoyable learning environment for servicing aeroplanes.

According to Suh and Ahn (2022), teachers now have more power because they employ digital tools to create effective instructional processes. There have been few attempts to comprehend these technologies from the perspective of the learner rather than the technical one. Knowing what technology pupils are using and how it influences their development and relationships is more crucial when working with them

Related research on Metaverse

Liu (2022) explained that it is inevitable that activities linked to science teaching will be included in the educational metaverse. Science education should look into new development paths as a result of the popularity and consistency of online teaching, which has clearly established the trend of standardized online learning. However, in the field of metaverse, science teaching approach breaks free from the limitations of objective environmental factors, places a high value on immersion in the real world, aids teachers and students in developing a personal understanding that emphasizes students' subjectivity and enhances their ability to learn on their own. This understanding is helpful for learning scientific information and abilities.

Beyond games and entertainment, it is projected that the metaverse will have an impact on our daily life and the economy, according to Kye et al. (2021). Additionally, all social, cultural, and business activities will take place on the new platform for the

metaverse. According to Kye et al. (2021), the metaverse has risk factors that are poorly managed since it is anticipated to grow quickly during and after the COVID-19 pandemic. Here are some ideas for upcoming metaverse education initiatives: It is necessary to investigate students' activity patterns, the extent of their immersion in the metaverse, and both its beneficial and detrimental effects on their learning activities. It is crucial to first thoroughly examine how students perceive the Metaverse, their goals there, and their reasons for liking it. Each sort of metaverse has its own technological quirks, so instructors must be aware of these before designing lessons that encourage collaborative problem-solving and creative job completion. It is possible to mistakenly embrace the objectives of content producers or service designers rather than the cognitive abilities and inventiveness of pupils. To prevent the abuse of student data, a platform for teaching in the metaverse must be developed. It is also vital to conduct data-gathering evaluation studies to improve teaching and learning..

According to Mustafa (2022) the research set out to find out how instructors felt about the possibility of using a metaverse tool into their lesson plans. Due to the continuous lack of face-to-face interaction and the rapid advancement of technology, Metaverse is interested in education as well as society, economy, culture, and industry. Participants in the research acknowledged the need for educational assistance; such are instructions on how to use the Metaverse platform, instructional techniques, and teaching methodologies. Since the major and topic type (number of students, class types, evaluation criteria, etc.) may have a significant influence on how each student views the Metaverse, they made it apparent that each college major requires a distinct education. Participants in the study agreed that utilizing Metaverse in education might aid learning in a variety of ways. It was specifically mentioned that metaverse-based seminars would be more successful when they focused on student interaction, problem-solving, learning, or discussion as opposed to lectures that covered a wide range of theoretical topics. They hypothesized that the metaverse may have cooperative and communicative abilities, making interactive learning environments the primary characteristics of future brilliance.

According to Phakamach et al. (2022), the metaverse is a digital environment where users may create their own virtual reality. The metaverse offers wonderful chances to interact with individuals from all around the world while studying. By

donning a VR headset or using a web browser, anybody, from anywhere, may connect to the virtual world and engage in face-to-face communication with others. Think of the metaverse as a virtual game that players and creators may customize to suit their preferences. Additionally, according to Phakamach et al. (2022), educators are allowed to construct metaverse schools or virtual stadiums on their own territory. In a world when pandemics and other natural catastrophes are splitting people based on geography, they give a way for relatives and friends to interact online..

According to Hwang and Chien (2022), the metaverse will present an entirely new perspective on educational technology. It will offer new learning opportunities and surroundings to students. In the metaverse, it is possible to carry out a variety of training regimens and goals that are challenging to accomplish in the actual world. Specific barriers to learning specific things or developing certain skills, such as limitations on time or space or even hazards while learning, may be addressed in this new environment. Furthermore, there are challenges when creating a metaverse for academic or other purposes. Strong writing systems, robust computer hardware, and responsive networks are essential. Users want low-cost, portable technology that allows the use of high-definition digital content to enable individuals to engage with and fully immerse themselves in the metaverse.

According to Mystakidis' study from 2022, Thanks to new meta-educational paradigms driven by the metaverse, education may advance to provide rich, hybrid formal and informal learning experiences. These concepts include online 3D virtual campuses for distance learning. The last barrier to casual learning and social engagement will be erased through online training in the Metaverse. The advantages of being present in a classroom in person will no longer apply to students. Virtual involvement will be just as successful as in-person participation thanks to telepresence, avatar body language, and lifelike face emotions. Though in the context of MR, the special affordances of immersive VR and AR technologies may be paired with social network linkage. If the relationship between them is creatively launched, one of the many industrial sectors that might be revolutionized is distance online education.

In contrast to present educational technologies Zhang et al. (2022) claim that the idea of the metaverse is completely new. The metaverse has enormous potential for

enhancing education. The constraints and difficulties of modern education may be somewhat alleviated in a metaverse setting. More significantly, continued interest in even future academic research trends and directions are suggested by the metaverse.

According to Dwivedi et al. (2022), widespread adoption of the metaverse poses many challenges in terms of governance, ethics, safety and security, appropriate behavior, privacy, and the potential emancipation of groups of people who do not have access to the infrastructure needed to access the metaverse. This is true even while the development of the metaverse offers novel and fascinating levels of interaction between the actual and virtual worlds, creating new opportunities and potential economic models.

In order to maintain students' interest in and engagement with remote learning in higher education settings, Mystakidis (2020) developed a metaverse research (referred to in this study as Social VR gamification platform). He discovered that postgraduate participants were quite engaged with metaverse platforms, and that the gamified features tended to pique their interest. He argues that the metaverse provides a compelling alternative wherein A significant sense of telepresence may be experienced when encountering other avatars in the same 3D virtual environment and realizing that they are the actual persons hiding behind the several identities. This is true even when online environments struggle to match the significant educational benefits of in-person encounters.

In their 2013 study, Crespo et al. looked at OpenSim applications for educational virtual worlds and knowledge sharing in open courses in the Metaverse.

Han (2022) claimed that as video conferencing and metaverse platforms have become more popular as a result of COVID-19, there may be a significant sense of telepresence when meeting other avatars in the same 3D virtual environment and realizing who the real individuals are behind the multi-personas. This is true even in cases when real-time interactions in physical settings are difficult for online environments to match in terms of their high instructional value. Computers, intermediate platforms, and physical computing devices are the three primary computing platforms used in this article to group a variety of ethical problems. Computer ethics, information ethics, cyber ethics, robot ethics, and AI ethics are all included in this categorization, which offers a conceptual foundation for ethics.

The study conducted by Dionisio et al. (2013) examines four aspects of realism: ubiquity, interoperability, scalability, and the growth of the metaverse.

Dahan et al. (2022) explained that applications for e-learning are indispensable in our daily life. Our time requires that new technology be included into these applications. The most current technology that has not yet been completely investigated or put into practice is the metaverse. In the future, we advise using E-learning environment (ELEM) must prove its effectiveness, precisely supply all of its qualities, and help humanity.

The Wang et al. (2022) research provided an in-depth analysis of the metaverse's foundations, security, and privacy concerns. The main characteristics of the new distributed metaverse architecture, as well as its supporting technologies and working prototypes, were covered. The research also looked at the dangers to privacy and security, as well as the biggest obstacles to privacy protection in this distributed metaverse architecture.

Yu (2022) claimed that learners must first establish themselves as active users who autonomously consume, generate, and share material in the metaverse area that the teacher has built. The ability to properly create and deliver physical education curriculum to students is the second need for instructors. Third, diverse physical education-related material has to be developed. Fourth, It's crucial to remember that users must give and receive in order to have an influence on outcomes in both the virtual and real worlds. Fifth, a connection in the metaverse needs to be made between the teacher and the student. Regarding these five criteria, the metaverse environment is still developing and is only being used at the game level in physical education.

Park and Kim (2022) explained that the Association Studies Foundation proposed three different kinds of metaverse in addition to virtual worlds. Out of these, augmented reality is already commonly utilized in education; however the majority of augmented reality educational materials do not take into account the metaverse's peculiarities. Applying lifelogging or mirror world to teaching will require more study. There has to be further investigation into how these three categories fit into schooling from a metaverse standpoint.

Using the extended technology acceptance model, Aburbeian et al. (2022) investigated how many aspects affect people's adoption of Metaverse technology.

Results showed that overall, participants had a positive attitude towards using Metaverse technology, and males were more interested in trying it. Additionally, the study found that the cost of Metaverse technology had a negative impact on people's intention to use it, while other factors, such as social norms, self-efficacy, perceived pleasure, curiosity, usefulness, ease of use, and attitude towards Metaverse technology, which has a favorable impact on intention to use. The survey also discovered that there was no correlation between price and attitudes towards Metaverse technology.

According to Tlili et al. (2022), the usage of the Metaverse can open up educational opportunities for fields that were previously inaccessible due to time, space, and financial constraints, addressing real-world challenges in virtual domains.

According to Lopez et al. (2022), the potential of the Metaverse and its capacity to achieve greater accessibility, usefulness, and simplicity of deployment will also be determined by the evolution of the technology that supports it.. It will take time to evaluate the influence on education, and it will require money and capabilities among other things. The ethical (respect, or anything linked to netiquette) and privacy are additional significant aspects to take into account or establish rules for.

According to Areepong et al (2022) broad teaching processes that are incorporated into various digital learning forms, learners and instructors are viewed as the perfect places. Students' learning involves teamwork, traditional teaching methods that change from static to dynamic, as well as classrooms that are turned on their sides. With regard to teaching and using 'new technologies,' the paradigm of traditional education is no longer valid. Information Computer Technology (ICT) removes physical boundaries for all students who desire to learn from anywhere and serves as a support or method of access to information. This kind of technology aids in teaching and methodological development by giving both students and teachers alternatives for instruction and learning while also extending learning styles like hybrid and mobile that encourage dynamic adaptability and the classroom. These methods are scalable due to the program's design and the development of metaverse, which enables the incorporation of other ICT resources, more interactive elements, or the widening of the output scope are all examples of this. It is possible to use this digital resource in this way with the right platform competence. One study plan may be used by both students and professors,

allowing for course modifications and technique changes for everyone. As a result, in order to promote participant involvement, the design of virtual environments used to coordinate training activities must follow the same exacting and excellent design requirements.. As a result, there was a decline in involvement and poor relationships in the Virtual Learning Community (VLC) under investigation.

The "four ecology integration" are ecology of resources, ecology of interactions, ecology of space, and ecology of cooperation that Zhou (2022) explores in metaverse-based smart education. By providing a strong theoretical foundation and frame of reference for creative applications in student-centered education, this integration intends to improve the seamless integration of the metaverse and smart education. It makes it easier to create a dynamic, integrated teaching environment and offers a wealth of tools for successfully integrating the metaverse into education by providing a variety of instructional situations.

Shin and Kim (2022) It was explained that there are a number of design principles that may be used to enhance soft skills when the metaverse and video games are combined. This model was developed using a variety of research and well-known applications that were successful with the metaverse idea, gaming, or bot

Ge (2022) asserts that the emergence of the metaverse period has gradually changed the function of college students in academic institutions. They are now profoundly ingrained in many facets of their academic endeavors, social interactions, entertainment, and purchasing habits as opposed to simply being the objects of ideological and political teaching. This denotes the appearance of fresh patterns and traits in modern culture. College students' online behavior may be understood in light of intelligent technology in a variety of ways, including the kinds of activities they engage in, the wide range of consequences it has, and the fundamental principles guiding their online behavior. As a result, this setting provides a solid framework for intellectual and political instruction.

Not all colleges may be successful in the metaverse, according to Hassanzadeh (2022). The metaverse is a technologically driven competitive environment, and going forward, this competition will be more intense. By marketing their brand in the metaverse, top-tier and flagship colleges can act as metaversity agents. More of an influence on society will be possible for Metaversity. However, establishing

infrastructure, fostering conversation and empowerment, and offering expertise are necessary for reaching the true metaversity.

The Gap in the Studies

The present understanding of the Metaverse is based on the social perceptions of Generation Z, who believe that the online identity is the same as the ideal self (Duan, 2021). In other words, it is thought that people's online digital personas serve as a reflection of and representation of their true selves in their offline, physical lives. Some argue that a new definition is necessary since Generation Z's influence and growth in the Metaverse have altered it from what it once was. (Park S. M., 2022). Therefore, it is important to look into the development of the Metaverse in education, its architecture, and historical research trends. Additionally, a number of literature reviews pertaining to Metaverse in general were carried out (Narin, 2021). However, no literature analysis has been carried out to compile the conclusions on the usage of the Metaverse in education and offer prognostic information. As a result, many issues remain unanswered, including what kind of Metaverse, in terms of the blueprint Metaverse, is utilized in education as well as what kind of learning scenarios and evaluation techniques are used. In order to close this gap, this study uses content analysis to undertake a survey of the literature on the use of the Metaverse in education and to produce visual representations of the relationships between the key concepts (Yilmaz, 2019).

CHAPTER III

Research Methodology

The research technique is thoroughly explained in this chapter, including the research design, data kinds, data collection methods, study population, sample size, and data analysis.

Research Design

For this inquiry, a descriptive survey research design was adopted. Using a carefully selected sample of university students who satisfy the criteria for interest, a descriptive survey design is used to gather data from a population at a certain time. A general framework for how the research subjects should be treated was supplied by the study design. This project will include the goal of the study, the methods to be used to gather and analyze the data, as well as any potential ethical concerns. Additionally, it needs to demonstrate that every aspect of the study's design was taken into consideration. (Yeomans, 2017).

Participants

The research population involves enrolled Students attending educational institutions in the TRNC, the Turkish Republic of Northern Cyprus. Males made up 58.6% of participants, while females made up 41.4%. The bulk of participants were between the ages of 17 and 26, accounting for 74.6% of all responses. During the fall semester of 2022-2023, a closed-ended questionnaire was used to gather the data, and 383 students responded in total. The demographic details of the participants are summarized in Table 4

Sample Size

This is the overall figure for study participants or observations. The sample size was decided using calculations for a specified population. The computation looks like this:

$$\text{Sample size} = \frac{\frac{z^2 x\, p(1-p)}{e^2}}{1 + \left(\frac{z^2 x\, p(1-p)}{e^2 N}\right)}$$

Where Z = 1.96, p = 0.5, Q = 0.5, e = 0.05, N = 108295. 382 students were sampled.

Data Collection Tools

This study used a close-ended questionnaire to gather data, with the questions designed using Google Forms by the researcher. The questionnaire was searched for from various databases from the web. Many were evaluated and tested until the questionnaire of Professor Fezile Ozdamli of her doctoral thesis on mobile learning was finally used by converting it from mobile learning to metaverse by the researcher to suit the aim and scope of this study. The questions were created to address the study's research objectives. The data collection tool used in this investigation is included in Appendix 1. Before sending the survey to participants, a request for authorization to conduct the survey was made to the ethics committee. After being approved, the questionnaire was made available online through email and several social media platforms. The letter of endorsement from the Ethical Committee is in Appendix 2.

A representative sample of university students from the TRNC population who had been chosen within a specific time frame was surveyed using a descriptive survey technique. The questionnaire is made of four sections. The respondents' demographics, which were utilized to compile participant demographic information, is presented in the first section. The second, third and fourth portions were rated on a five-point Likert scale. The survey's goal was to compile a list of appealing traits and characteristics.

Part "A" demographic: this section includes the respondent's demographic and personal information such as gender, age, nationality, university affiliation, faculty, department, and the respondent educational level. The study collected data from university students, which was then categorized.

Part "B" The use of metaverse device/tools: this section will ask how much the respondents’ utilizes the metaverse's tools. This section includes five items such as desktop/laptop, augmented reality smart glasses, mobile, virtual reality headset, and

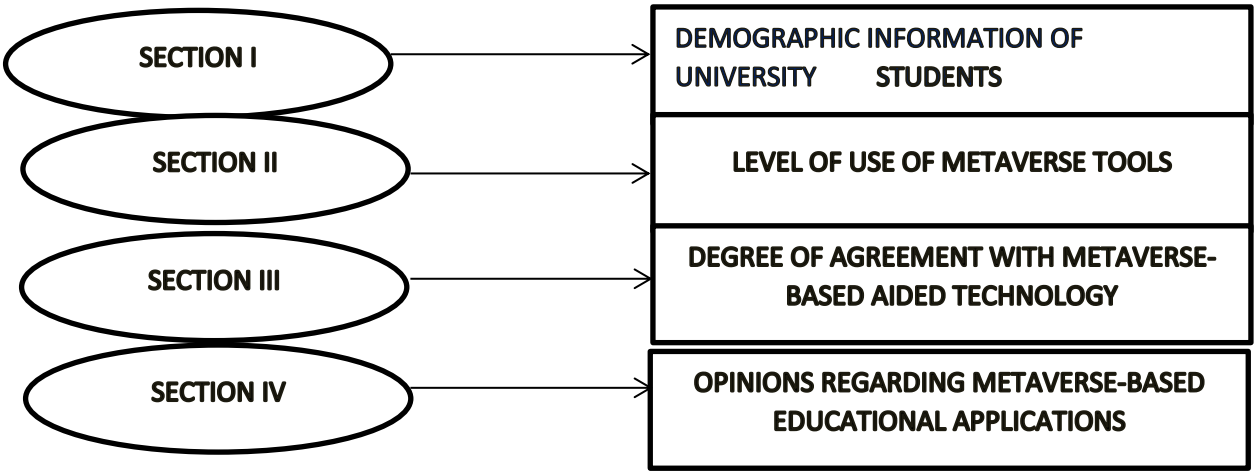
Hololens. It focuses on the user-friendliness of the devices, the researcher wanted to evaluate the participants' usage of metaverse devices on a regular basis and their competency with them. Participants were asked to rank their familiarity with the gadgets on a scale of "very good" to "very weak" or to say whether they had never used one before.

Part "C" will ask about the ability level about the employment of metaverse-based assisted technology. The research intends to investigate the ability level surrounding the use of technologies based on the metaverse. The primary focus of this section is determining the participant's degree of ability, which spans from "strongly agree" to "strongly disagree." The questions in this section are related to various facets of metaverse-assisted learning, including the ability to share course materials with peers, using well-known metaverse platforms like Roblox, Decentraland, Sandbox, Axie Infinity, Star Atlas, etc., using metaverse devices to access the internet, producing instructional videos with metaverse technology, developing multi-environment projects with metaverse technology, and completing assignment tasks while teaching.

Section "D" will ask about perceptions towards metaverse-based educational applications. The researchers polled university students to learn about their perspectives on the possibilities of metaverse-based learning applications. This component of the survey attempted to assess students' perceptions toward the usage of such applications in higher education, using a scale ranging from "strongly agree(5)" to "strongly disagree.(1)" The statements examined in this section covered topics such as the potential for metaverse-based learning systems to improve educational quality, their accessibility from any location, their safety for personal information sharing, their ability to simplify learning, their effectiveness in promoting interaction, their capacity to facilitate learning anytime and anywhere. The researchers hoped to fulfill the study's key goals by studying these claims.

Figure 3.1

A diagram showing the format of the questionnaire



Ethical Concerns

The ethical considerations and protocols that could have a direct or indirect influence on the study were evaluated in the assessment of the research methods employed. To conduct the study, the researcher must uphold the following ethical principles: refraining from mistreating the participants, adhering to the designated questionnaire distribution time, avoiding any unethical behavior such as manipulation or dishonesty, refraining from altering the participants' responses, ensuring that the participants are aware that the research is solely for academic purposes, and guaranteeing the confidentiality of the participants' identities.

Reliability

According to the information provided, the questionnaire's Cronbach alpha value is 0.92, which is higher than the minimal standard of 0.6 recommended by Robinson et al. (2013) to consider the questionnaire reliable. As a consequence, it is possible to draw the conclusion that the survey has sufficient internal consistency and may be used for scientific research.

Table 3.1

Reliability test for the Questionnaire

Item	Number of items	Cronbach's alpha
Ability to use metaverse aided technology	12	.833
Metaverse based learning applications	25	.896

Participant demographics

Table 3 displays the demographic information and descriptive statistics for the 383 study participants. There are 224 male (58.6%) and 159 female (41.4%) among them. Male participants outnumber female participants, according to the data.

The analysis included participants from various departments: Management Information Systems (48 participants, 12.6%), Computer Engineering (37 participants, 9.7%), Computer Information Systems (40 participants, 10.5%), International Relations (34 participants, 8.9%), Nursing (32 participants, 8.4%), Architecture (35 participants, 9.2%), Pharmacy (39 participants, 10.2%), Medicine (25 participants, 6.5%), Business Administration (11 participants, 2.9%), International Law (7 participants, 1.8%), Physiotherapy and Rehabilitation (8 participants, 2.1%), and Tourism and Hotel Management (7 participants, 1.8%).Electrical and Electronics department, there were 7 participants, accounting for 1.8% of the total. Human Resource Management had 4 participants, representing 1.0%. Banking and Finance had 4 participants, representing 1.0%, Psychology had 5 participants, representing 1.3%, Environmental Engineering had 4 participants, representing 1.0%, Accounting and Finance had 5 participants, representing 1.3%, and Civil Engineering had 4 participants, representing 1.0%. Other departments had 26 participants, making up 7.0%.

Participants in the analysis come from a variety of faculties, with the distribution being as follows: With 155 participants or 40.6% of the total, Economics and Administrative Sciences had the largest representation. The lowest percentages are in

educational sciences with 2 participants (0.5%), nursing with 32 participants (8.4%), tourism with 7 participants (1.8%), engineering with 67 participants (17.6%), health sciences with 10 participants (2.7%), pharmacy with 39 participants (10.2%), law with 7 participants (1.8%), medicine with 25 participants (6.5%), and 38 participants from architecture with 9.9%

Based on their educational level, the participants are divided into two groups: postgraduate and undergraduate students. 292 (76.4%) of the total 382 participants are undergraduate students, signifying the highest representation. The remaining 90 (23.6%) participants are postgraduate students.

According to the study's findings, 34 distinct nationalities were represented. Iran had 16 participants, contributing for 4.2% of the total. Liberia had 26 participants, accounting for 6.8% of the total. Sudan had 35 participants, accounting for 9.1% of the total. Nigeria had the most participation (104), accounting for 27.2% of the total. Turkey had 12 participants, accounting for 3.1% of the total. Sierra Leone had 63 participants, accounting for 16.5% of the total. Congo had 37 participants, accounting for 9.7% of the total. Chad had 8 participants, accounting for 2.1% of the total. Cameroon had 7 participants, accounting for 1.8% of the total. Malawi had six participants, accounting for 1.6% of the total. Zimbabwe had 11 participants, contributing for 2.9% of the total. Kenya had seven participants, accounting for 1.8% of the total. The remaining 22 countries had 50 players, accounting for 13.2% of the total.

Table 3.2

Participants' demographics

Item	Frequency(f)	Percentage(%)s
GenderMale	224	58.6
Female	159	41.4
Age group 17-21	118	30.9
22-26	167	43.7
27-31	57	14.9

32-36	38	9.9
37-41	1	0.3
42+	1	0.3
Educational Level		
Undergraduate	292	76.4
postgraduate	91	23.6
Nationality: Nigeria	105	27.4
Sierra Leone	62	16.2
Congo	36	9.4
Sudan	35	9.1
Liberia	26	6.8
Iran	16	4.2
Turkey	12	3.1
Zimbabwe	12	3.1
Kenya	9	2.4
Chad	8	2.0
Cameroon	7	1.8
Malawi	6	1.6
Somali	6	1.6
Yemen	4	1.0
Guinea	4	1.0
Pakistan	4	1.0

Tanzania	3	0.8
Syria	3	0.8
Zambia	3	0.8
Namibia	2	0.5
Palestine	2	0.5
Ethiopia	2	0.5
South Africa	2	0.5
Ivory Coast	2	0.5
Senegal	2	0.5
Egypt	2	0.5
Other Countries	8	2.4

The Research Procedure

The following stages explain the processes' consecutive execution.

1. A literature study was required to get a thorough grasp of past work on the same or similar issue.
2. The department of computer information systems received a thesis proposal for examination.
3. As the researcher's work developed, the supervisor offered input.
4. The ethics committee reviewed the study to make sure it adhered to ethical standards.
5. After the component was reviewed and given the ethics committee's seal of approval, the questionnaires were given to the participating students.
6. For statistical analysis, the data were exported to an Excel spreadsheet and entered into SPSS.
7. The data was analyzed, and the results were properly presented.

8. The supervisor was constantly informed at every stage of the process, and suggestions and changes were always welcome.
9. A jury board was presented with the thesis for additional review and amendment.

Measurement and Scale

The following table presents the evaluation criteria used to evaluate the data obtained from the data collection tools

Table 3.3

The Level of Adoption of the Questionnaire Paragraphs

Likert-Scale	Classification	Description
1	1 – 1.79	Strongly Disagree
2	1.8 – 2.59	Disagree
3	2.6 – 3.39	Neither Agree nor Disagree
4	3.4 – 4.19	Agree
5	4.2 – 5	Strongly Agree

If the paragraph's average mean falls between 1 and 1.79, there is a significant disagreement in opinion. Disagreement exists if the average mean is between 1.8 and 2.59. Between 2.6 and 3.39, neither agreement nor disagreement is represented by the average mean. There is agreement between the average means of 3.4 and 4.19, while a strong agreement exists between the average means of 4.2 and 5.

CHAPTER IV

This chapter analyses the study's findings, focusing on the research questions and the primary objective of the study.

Result and Analysis

The metaverse tools usage levels of higher education students

The independent sample test in the table below shows the various elements: gender, standard deviation, and the significant of the result

Table 4.1

Independent sample test for gender equality means

Item	Gender	N	Mean	SD	Mean difference	T	P
Mobile	Male	224	4.73	.527	0.238	4.191	.000
	Female	159	4.47	.718	0.238	3.982	.000
Smart	Male	224	1.42	1.534	0.540	3.657	.000
glasses	Female	159	0.87	1.291	0.540	3.765	.000
Laptop	Male	224	4.32	.711	0.416	5.318	.000
	Female	159	3.88	.910	0.416	5.104	.000
Headset	Male	224	1.71	1.649	0.609	3.845	.000
	Female	159	1.09	1.382	0.609	3.961	.000
Hololens	Male	224	1.23	1.535	0.468	3.211	.001
	Female	159	.75	1.241	0.468	3.327	.001

The statistical analysis of the table, males had the highest recorded mean for mobile usage, with 224 responses. Males have a mean score of 4.73 (SD = 0.527), while females have a mean value of 4.47 (SD = 0.718). The gender mean difference is 0.238, with a significance value of 0.000. This implies that there is a considerable disparity in Mobile usage between male and female. However, when it comes to instruments to continue using, such as, augmented reality glasses, virtual reality headsets, and Hololens, the results demonstrate a resemblance in averages between males and females. This means that there isn't much of a difference in how men and women use gadgets and tools to access applications. The use of the metaverse In the remaining dimensions, however, there is a statistically significant difference between males and females ($P < 0.001$). Furthermore, there is a statistically significant difference between the viewpoints of mobile usage and laptop usage for both genders ($P < 0.001$).

Metaverse technology usage levels of students

The collected questionnaire data was analyzed using descriptive statistics in order to determine the amount of students' level of usage with metaverse technology. Table 5 displays the average and standard deviation for each item within the different components, with the highest mean value recorded being 4.36.

Table 4.2

Descriptive data from the student survey on their use of metaverse technologies

Items	Mean	Standard Deviation
Metaverse learning Technologies: I can communicate well with my friends	4.36	0.773
Teaching with metaverse technology, I can do the assignment task	4.22	.753
I can manage the project I lead through metaverse devices	3.94	.916
I can use current metaverse platforms such as Sandbox, Roblox, Decentraland etc.	3.34	1.121
I can communicate with my teachers and friends via video	4.18	.752
I can develop my multi-environment supported project with metaverse technologies	3.03	1.183
I can access the internet via metaverse devices	4.01	.759
I can use online groups such as yahoo group, Google group for learning activities	4.09	.803
I can send a single message to the entire group for necessary notifications.	4.24	.760
I can share course materials with my friends through metaverse learning technology	4.01	.791
I can record and share topics related to projects on video using metaverse	3.99	.7844
I can create video materials about my lessons with metaverse	3.86	.824

Usage Level of Metaverse Technology		
Valid N (list wise) = 383	3.9399	.51237

From the study analysis, The following are the Metaverse learning Technologies: I can effectively communicate, which scored a mean range of 4.36 and a standard deviation of 0.773, was followed by Teaching with Metaverse Technology, which scored a mean range of 4.22 and a standard deviation of.753, and a Multi-Environment Supported Project with Metaverse Technologies, which scored a mean value of 3.03 and a standard deviation of.183. Moreover, the most useful and widely used means for accessing and reading about metaverse usage and feasibility are Google and Video. For the use of Video and Google websites, the mean utilization was 4.09, with a standard deviation of.803. The video shows the mean value of 3.99 and the standard deviation. Looking at the other elements of the study with mean values and standard deviations, I can manage the project I lead through metaverse devices with a mean value of 3.9 and a standard deviation of.916, which is the lowest range as compared to the other elements, such as using current metaverse platforms such as Sandbox, Roblox, Decentraland, and so on, with a mean value of 3.34 with a higher variance and a standard deviation of 1.121. The use of metaverse devices to access the internet received a mean grade of 4.01 and a standard deviation of 0.759. The research also noted that participants shared course materials with their friends, with a mean value of 4.24 and a standard deviation of.760, and that individuals used a single message to the whole group for important notifications. Using metaverse learning methods, I found that discussing course material with friends resulted in a mean value of 4.01 and a standard deviation of.791. These shows that the use of single message to the whole group for essential alerts is quiet higher and more utilized as compared to share course materials with my friends with the lowest lower usage of metaverse tools. As a result, the study examined the degree of involvement of Valid N (list-wise) = 383 using metaverse Technology, with an overall mean of 3.9399 and a standard deviation of.51237

Table 4.3

Statistic usage level of metaverse technology

Gender	N	Mean	Std. Deviation	Std. Deviation error mean
Usage level of metaverse technology: Male	224	3.9877	.51048	.03411
Female	159	3.8726	.50904	.04037

The table investigated the use of metaverse technologies by people of both genders. The research has 224 participants with an average value of 3,987 and a standard deviation of 51048. It also calculated a standard error mean of, 03411. There were 159 female participants, with an average value mean of 3, 8726 and a standard deviation of, 50904. The female group's standard error mean was 04037. These findings imply that males in the research place a greater importance on metaverse technology than females. The study, however, demonstrates that there is no substantial variation in the overall meaning and values of knowledge across the genders, as the standard deviation matches the findings of the gender-based analysis.

Table 4.4

Independent Samples Test of metaverse technology

		Levene's Test for Equality of Variances		t-test for Equality of Means
		F	Sig.	t
Usage Level of Metaverse Technology	Equal variances assumed	,024	,878	2,176
	Equal variances not assumed			2,178

The table above provides an independent test on the previously indicated descriptive variable test. This test was designed primarily to assess the extent of utilization of metaverse technology and its significant worth. The assessment of several statistical parameters was part of the analysis. The study looked at the F-value of 0.024 derived by Levene's Test, which checks for variance equality. Furthermore, the study

examined the significant value of 0.878, which assessed the equality of means under both equal and unequal variances. As a consequence, the results suggested that both equal and unequal variances were taken into account. The significance value of the findings was determined to be 0.878, indicating significant importance in the study's findings.

Table 4.5

Independent Samples Test on usage metaverse technology

		t-test for Equality of Means		
		df	Sig. (2-tailed)	Mean Difference
Usage Level of Metaverse Technology	Equal variances assumed	381	,030	,11508
	Equal variances not assumed	340,978	,030	,11508

An independent sample test was used to analyze the study, which provided a variety of values, significances, and findings. The test assumed equal variances for the variable assessing the extent of metaverse technology adoption and got a degree of freedom value of 381. The degree of freedom was 340,978 when no equal variances were considered. The two-tailed significance value for assuming equal variances was 0.030, and the significance value for assuming equal variances was similarly 0.030. Furthermore, in both situations, the mean difference between the two circumstances was 0.11508. According to the significance value of the findings, there is likely no significant difference between assuming equal variances and not assuming equal variances.

Table 4.6

Independent sample test

	t-test for Equality of Means		
		95% Confidence Interval of the Difference	
	Std. Error Difference	Lower	Upper

Usage Level of metaverse Technology	Equal variance assumed	.05287	.01112	.21904
	Equal variance not assumed	.05285	.01113	.21903

The statistical analysis shown in the above table is for an independent sample test. It investigates the amount of adoption of metaverse technology and explores two scenarios: one with equal variations and the other with differential variances. The standard error difference is 0.05287 0.05285 when equal variances are assumed, and 0.05 when they are not. A t-test is also performed to determine mean equality, with a 95% confidence range for the difference. Lower confidence interval values are presented as 0.01112 when equal variances are assumed and 0.01113 when equal variances are not expected. Similarly, with equal variances assumed, the higher values of the confidence interval are 0.21904, and for equal variances not assumed, they are 0.21903. As a result, the study findings on the amount of metaverse technology utilization show very significant results for both scenarios, with equal variances assumed and not assumed.**4.3.** The perceptions of students towards the metaverse and the difference between male and female students' perceptions towards metaverse applications in education.

4.3 The perceptions of students towards the metaverse and the difference between male and female students' perceptions towards metaverse applications in education

Table 4.7

Descriptive Statistics of metaverse applications in education

	Mean	Std. Deviation
Metaverse learning Technologies: I can communicate well with my friends	4,43	,802
Teaching with metaverse technology, I can do the assignment task	4,31	,907
I can manage the project I lead through metaverse devices	4,34	,789
I can use current metaverse platforms such as Sandbox, Roblox, Decentraland etc.	4,12	,860
I can communicate with my teachers and friends via video	3,19	1,268
I can develop my multi-environment supported project with metaverse technologies	4,11	,728
I can access the internet via metaverse devices	4,36	,691
I can use online groups such as yahoo group, Google group for learning activities	4,13	,703

I can send a single message to the entire group for necessary notification	4,16	,703
I can share course materials with my friends through metaverse learning technology	4,15	,632
I can record and share topics related to projects on video using metaverse	4,29	,708
I can create video materials about my lessons with metaverse	4,10	,685
Metaverse learning Technologies: I can communicate well with my friends	4,28	,829
Teaching with metaverse technology, I can do the assignment task	2,69	1,427
I can manage the project I lead through metaverse devices	4,10	,694
I can use current metaverse platforms such as Sandbox, Roblox, Decentraland etc.	4,10	,775
I can communicate with my teachers and friends via video	4,10	,807
I can develop my multi-environment supported project with metaverse technologies	4,16	,744
I can access the internet via metaverse devices	4,09	,739
I can use online groups such as yahoo group, Google group for learning activities	4,06	,678
I can send a single message to the entire group for necessary notification	4,06	,645
I can share course materials with my friends through metaverse learning technology	4,06	,721
I can record and share topics related to projects on video using metaverse	4,04	,706
I can create video materials about my lessons with metaverse	4,17	,689
Metaverse learning Technologies: I can communicate well with my friends	4,07	,743
Perceptions	4,0665	,43192
Valid N (list wise) N = 383		

The descriptive statistics and findings of the study illustrate the efficacy and relevance of the elements and factors under consideration. The table demonstrates the adaptability of metaverse technologies and their applications. The factor with the highest mean value among those examined is "Metaverse Learning Technologies: I can communicate well with my friends," having a 4.43 rating and a 0.802 standard deviation. The mean score for "Teaching with Metaverse Technology: I Can Do the Assignment Task" was the lowest at 2.69, with a standard deviation of 1.427. This demonstrates that students choose independent application over traditional teaching methods.

The analysis of the research also includes "Teaching with metaverse technology: I can do the assignment task, with a standard deviation of 0.907 and a mean value of 4.31. Additionally, "I can use the current metaverse platforms, such as Sandbox, Roblox, Decentraland, etc." had a mean value of 4.12 and a standard deviation of 0.860, while "I can access the internet via metaverse devices" had a higher mean value of 4.36 and a standard deviation of 0.691. Additionally, the study examined "Metaverse Learning Technologies: I can communicate effectively with my friends," with a mean score of 4.28 and a standard deviation of 0.829.

With a mean score of 4.04 and a standard deviation of 0.706, "I can record and share topics related to projects on video using metaverse" received a lower mark. In a similar vein, "I can use online groups such as Yahoo Group or Google Group for learning activities" received a somewhat higher mean score of 4.06 and a standard deviation of 0.678. The variable "I can share course materials with my friends through metaverse learning technology" showed similarity with a mean value of 4.06 and a standard deviation of 0.721. Thus, the average total perception score was 4.0665, with a standard deviation of 0.43192, according to the study's findings. The total number of legitimate participants in the research (according to the list) was 383.

Table 4.8

Group Statistics of perceptions of students on metaverse

	Gender	N	Mean	Std. Deviation	Std. Error Mean
Perceptions	Male	224	4,0693	,45582	,03046
	Female	159	4,0626	,39719	,03150

The statistical statistics on males and females' perceptions of the research variable show a gender discrepancy. The study included 224 male participants and 159 female participants. Additionally, the mean score for male was 4.0693, but the mean value for female was 4.0626. The standard deviation for male was 0.45582, while the standard deviation for female was 0.39719. Furthermore, the standard error mean for male was 0.03046 and 0.03150 for females, respectively. As a result, the study's findings

imply that while both genders have modest variations, they have similar perspectives on the metaverse.

CHAPTER V

Conclusion aad Recommendations

Conclusion

Rapid changes are occurring with technical developments in this period, sometimes known as the information and communication age. A growing number of people are integrating technological tools into their daily life as they become more widely used and more easily available. As a result, using these tools in the quest of education has become inevitable for those growing up in this technological age. The metaverse is one of the most talked-about modern technologies that have evolved along with technological development. By obtaining student opinions and viewpoints on the metaverse's application in education, this research seeks to further the area of education. With the intention of generating useful insights to enhance the overall educational experience, the study seeks to assess the suitability of this technology in existing and future educational environments. Students at universities were given questionnaires in order to accomplish this (Talan, 2022). The results of the study were fully analyzed and contrasted with those from prior research in the literature, and both similarities and differences were carefully investigated. The results of this study are also used to provide suggestions for future research.

According to the study, students had a wide range of viewpoints on the advantages of utilizing the Metaverse in education. They emphasized how Metaverse enriches classes with a sense of variety and fascination, encouraging participation of students and curiosity while establishing a positive learning environment (Jung, 2021). Additionally, Metaverse is useful for online learning since it gives students access to flexible learning possibilities wherever they are. The benefits of Metaverse for learning were emphasized by students, who noted that it promotes engagement, piques the imagination, helps with comprehension and learning, and improves the process' overall efficacy and efficiency. Additionally, they claimed that Metaverse heightens interest and attention in educational content, resulting in increased productivity and motivation during class time. . It is quite likely that the potential educational benefits of the Metaverse will lead to more study and more widespread use in the near future.

Furthermore, the Metaverse advances the advancement of teaching resources focused on two dimensions (2D) (Mystakidis S. , 2022).

Alternatively, students voiced reservations about the Metaverse, citing a variety of obstacles and downsides in addition to its educational and other benefits. Students raised concerns about the application's hardware and technological challenges, dependency on internet connectivity, and restricted access to technology. They also discovered negative repercussions such as technology addiction, excessive screen time, and a variety of health-related issues. The negative characteristics of the Metaverse were described further by its impact on social relationships, difficulties in successfully expressing views, and a sense of alienation from reality. According to student comments, using Metaverse in packed classrooms can cause chaos, loudness, difficulty maintaining discipline, and distractions that divert students' attention. These negative elements complicate the proper integration of Metaverse in educational contexts and have an influence on both student and teacher acceptance. The goal of this research is to learn what students think about using the Metaverse for education. It is advised that academics, professionals, and decision-makers thoroughly consider the study's conclusions and adopt the appropriate safety measures. These results' main objectives are to give an invaluable resource for further study in the area and to offer crucial guidance to instructors and creators of digital art that intend to integrate the Metaverse into learning environments. Quantitative research or a combination of approaches may be used to examine the data in great detail, and subsequent study can concentrate on the incorporation of the Metaverse into certain courses.

Recommendations

Numerous causes, including those already mentioned, contribute to the growing feasibility of integrating the metaverse into educational settings. This is mostly a result of the quick development of technologies associated to the metaverse, such as wearable technology, high-performance computers and networks, and sensor technology. As a result, using the metaverse for educational purposes is becoming increasingly practical.

The study's conclusions recommend allowing students' access to the Metaverse while also integrating Metaverse-related apps into the classroom to teach them about

cutting-edge technologies. Teachers can obtain training on the topic, and textbooks can include pertinent applications in order to assist the widespread use of the Metaverse in schools. With the help of this method, students may learn more about the Metaverse and become more adept at using these tools. It is essential to recognize any issues and resolve them if the integration of the Metaverse into education is to be effective and advantageous in educational contexts. To fix software and technical problems, it is also crucial to perform usability testing and pre-testing of the apps. Users require accessible, portable gadgets that enable them to regularly engage and interact with the metaverse through top-notch digital content. One of the primary issues that must be overcome to close the gender gap in the technology industry, according to several studies conducted up to this point, is the low involvement of females in STEM fields (Akour, 2022). The technological characteristics of each metaverse variation must be well understood by instructional designers and instructors in order to successfully integrate the metaverse into education. As a result, they will be able to craft instructional programs that encourage group problem-solving and imaginative project implementation (Kye, 2021). Understanding the particular technology that student’s use and how it affects their development and relationships must take precedence over just focusing on how much time students spend using technology (Turner, 2015). As a result, the study's findings will help students understand the subject matter and provide a theoretical and intellectual foundation for using the metaverse in educational settings.

Future research may examine the Metaverse's impact on various aspects, including learning success, desire, mindset, and sustained participation because it is still early in the adoption of the Metaverse in education. Researchers might also look at the reasons why the Metaverse is not frequently used in classroom settings. Future research may include students from varied backgrounds to measure student happiness across various educational levels and geographical areas.

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Appendix A

YAKIN DOĞU ÜNİVERSİTESİ

BİLİMSEL ARAŞTIRMALAR ETİK KURULU

01.02.2023

Dear Ibrahim Seray Khan

Your application titled **"Perceptions of University Students on the integration of Metaverse inHigher Education"** with the application number NEU/AS/2023/181 has been evaluated by the Scientific Research Ethics Committee and granted approval. You can start your research on the condition that you will abide by the information provided in your application form.

Prof. Dr. Aşkın KİRAZ

Coordinator of the Scientific Research Ethics Committee

Appendix B

PERCEPTIONS OF UNIVERSITY STUDENTS ON THE INTEGRATION OF METAVERSE IN HIGHER EDUCATION

Dear Participants

With the changes in information and communication technologies in recent years, the concept of metaverse-based learning has emerged. In particular, developments such as laptops, mobile phones, PDA, Mobile TV, wearable technologies, Wireless internet and 3G technology applications have enabled us to put metaverse learning environments and tools at your service. To what extent are teachers and students prepared for these developments? This question should be answered with scientific research findings. In this context, the aim of this survey is to explore university students' perspectives and give guidance for the use of metaverse-based learning in higher education. It will be enough to mark (x) the option that is suitable for you. The opinions given in this survey will only be used for research. Thank you for your interest and sincere answers.

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I. PERSONAL INFORMATION

1. Your gender

a. Male b. Female

2. Your age……

3. Your nationality ……..……

4. University

a. Near East University (NEU)

b. Cyprus International University (CIU)

c. Bahçeşehir Cyprus University (BAU)

d. Rauf Denktas University

e. European University of Lefke

f. University of Krynia

g. Eastern Mediterranean University **(EMU)**

h. Girne American University

i. Others (please specify)……..

5. Faculty …….

6. Department ……

7. Educational level

a. Undergraduate b. Postgraduate

8. Have you heard of Metaverse application before?

b. Yes b. No

9. Have you participated in Metaverse workshop/seminar?

a. Yes b. No

10. Where are you using the internet? (You can choose more than one option)

a. At home b. at school c. in the library d. at the internet café e. from the phone f. others

11. How many hours a day do you use the internet?

a. Less than 1 hour b. 1-2 hours c. 3-7 hours d. above 7 hours

I. Your level of use of the following tools

Tools/device	V. good	Good	Moderate	weak	V. weak	Never used before
1.Mobile						
2.Augmented Reality smart glasses						
3. Desktop/ laptop						
4.Virtual Reality Headset						
5.Hololens						

II. Your level of agreement with the following statements (x)

Ability to use metaverse aided technology	strongly agree	agree	neutral	disagree	Strongly disagree
1. Metaverse learning technologies: I can communicate well with my friends					
2. Teaching with metaverse technology, I can do the assignment tasks					
3. I can manage the project I lead through metaverse devices					
4. I can use current metaverse platforms such as Roblox, Decentraland, Sandbox, Axie Infinity, Star Atlas, etc.					

5. I can communicate with my teachers and friends via video					
6. I can develop my multi-environment supported project with metaverse technologies					
7. I can access the internet via metaverse devices					
8. I can use online groups such as yahoo group, Google group for learning activities.					
9. I can send a single message to the entire group for necessary notifications.					
10. I can share course materials with my friends through metaverse learning technologies.					
11. I can record and share topics related to projects on video using metaverse					
12. I can create video materials about my lessons with metaverse technologies					

12. Would you be happy to use Metaverse-based learning apps in your lessons?

a. Yes b. No

III- YOUR VIEWS ON METAVERSE-BASED LEARNING APPLICATIONS:

Please mark your level of agreement (x) for the following statements:

advantages of metaverse-based learning	strongly agree	agree	neutral	disagree	Strongly disagree
1. Metaverse-based learning systems increase the quality of education					
2. Metaverse devices can be used everywhere					
3. With metaverse technologies, the information I need is always with me.					
4. Metaverse-based learning applications should be used as a supplement to traditional education					
5. Metaverse-based learning applications are safe for sharing personal information.					
6. Metaverse-based learning applications make it easy to learn subjects					
7. Metaverse-based learning apps are a good option for interaction					
8. In education, learning activities can					

be performed with metaverse-based learning applications.					
9. I can access the course materials I need instantly with metaverse technologies.					
10. Metaverse technologies can be used to assist students in learning activities					
11. Information can be shared using metaverse technologies and chat programs					
12. I would like teachers to support my lessons with metaverse learning method in future terms.					
13. using metaverse-based learning technologies increases my motivation					

Availability of metaverse-based learning applications in lessons	strongly agree	agree	neutral	disagree	Strongly disagree
14. Metaverse-based learning applications can be used as a good discussion tool in learning-activities.					
15. Metaverse-based learning apps are a					

convenient way to learn course topics					
16. Metaverse-based learning applications can create suitable environments for my discussions about my lessons.					
17. Metaverse-based learning apps are a convenient way for me to share topics in learning activities					
18. I can carry out my learning activities regardless of time and place with metaverse-based learning technologies.					
19. teachers can effectively send course materials to us via Multimedia Messaging Service					
20. I can access websites related to my courses through metaverse-based learning technologies when needed.					
21. Metaverse-based learning technologies can be applied as supportive in all courses					
22. Instant communication programs such as messenger and Skype used over mobile tools provide the opportunity to exchange ideas on the subject without time and place limitations.					
23. Metaverse learning environment can be created by the teacher					
24. we can provide communication between student and teacher with metaverse-based learning tools					
25. An effective learning environment can be created by the teacher from the lecture notes by sending e-mails with metaverse-based learning tools.					

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