TECHNIUM
SOCIAL SCIENCES JOURNAL

Vol. 32, 2022

A new decade for social changes

www.techniumscience.com

ISSN 2668-7798

Technium Social Sciences Journal
Vol. 32, 278-295, June, 2022
ISSN: 2668-7798
www.techniumscience.com

Analyzing education based on metaverse technology

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Abstract. The Metaverse is a post-reality universe, a perpetual multi-user environment that combines physical reality and digital virtuality. It is based on the convergence of technologies that enable multisensory interactions with virtual environments, digital objects, and people, such as virtual reality (VR) and augmented reality (AR). As a result, Metaverse is a web of social, networked immersive environments on persistent multi-user platforms. It allows for real-time, embodied user communication and dynamic interactions with digital artifacts. Its first incarnation was a web of virtual worlds between which avatars could teleport. The modern Metaverse includes social, immersive VR platforms that are compatible with massive multiplayer online video games, open game worlds, and AR collaborative spaces. The aim of the research is to thoroughly examine the perceptions and educational requirements of Metaverse-based education and to investigate its educational applicability. Using a mixed research method, the study investigated instructors' and students' perceptions of the use of the Metaverse in education, as well as the support system for classes that use the Metaverse. And determining the implications for action. plans and directions for its application in education.

Keywords. metaverse, education, virtual worlds, virtual environments

1.0. Introduction

Images of VR headsets generating vibrant avatars frequently come to mind when we discuss the Metaverse. It's a world where augmented reality solutions and decentralized technology drive user connection and interaction. To achieve a digital approach to social learning, the Metaverse incorporates the immersive benefits of online technology. (Choi, H. S., and S. Kim, 2017).

The education and learning and development communities are always looking for new ways to apply platforms like the Metaverse to current learning tactics (Akçayr, M., & Akçayr, G, 2017). There is arguably a greater need for innovation in education and training. This is because schools and universities do more than just educate students; they actively shape young people for the future, which goes beyond the workplace (Howard, S. K., & Gigliotti, A. 2016). The Metaverse has many applications in the digital age, but in education, everyone wants to be a part of what happens next. The digital age has arrived, full of ideas, and the consensus on the future of education is that change must happen faster. L. Kerawalla, A. Woolard, R. Luckin, S. Seljeflot, and L. Kerawalla (2006).The goal of this research is to raise awareness about the

Metaverse's origins and benefits, as well as Metaverse-powered online distance education. To accomplish this, I organized my research into definitions of the key concepts presented.

The following are summaries of the limitations of two-dimensional learning environments. I present a brief history of virtual media and VR technology. I discussed the importance of virtual worlds and VR in education. Metaverse development, Meta-education, and innovative applications are all priorities. Its futuristic qualities appeal to those who are interested in learning development; however, how will this impact education?

This paradigm is known as Metaverse. The term Metaverse is a closed compound word made up of two words: Meta (a Greek prefix meaning "after, after, or beyond") and Universe (Dionisio III, J. D. N. WGB, & Gilbert, R , 2013). The Metaverse is a post-reality universe, a perpetual multi-user environment that combines physical reality and digital virtuality. S. Barteit and C. Beiersmann, 2021). In terms of online distance education, Metaverse has the potential to describe a persistent, immersive 3D virtual environment in which any user, anywhere in the world, with access to a terminal could engage in everything from business to entertainment and education. (Dalgarno, B., & Lee, M. J, 2010). The concept of a "metaverse" has existed since the dawn of the digital age. Philip Rosedale created Second Life in 2003. Its value for students and teachers was obvious from the start (Moro, C., tromberga, Z., & Stirling, A, 2017), with best practices discussed globally by experts at leading events in the sector (Bing, E. G., & Sullivan, R, 2019). (Loorbach, N., Peters, O., Karreman, J., & Steehouder, M. 2015). The Covid-19 pandemic had a significant impact on the workplace and universities. (Stöhr, C., Demazière, C., & Adawi, T, 2020); Instead of socializing in classrooms and offices, people focused on team meetings (Boltz, L. O., Yadav, A., Dillman, B., & Robertson, C, 2021). With pre-pandemic lack of virtual innovation and pandemic limiting social interaction, the Metaverse has the tools to host a destination that works both virtually and socially (Mystakidis, S,2019). If we assume that, over time, barriers to adoption and technical impediments will overcome, and that broad adoption of virtual worlds will become commonplace, then several possibilities emerge, not only for education but also for other sectors.

Despite many technological innovations, education is one critical field for society and the economy where core implementation methods remain unchanged and revolve around content transmission, classrooms, and textbooks (Friesen, N,2017). There is currently a race to build the infrastructure, protocols, and standards that will govern the Metaverse (Mystakidis, S., Berki, E., & Valtanen, J. P, 2021). Large corporations are attempting to build closed, proprietary hardware and software ecosystems in order to attract users and become the de facto Metaverse destination (Dalgarno, B., & Lee, M. J, 2010).

'Sub-verses' are being created within the Metaverse. k-20 Educators is developing a virtual world called the Eduverse (Brown, A., Gavin, L., Berridge, P., Achten, H., & Knight, M, 2000), based on web3, with the goal of bringing learners together as avatars. Leaders in the technology industry aggressively promoted the wonders of web3 in the market. but also praised by educators and communities (Messinger, P. R., Ge, X., Stroulia, E., Lyons, K., Smirnov, K., & Bone, M, 2008). One notable advantage is web3's fair goal of making development opportunities available to all humans, the first major step in its journey to generating equality in education and learning.

The aim of using the metaverse in education is to implement the concept of 'transparent accreditation,' which reports competency rather than hours or location. This is a more effective way of looking at students' learning techniques, skill sets, and individual needs (Dunn, T. J., & Kennedy, M., 2019). Transparent accreditation acknowledges that every student learns differently and thus has a different attention span. The traditional classroom environment does

Technium Social Sciences Journal
Vol. 32, 278-295, June, 2022
ISSN: 2668-7798
www.techniumscience.com

not work for everyone, and with the increased use of technology, people are finding it less engaging (Cruz, A., Paredes, H., Morgado, L., 2021). After spending hours interacting with each other in digital spaces, The Metaverse has the upper hand here; it possesses the same technological qualities that entice us to gaming, TV, and other forms of entertainment (Kozinets, R. V, 2022).

So, how will Metaverse aid in this endeavor? It all begins with examining why we need to change the educational system and what triggered this need for change. The Covid-19 pandemic is without a doubt the most significant cause of the decline in socialization in learning. Why is it necessary to improve the social aspects of learning? Many reports show that students of all ages are lacking in certain skills because of a lack of socialization–skills that are frequently required outside of the classroom. There is a lot of emphasis on the significance of these soft/transversal skills and how they can be developed (Maloney, D, 2021). Even with the limitations imposed by lockdowns and isolation periods, the Metaverse can generate high levels of socialization in learning (Liu, X., & Zhang, J, 2012). It can be a place where we not only learn practical, applicable skills, but also how to apply those skills in a social setting.

The Metaverse thrives on the use of digital tools, online technology, and virtual reality in creating worlds. Its immersive environment will appeal to and engage students of all ages. Consider an ecosystem in which learners purchase access to courses without enrolling in colleges using web3. It decentralized the key that connects web3 to Metaverse technology (Suh, W., & Ahn, S, 2022). Following the pandemic, incorporating socialization into remote learning is in high demand, but using the Metaverse to accomplish this will take time. It took two years for learning institutions to adapt during the pandemic, so adapting to Metaverse teaching will take time as well. (Díaz, J., Saldaña, C., & Avila, C, 2020) Some universities are experimenting with the metaverse, which combines the real and virtual worlds, in the field of teaching and learning. , introducing Metaverse to the educational field is an unavoidable change for those who were born and raised in a digital media environment, which has recently received a lot of attention in various fields, to interpret the meaning of the metaverse in the educational field, and to serve as a compass to suggest the educational direction of domestic metaverse research in the future (Collins, C, 2008).

Because perceptions of the metaverse may vary depending on major and subject type (number of students, class types, evaluation guidelines, etc.), more meaningful research results will be generated if we study the metaverse design method according to class type, as well as the satisfaction and effectiveness of learners taking part in the metaverse class (Schlemmer, E., & de Queiroz Lopes, D, 2011). Because of active investment in the metaverse, metaverse utilization technologies are now reaching maturity. And the metaverse's technologies, such as platforms, are diverse. HMDs, cloud computing, GPUs, and content creation tools However, there have been few studies that have used these technologies in industrial or educational settings (Lee, H., & Hwang, Y, 2022). It is necessary to test the effectiveness metaverse in the classroom and to investigate the learner's learning experience. The metaverse must develop into a learning paradigm. I believe the metaverse should be viewed as an additional educational tool that can enhance the learning and educational effects of classes that are not traditional.

2.0. Research Aim

The metaverse's potential as a useful educational tool is an open question. This research examines the metaverse and its role in education and learning. With its qualitative and analyzing research methods, this study investigates how metaverse exists in various forms of education.

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The applications and developments in metaverse technology, as well as the challenges and provisions of using metaverse in education.

3.0. Research Questions

The following are some research questions that will serve as the foundation for other research processes involving metaverses used in educational settings.

R1: Why is it necessary to use the metaverse in education?

R2: How have educational systems developed because of the use of metaverse technologies?

R3: Why is it necessary for developing countries to use metaverse technologies to improve education?

R4: Is the metaverse education environment superior to traditional education?

4.0. Methodology

4.1 Research Design

This research satisfies the requirements of metaverse-based education and investigates its educational utility. A mixed research method was used to create a support system for classes using the Metaverse, as well as instructional design using the Metaverse. According to the findings, the Metaverse would be suitable for use as a complementary delivery tool and for student-centered learning, including curriculum and information about teaching and learning strategies. I conducted this research on the field applicability of the Metaverse in education by raising awareness and demand for education using the Metaverse, as well as identifying implications for action plans and future directions for its use in education. This study is significant because it discovered implications for the metaverse in education, such as the applicability of metaverse to the field of education, as well as practical measures and directions for metaverse. This research aims to investigate the future use of the metaverse in education and to investigate metaverse-based education as an educational medium.

5.0. Sample and Data Collection

The study samples were the same in quantitative and qualitative data collection, and when comparing or interpreting both quantitative and qualitative data about metaverse worlds, it frequently dismissed metaverse worlds as a technology that isn't yet ready for serious academics. In this article, I show that legitimate educational uses of metaverse worlds are already being discovered and documented, and that academic inquiry into metaverse worlds is extremely serious. But, beyond the capabilities that metaverse worlds currently provide, the possibilities for the future that we can imagine may be the most intriguing.

6.0. Findings / Results

Meta-educational models that are new. Rich people may benefit from metaverse-powered online distance education. The Metaverse's online learning will break the last barrier between social connections and informal learning. We consider physical presence in a classroom a valuable educational experience. Telepresence, avatar body language, and facial expression fidelity will make virtual participation equally effective.

The Metaverse's social mixed reality can support blended active pedagogies that deepen and sustain knowledge. It has the potential to become a democratic factor in education, allowing for global participation on an equal footing, unconstrained by geographical boundaries. As analysis data for this study, they used thirty questionnaires in which they

Technium Social Sciences Journal
Vol. 32, 278-295, June, 2022
ISSN: 2668-7798
www.techniumscience.com

answered all questions accurately. Figure 1 depicts the survey respondents' demographics. For the demographics of the faculty members who responded to this survey, assistant professors had the most (22.0 percent), while research professors had the least (20.0 percent). In terms of educational experience, students attend university (44 percent). Association professors (9%) and university professors (9%) were the most common genders (6 percent).

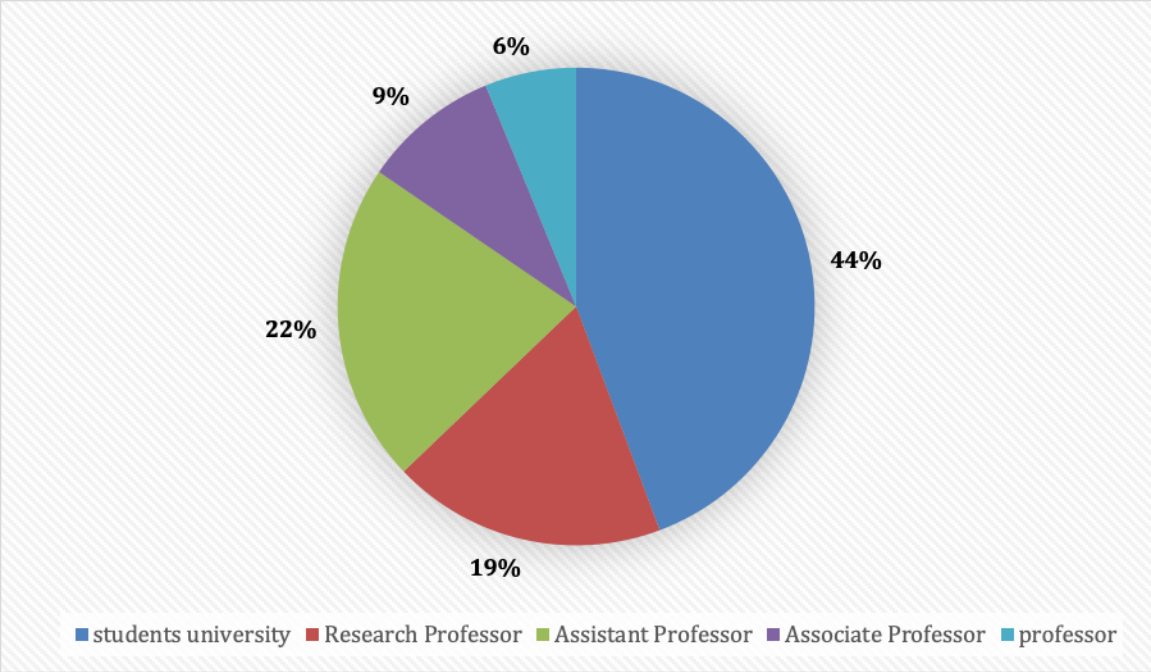

Figure 1. Demographic information about participants

In this study, I used the SPSS 21.0 statistical processing program to analyze the frequency of responses to each question for 35 survey data collected. For in-depth interview data, all interviews were transcribed for qualitative analysis, and then the contents of the same context, divided by topic, were analyzed. Table 1 contains the questionnaire questions, and Table 2 contains the semi-structured interview questions.

Table 1. Survey question structure

Major Area	Questions	Types of question
Background information on demographics	Department, education, career, gender, and age	Multiple choice
understanding of the Metaverse Basic of the Metaverse	Level of knowledge about the Metaverse, how you became acquainted with the Metaverse, and recognition of Metaverse applications in education	Multiple choice

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Education in the Metaverse	Methods of incorporating the Metaverse into the classroom, appropriate class types for the Metaverse, and anticipated educational benefits of implementing Metaverse-based Education	Multiple choice + Short answer questions
Metaverse-based Education Support and System	Instructional assistance for a Metaverse-based class	Multiple choice + Short answer questions

Table 2. Questionnaire for semi-structured interviews

Major Area	Questions
Overall Thoughts on Metaverse-Based Education	Overall thoughts and feelings about Metaverse-based Education, Appropriate uses of the Metaverse in the Classroom
Aspects of Metaverse Preparation for Metaverse-Based Education	Elements required when attempting to apply and prepare the Metaverse for the Educational field
Aspects of Education in the Metaverse	Implementing Metaverse-based classes is expected to be difficult. Metaverse-based Education: strengths, weaknesses, and improvements
Metaverse-based Education Enhancements and Suggestions	Topics you'd like to see covered at the Metaverse workshop. University and departmental institutional and technological support for Metaverse-based Education.

The metaverse knowledge level of professors was investigated in this study. As shown in Figure 2, they confirmed it on four levels. The beginner level of 'I've heard of the word, but I don't know the exact meaning,' the intermediate level of 'I can explain the meaning of the metaverse to others,' and the advanced level of 'I have my avatar in the metaverse platform and do basic activities'. At the intermediate level, you can decorate, enter the world, and so on. At the advanced level, you can do interactive activities (making friends, taking pictures, and so on), and finally, you can create your own world on the metaverse platform. According to the results of responses to the level of metaverse knowledge, the beginner level had the most (51

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Vol. 32, 278-295, June, 2022
ISSN: 2668-7798
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percent), followed by the advanced level. Intermediate-level respondents were (7 percent). The research participants have a strong interest in the metaverse, but their knowledge of it is low.

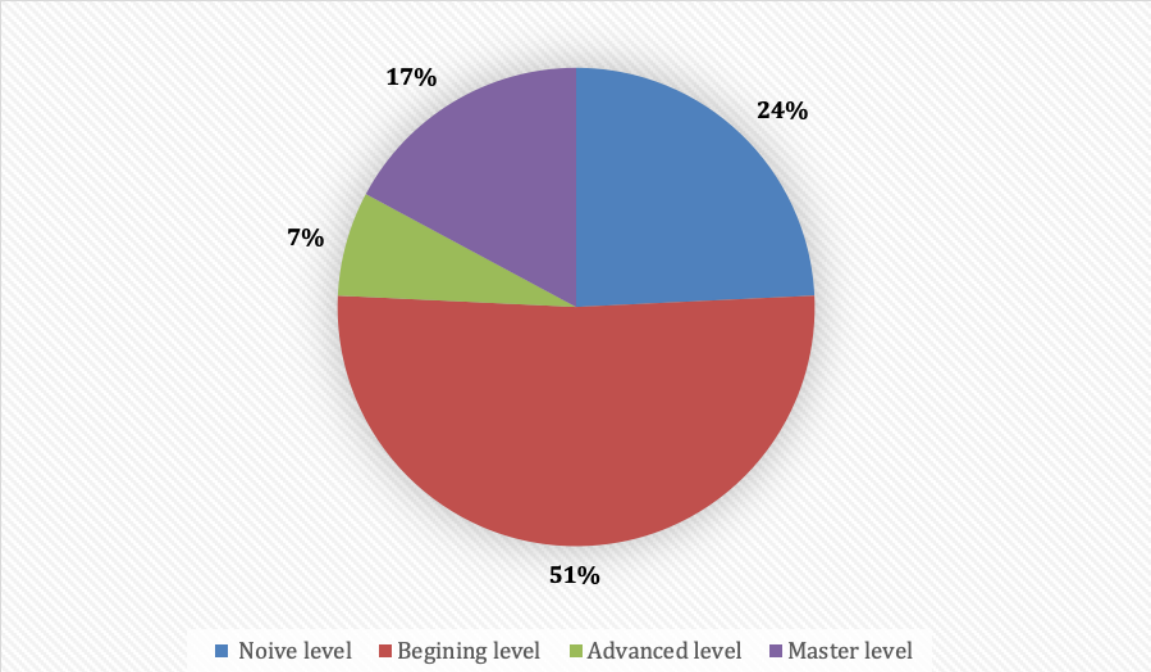

Figure 2 . level of familiarity with the Metaverse

Because of the coronavirus, interview participants said they understood the term "Metaverse." It discovered, however, that there was a significant difference in knowledge about the metaverse depending on major and interest. According to Figure 3, the most common way to learn about the metaverse was through mass media (60 percent), and the least common way was through individual research (4 percent). Because of the response, there is a keen interest in the Metaverse in our society, as non-face-to-face activities have become commonplace in order to avoid corona infection.

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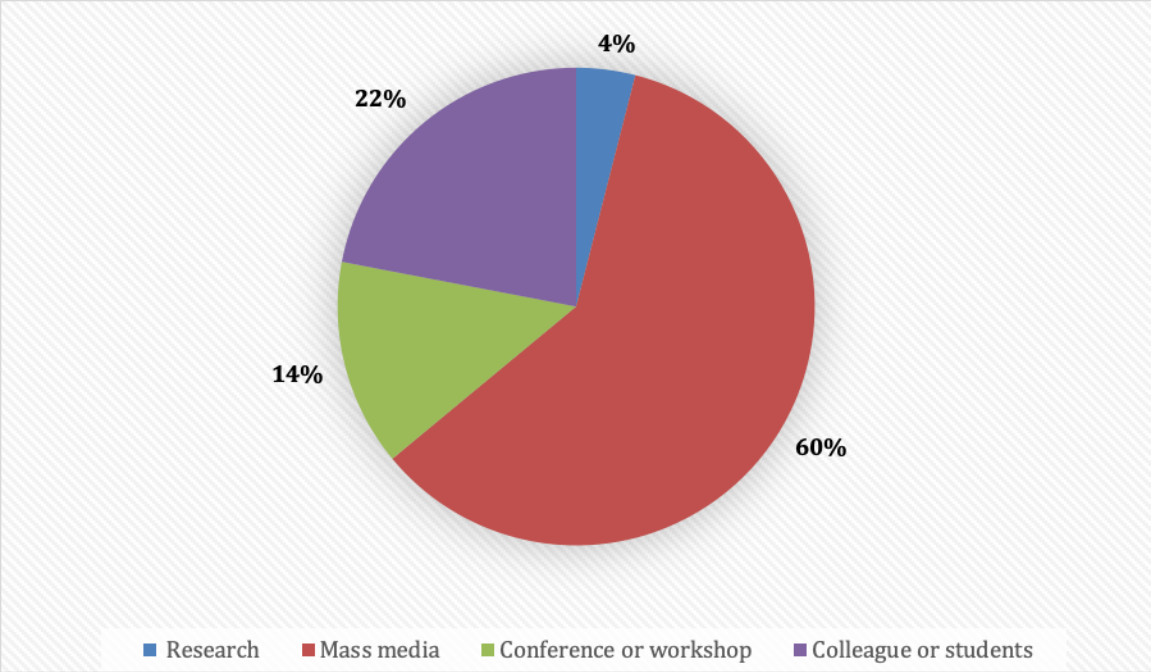

Figure 3. How did you become acquainted with the Metaverse?

These researchers discovered that over 500 metaverse-related news items were produced and distributed between January 1, 2022, and April 24, 2022, after analyzing the metaverse's development stage and dividing it into three periods. The results show mass media is the most common metaverse recognition path for most students.

Figure 4 shows that most study participants (73.00%) were aware of the possibility of using the metaverse in the educational field and class. Participants in the study conducted real-time non-face-to-face classes using media such as ZOOM or WebEx to prevent the spread of COVID-19 infection, which lasted more than a year, and experienced learners who could exist both online and offline at the same time. They interpreted it as favoring the introduction of the metaverse, which allows free movement of space into the educational field.

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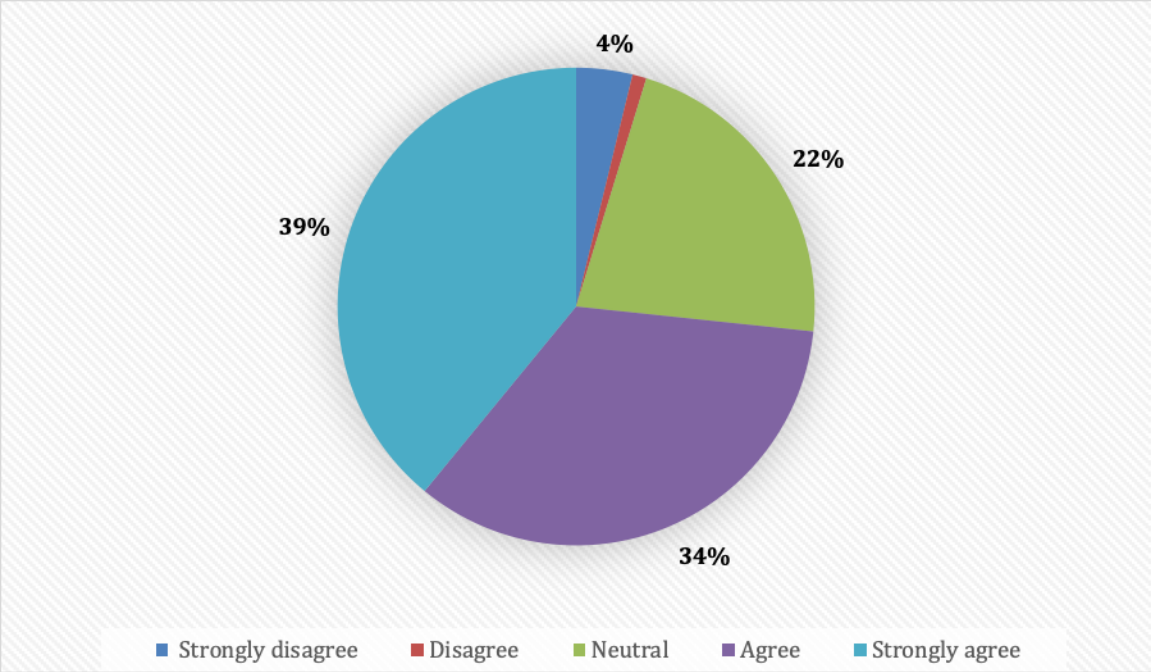

Figure 4. Degree in recognition of Metaverse application in education

When a new technology is introduced, it debates its applicability and effectiveness in education. But the unanimous conclusion is that it is critical of what context the instructor uses it. The ability of the instructor to use technology, as well as expertise and confidence in teaching and learning methods, is required for the metaverse to be used in the educational field. The metaverse is merely a tool for education, not its end goal. They can use it as a main depending on the capabilities and infrastructure of the instructor, so the role of the instructor is critical. Participants in the study suggested that metaverse-related technology developed as well as faculty competency improved in order for the metaverse to be used appropriately as a major tool and an auxiliary medium for teaching and learning in the classroom.

Combining the opinions of the interview participants, they concluded that because education in the metaverse is still in its infancy, fewer than 20 students should take part in actual education classes. However, in order for an education to truly use the metaverse, it must be possible to transcend time and space and allow most people to take part. They interpreted the study participants' responses as indicating that having the greatest number of participants within the allowable range of technology and infrastructure would be possible in the future.

According to Figure 5, participants in this study felt that using the metaverse in a class centered on learned activities, such as student-centered problem solving, online education, and discussion, was the most appropriate. They considered theoretical classes to be unsuitable for the metaverse (8 percent). The research participants expect learners to form their own knowledge and learn autonomously through the metaverse rather than the traditional method of imparting instructor knowledge.

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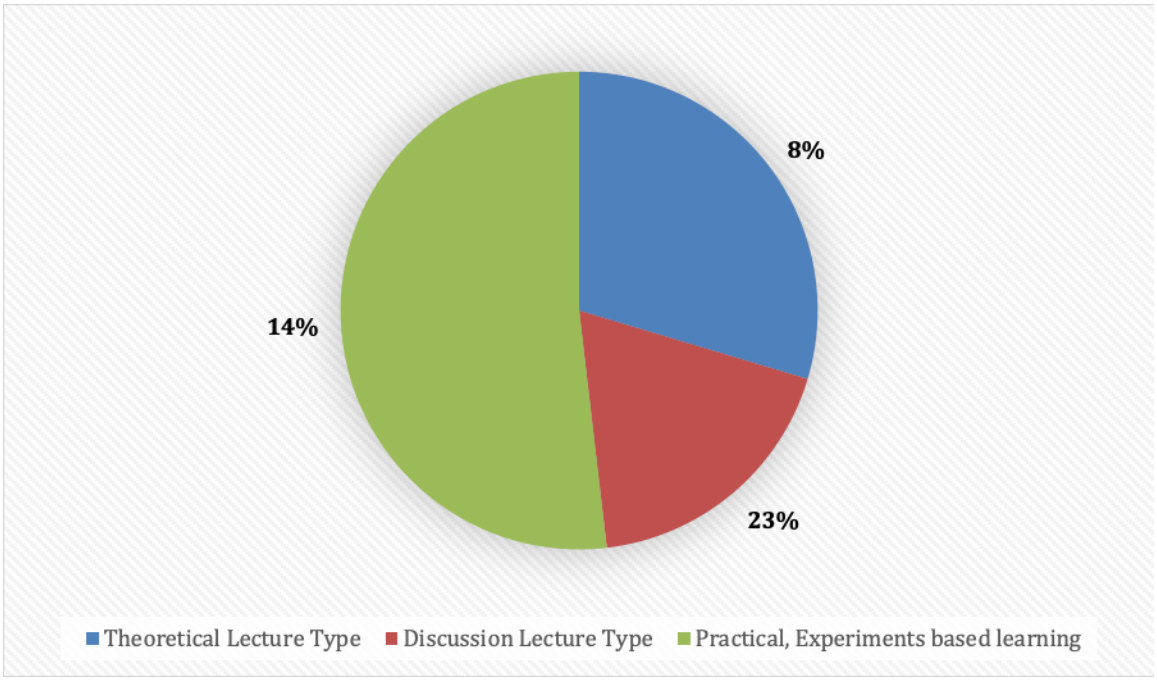

Figure 5. The Metaverse class type

To use Metaverse as a teaching medium, interview participants thought it would be more effective to use a real-time platform or to create and distribute lecture videos. Among the challenges expected to implement metaverse-based classes, the items with the highest number of respondents, as shown in Figure 6, include 'insufficient support from educational institutions,' 'absence of metaverse-related teaching/learning methods,' 'limitation of faculty competence,' and 'burdensome class preparation process.'

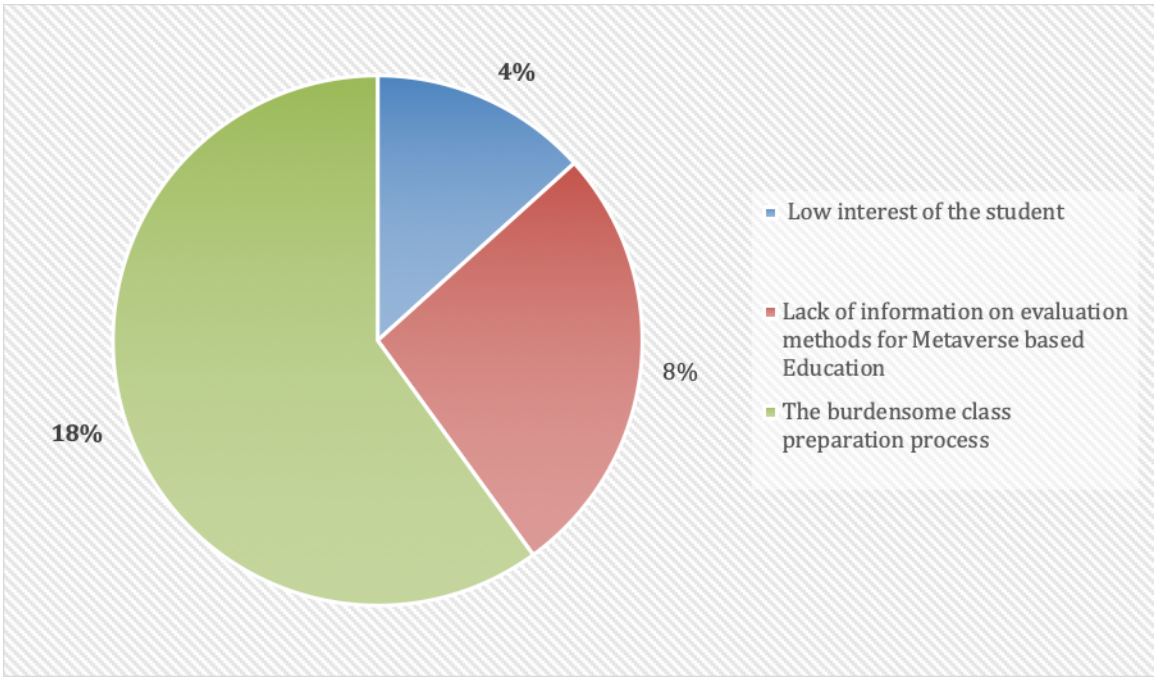

Figure 6. Difficulties in implementing metaverse-based classes are expected.

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Vol. 32, 278-295, June, 2022
ISSN: 2668-7798
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They failed to recognize the difficulties in implementing the metaverse in the absence of metaverse experts, and the level of knowledge about the metaverse remains at the beginner level, and the teaching method and instructional design using the metaverse remain in place. It shows the importance of improving teaching competency and metaverse-based teaching/learning methods that can be used in the classroom. If it enrolled them in a metaverse class.

It is difficult for instructors to build infrastructure and a technological environment on their own, and I believe that active interest and willingness from instructors and schools is required. Creativity, problem-solving ability, and collaboration ability will naturally develop because of adapting to a new environment and performing a task with others through classes using the metaverse.

The interviewees require policy support for the class operator and the educational environment in order to operate the metaverse class, which includes providing guidelines for metaverse class design and operation. It shows that you understand what you must be capable of.

According to Figure 7, the competencies of study participants expected to improve through metaverse classes are 'communication ability (18%)' and 'critical thinking ability (8%)'. Participants in the study perceived the metaverse as a space where learners can actively communicate with fellow learners or instructors rather than offline teaching and learning sites, and they expect such communication to improve problem-solving ability and broaden their perspectives.

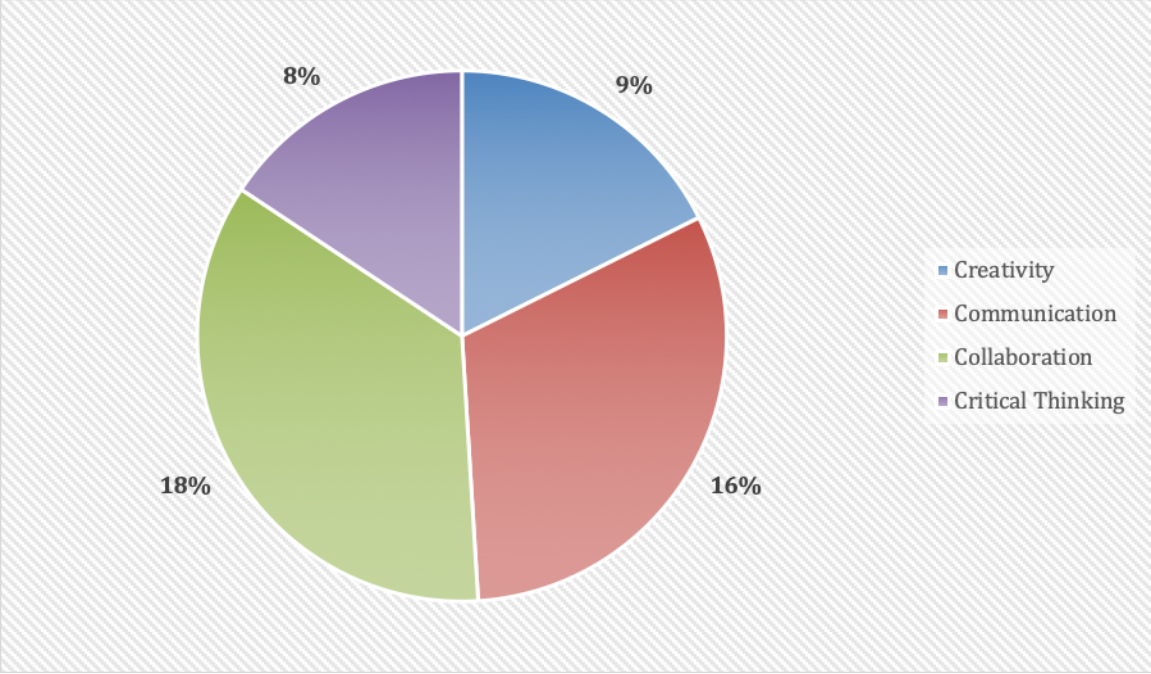

Figure 7. Metaverse in education is expected to improve students' abilities.

Participants in the interviews expected that if the metaverse was used as an educational medium, learners could overcome the limitations of non-face-to-face classes, which are a universal teaching and learning format in education. They recognized that the metaverse, as an

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educational medium, could increase cognitive flexibility related to creativity by allowing learners to interact with other learners and instructors. This is because the use of avatars in the metaverse space ensures anonymity compared to the offline space, so when solving problems it expands the opportunity to express one's own thoughts rather than stereotypes such as other people's views. We can say that the participants in the study hope to improve learners' creativity by using the metaverse as an educational medium.

According to Figure 8, the responses to the educational effects expected from the study participants' metaverse-using education were 'interaction-based learning to use avatars (25.0 percent),one-way Class methods in which students can participate rather than lecture-style classes (19 percent), and 'Various online classes that can overcome time and place constraints (24 percent).

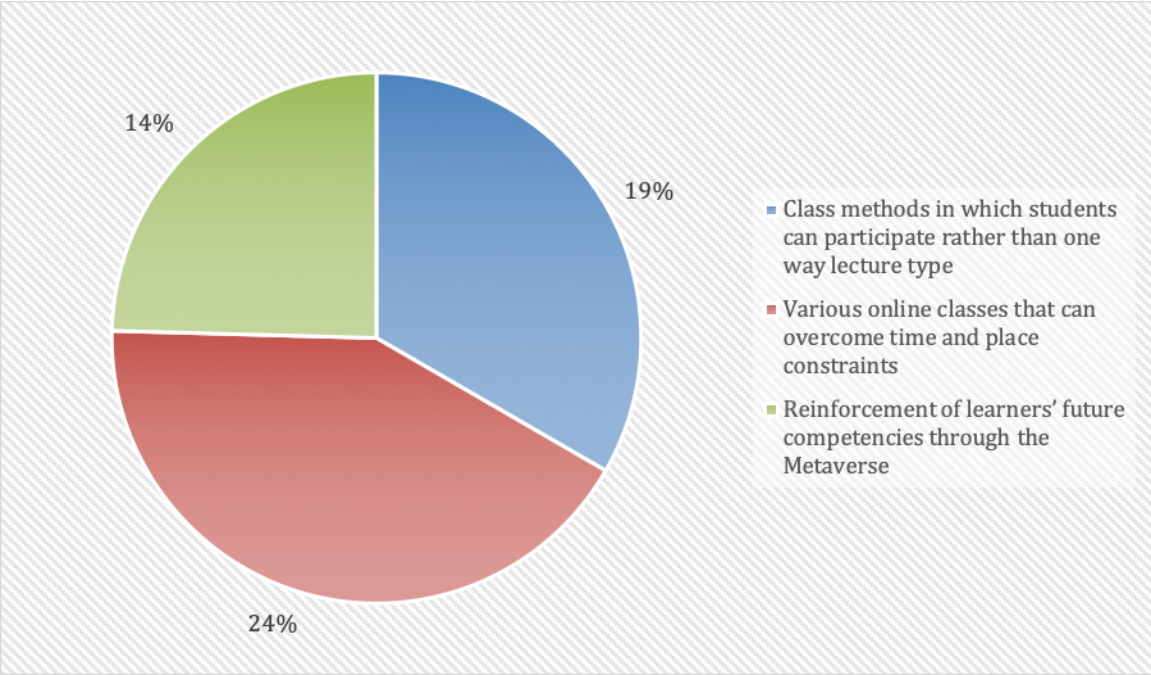

Figure 8. Educational benefits that students can expect when the Metaverse is used in education

The metaverse research shows a reduction in opportunities for students' face-to-face contact and learning activities, showing the limitation of non-face-to-face teaching and learning operations, which have been conducted to prevent COVID-19 infection since 2020. We can see that they expected it to be used as an educational tool not only during the Corona virus pandemic but also in the near future.

Because the metaverse is still in its infancy for classrooms, active environmental support and incentives within the school, as well as platform education, are required. and metaverse support and system result from investigating the elements and conditions for metaverse-based classes that can be used. As the metaverse is still in its infancy for classrooms, active environmental support and incentives within the school, as well as platform education, are required. The exploration of the elements and conditions for metaverse-based classes that can be supported by university teachers and the Teaching Learning Development Center, as well as

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the direction of the workshop for metaverse-based classes, resulted in the development of support and system for metaverse-based classes.

According to Figure 9, study participants ranked 'class environment support (17%)' and 'class design support (15%)' as elements and conditions required for metaverse-based classes in the following order. In the order of 'teaching community (5%),' it can be stated that the research participants had higher demands for expert support such as class consulting and the establishment of a class environment such as a platform for classes using the metaverse than the psychological factors of class members using the metaverse.

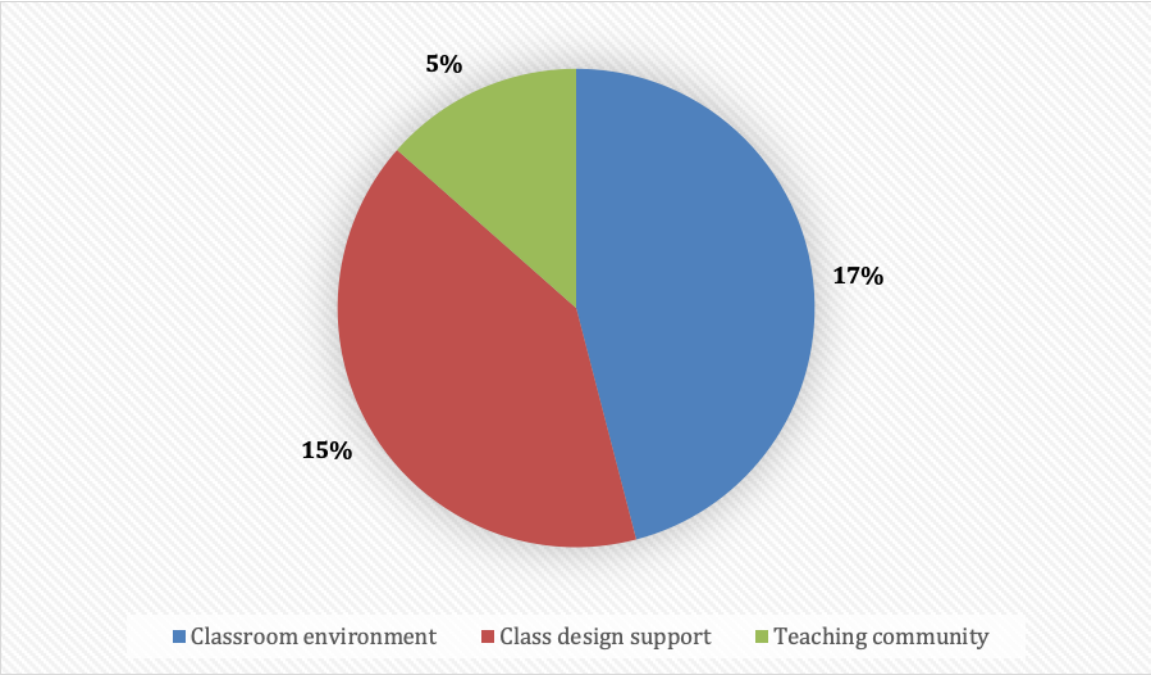

Figure 9. Elements required to apply the Metaverse to the educational field

We can see that interviewees will learn about the metaverse platform that is appropriate for their classroom environment in order to use the metaverse as a teaching/learning medium. When the contents of the questionnaire and interviews are combined, most universities recognize the need for a customized platform that can reflect the conditions of the instructors, such as subjects and learned characteristics, rather than the uniform LMS (Learning Management System) currently provided by most universities.

Education in the post-Corona era was mostly done through distance learning on a real-time platform. This type of distance education, however, has limitations in providing learners with an experience comparable to the teaching/learning environment of the existing face-to-face classroom setting. Recently, metaverse-based classes that can realize the benefits of face-to-face classes and non-face-to-face classes at the same time have received a lot of attention as one alternative to overcome the limitations of distance education. However, in order to implement and settle the metaverse in the classroom, the instructor who is in charge of the class must. It is critical to investigate the formula and draw conclusions from it. As a result, it conducted this study to better understand the general perception of metaverse-based education.

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7.0. Discussion

This study examines university students' and professors' perceptions of the metaverse, which has recently received a lot of attention in various fields, in order to interpret the meaning of the metaverse in the educational field and to serve as a compass to suggest the educational direction of future domestic metaverse research. Because perceptions of the metaverse vary depending on major and subject type (number of students, class types, evaluation guidelines, etc.), more meaningful research results will be got if we study the metaverse design method according to class type, as well as the satisfaction and effectiveness of learners taking part in the metaverse class.

This research can develop related teaching and learning methods or apply the metaverse to classes at universities and teaching and learning development centers in the future. However, because of the unexpected outbreak of Corona, we could accept a new medium on a half-voluntary basis, and the instructor's ability to use the medium improved. It is time to teach students about how to use the metaverse.

Because of social environmental factors that restrict outside activities and encourage non-face-to-face activities in order to prevent the spread of corona infection, the use of metaverse is increasing in education. Specifically, and other diseases that may emerge in the future. However, due to the unexpected outbreak of Corona, we were able to accept a new medium on a half-voluntary basis, and the instructor's ability to use the medium improved as a result. It is time to start teaching students about how to use the metaverse.

Even if the corona virus is eradicated through the spread of vaccines and collective immunity, introducing the Metaverse into the education field is an unavoidable change for those who were born and raised in a digital media environment. However, you must also consider the various negative functions that may occur during this process.

8.0. Conclusion

According to previous research on the educational effects of virtual reality and augmented reality, this study discovered that two types of metaverse, teaching and learning activities using these technologies, provide learners with opportunities to take part in active learning and constructivism-based learning. It has been effective in emotional learning domains, such as learning attitudes, engagement, and satisfaction. The purpose of this study was to investigate teachers' perceptions of the potential of using a metaverse tool in their classroom instruction. And the ability to incorporate such tools into classroom instruction. Because of the ongoing non-face-to-face situation and rapid technological development, Metaverse is interested not only in society, economy, culture, and industry, but also in education. However, there are few real-world applications.

Participants in the study agreed that the educational use of Metaverse could aid learning in a variety of ways. It was specifically stated that metaverse-based classes would be more effective in class types such as student participation-centered problem-solving learning (25.0 percent) or discussion (24 percent) rather than general lecture-style based on theory (9 percent). They believed that communication (18%) and collaboration ability (16%) could be a part of the metaverse, assisting the major strengths of future talents to be interactive classes. However, study participants agreed that using the metaverse as an auxiliary tool for learning activities rather than teaching activities was appropriate.

They confirmed that, despite the positive perception of metaverse education, they required support related to teaching methods in order to implement it in classes, and insufficient educational institution support (21 percent). A lack of metaverse-related teaching/learning

methods (18 percent), and metaverse class evaluation They reported difficulties such as a lack of methods and standards (11%), as well as a time-consuming class preparation process (23 percent). These challenges are gradually being addressed through a variety of teaching method workshops and technical education centered on the school's teaching and learning development center.

Participants in the study recognized the need for educational support such as teaching design (38 percent), how to use the Metaverse platform (35 percent), and best practices in education and classes using Metaverse (29 percent). They specifically stated that customized education for each college major is required because there may be a significant difference in perception of the Metaverse depending on the major and subject type (number of students, class types, evaluation guidelines, etc.).

Although metaverse has only recently been introduced in education, it is being trialed at onetime events, such as entrance ceremonies or graduation ceremonies, as well as extracurricular activities in education. Based on the education field, we can say that educational use of the metaverse is at an extremely rudimentary stage.

9.0. Recommendations

The study suggests some areas of education where future research could be usefully focused when using metaverse technology. We need to design a study that allows us to move beyond teachers' focus on learning content and address the underlying learning theories and mechanisms that may uniquely justify a metaverse learning experience. To accomplish this, we must collaborate not only with teachers but also with their students at universities, because developing teacher confidence and skill in using metaverse is only the first step in using metaverse to foster learning. Following the outbreak of COVID-19, for example, the first issue that arose in the educational field was the instructor's media literacy competency.

Many universities host workshops on non-face-to-face class operations, such as real-time platform usage, distance education class design, distance education class consulting, and so on. However, because of the unexpected outbreak of Corona, we could accept a new medium on a half-voluntary basis, and the instructor's ability to use the medium improved. It is time to teach students about how to use the metaverse.

10.0. Limitations

The current study clarifies natural communication and the emotional stress of users. Whereas the following limitations apply to metaverse platforms:

- Low self-perception: In 3D environments, users have a very limited perception of themselves. It represented them as disembodied entities via a photo or a live webcam head shot feed with no personalization options.
- No physical presence: they interpreted Web conferencing sessions as video calls to join rather than virtual collective meeting places. Long meetings cause participants to lean out and become distracted.
- Inactivity: 3D platforms provide limited opportunities for participant interaction. It limited students to passive participation with few opportunities to act unless instructors started a learning activity.
- Users have few options for expressing their emotions other than smileys and emojis.

It can address these limitations with a 3D metaverse network of 3D virtual worlds and immersive spatial environments.

Researchers may expand on this study and employ other methods to verify the impact of metaverse technology on the educational process. It may be appropriate to conduct the same study at different educational levels.

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Technium Social Sciences Journal
Vol. 32, 278-295, June, 2022
ISSN: 2668-7798
www.techniumscience.com

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