

Systematic Literature Review: The Effect of Student Interaction on Academic Achievement in Online Learning.

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Abstract. Virtual education has been gaining interest since technology has appeared in everything in our lives. Metaverse is one of the technologies that has been initiated since the late 90s and is currently being updated and renovated to suit current changes. However, many teachers and students still do not know how to utilize virtual space to create a new atmosphere in the learning process. Therefore, this study aims to show the results of using online learning in the form of virtual space in the field of education and how teachers and students respond to the process. In this study, the author wants to conduct a Systematic Literature Review (SLR) on the advantages and disadvantages of virtual education space based on many previous studies related to the topic. The results of surveys conducted by previous studies show that most students enjoy using virtual space as their learning method and can understand some lessons better when using virtual space compared to traditional learning—textbook-based learning and face-to-face learning. Unfortunately, there are several cases of student satisfaction results in online learning that are not optimal. But the results of the Spearman correlation on offline learning most have very good academic achievement (70.7%) and high learning motivation (76.0%), then during online learning most respondents have good academic achievement (76.0%) and low learning motivation (81.3%). In general, the author concludes that virtual space has very good potential in the future to be explored in depth in the field of education because of the development of skills in the use of technology and significant improvements in student academic achievement. However, guidance from teachers and parents is still needed so that students avoid bad things.

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1. Introduction

From the first part of 2020, domestic universities and universities will conduct face-to-face lectures online with limited due to the impact of the COVID-19 pandemic [1]. Programs in graduate studies emphasize project-focused teaching based on design and field experiences. In a situation where most of the education is done online [2]; Teachers face many problems due to their inability to conduct online courses [3]. This is reflected in a study among teachers in Indonesia that conduct non-face-to-face (online) training [4].

Difficulties they face when teaching online are difficulties in communicating, responding in detail and identifying the student's situation. On the other hand, students also experience obstacles including difficulty concentrating, decreased sense of presence, and limited practice due to lack of direct practical experience[4].

In fact, before conditions like this, distance learning has been implemented in several schools and universities using various methods, one of which is using online conference applications such as Zoom Meeting, Google Meet and many more [5]. Many people might say that this method is new, even though it has been around for years, these online applications can be defined as a network of digital technology and people that provide immersive and interconnected experiences, low self-perception in virtual space does not provide an optimal experience to users, therefore, until there is the development of online applications that build a complex 3D virtual world as a virtual space where users in the form of avatars as their alter egos can interact and socialize with other users without limits [6].

In practice, 3D technology has fundamental differences with other realities such as VR and AR[7]. The three main differences are that online 3D applications have a strong aspect as a service with more sustainable content and social meaning, while studies related to VR focus on physical approaches and rendering. Also, we don't need VR or AR to access the 3D app[7]. But in online learning there is a new challenge for teachers related to educational activities, online learning can improve school performance or reduce it, it can negatively affect the learning interaction in between teachers and students [8].

Therefore, this study aims to examine the current situation of distance education in schools and universities that occurred after the global pandemic. By increasing the interaction and communication between teachers and students through the analysis of distance learning and virtual space in a wide range of subjects, there are proposals to create a system effective distance learning for years to come.

2 Literature review

2.1 Planning a Review

The type of literature in this study is a literature review which is done by collecting and reviewing journal articles and studies to gain an understanding and theoretical basis for the research hypothesis. The type of literature review used is a systematic literature review, below is how the literature selection process was conducted using the PRISMA flow chart (Figure 1).

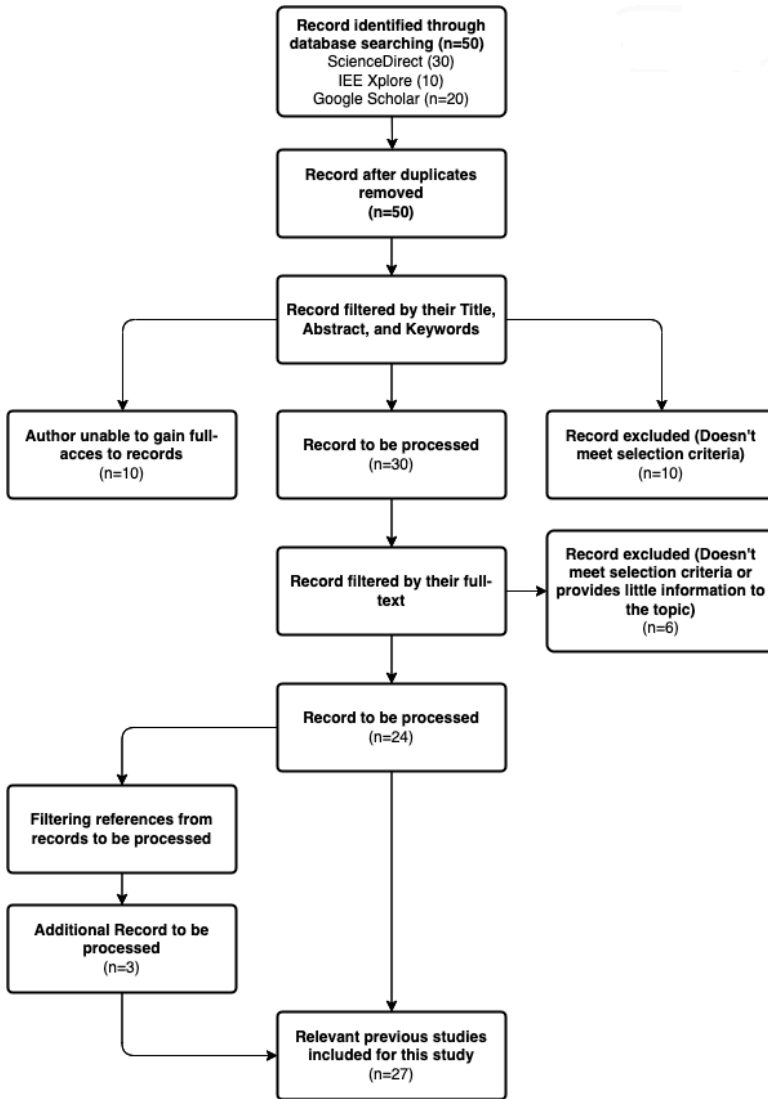


Figure 1.Prism Flowchart[9]

2.2 Selection Criteria and Search Requirements

After the selection of papers was carried out, a list of inclusion and exclusion criteria was determined to filter out irrelevant and outdated papers[10]. The inclusion and exclusion criteria can be seen in table 1 below:

Table 1. Selection Criteria

Inclusion Criteria	Exclusion Criteria
Papers must be relevant to the topic and field of research.	Papers published before 2019

Internationally recognized papers with publication years 2019 to 2023	Papers not written in English
Paper on the application of online/virtual based learning	
The paper must contain actual research data.	

We also defined a set of search terms and locations to search for paper references[10]. The results for both variables can be seen in Table 2.

Table 2. Search Terms and Locations

Search Location	Search Terms
Sciedirect	“Virtual Space” or “Metaverse”
IEEE Xplore	“Educate” or “Learn” or “Teach”
Google Scholar	“Distance Learning”

2.3 Research Questions

This systematic literature review aims to better understand the potential of implementing virtual applications for educational purposes and ways to further improve current methods. Here we have designed the following research questions:

- RQ1. What are the advantages and disadvantages of online conference applications/virtual rooms compared to traditional teaching methods?
- RQ2. How does the impact of student and teacher interaction in online learning affect academic achievement?

3 Research methodology

This section briefly discusses some of the main topics regarding the purpose of this paper from the papers selected in the previous section.

3.1 Distance Learning

The definition of distance education is a class in which teaching and learning activities are conducted at different times or in different places where teachers and students do not meet face to face [11]. The current pandemic has forced educational institutions to adapt to online learning instead of being in the classroom[12]. Many popular distance learning tools such as Microsoft Teams, Zoom and Virtual World are used, although these platforms are used for different purposes [5].One of the most widely used virtual space platforms for education is Second Life [13]. Many workshops have been conducted through this platform before the covid-19 pandemic. The first STEM (Science, Technology, Engineering, Mathematics) workshop was held by Nagaoka University (NUT) in Japan[9]. The goal of innovative education using cyberspace is to engage and motivate students of all ages to pursue academic studies, especially in STEM fields. Creative teaching methods include many techniques to enhance virtual workshop activities such as reverse engineering, multilingual lessons, student interest projects, reading and puzzle solving, and creative e-learning.[11].

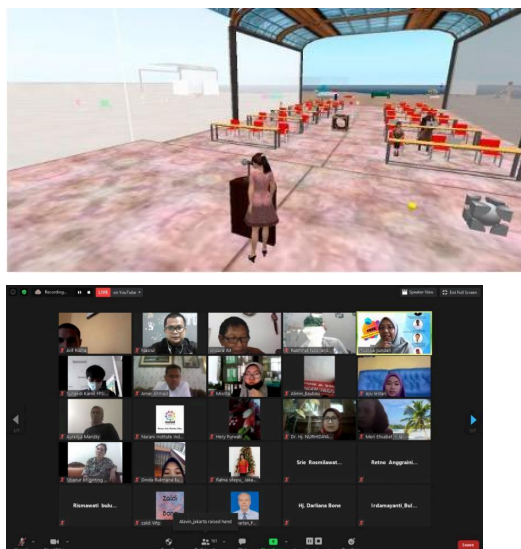


Figure 2. Virtual classrooms are used to carry out online learning[9]

Another workshop run by the NUT using Second Life was a work by students to come up with new electronic technologies focusing on the STEM subject. [9] The similarities between these two workshops are that due to the lack of space and time, there are many advantages that can be gained by using the virtual space as a container to carry out the work. Teachers and students do not need to be in the same place where they can conduct teaching and learning. In addition, cyberspace provides a hybrid environment that includes a variety of activities and resources without physical limitations.

3.2 Online Conference Application / Virtual Room

The virtual world is a world that develops rapidly and provides constant technological updates. We should also not miss online meeting programs (Zoom Meeting, Google Meet, etc.), which are becoming more and more popular today, especially in the online space[14]. Metaverse, mixed reality and virtual reality are among them. This virtual space, which is available to the public at any time, is called the virtual space[15].

The concept of the metaverse first appeared in the 1992 science fiction novel *Snow Crash* by American author Neal Stephenson[16]. The Metaverse is a combination of two words, meta, meaning transversal and virtual, and cosmos, meaning world and universe. This term refers to the digital world as a new world that is presented through digital media such as devices and the Internet. In 2021, the term was updated and popularized by Mark Zuckerberg, CEO of Meta, and refers to the virtual world, a continuous multi-user environment that combines physical reality and digital virtuality[17]. The Metaverse is attracting attention as an alternative way to overcome the limitations of online classes and distance on 2D due to the different experience values of the current Internet era by using various complex technologies for VR, MR and AR[18]. Some of the main uses of Metaverse for educational purposes are:

- Teachers must carefully analyze how students understand the Metaverse.

- Teachers must design classes for students to solve problems or work on projects cooperatively and creatively.
- Educational Metaverse platforms must be developed to prevent misuse of student data.

Metaverse provides a limitless and impactful educational experience for users[19]. Teachers and students can wear virtual reality headsets or use a web browser on their computer to enter this world, regardless of their real-life location. This function can increase the reach of education for those seeking education across regions or countries. Someone who only sits alone watching video tutorials can do it virtually with their friends in a virtual classroom[20]. Typically, these classrooms follow real-life patterns, such as movable chairs and tables, a whiteboard, and a TV.

4 Results and Discussion

4.1 Literature review study results

From previous studies that have been conducted, there are several papers and journals that discuss the use of online conference applications or virtual spaces as a platform for teaching and learning methods. A brief description of the methods used in each paper along with a summary can be seen in Table 3.

Table 3. Results of Paper Review

No.	Title	Review Results
1	Teachers and managers experiences of virtual learning during the COVID-19 pandemic: A qualitative study[21]	The results of this study may have important practical implications, especially in the context of educational policy development and management. Recommendations generated from this study can help institutions and organizations improve the quality of online learning and provide better support to teachers and managers.
2	Enhancing learning in an online doctoral course through a virtual community platform[22]	This article makes a significant contribution to the context of online learning, particularly in doctoral courses, by introducing the use of a virtual community platform. It demonstrates an awareness of the need for a socially connected and interactive learning environment, which is essential in facilitating deep and collaborative learning.
3	Utilizing the Metaverse for Learner-Centered Constructivist Education in the Post-Pandemic Era: An Analysis of Elementary School Students[23]	A survey of 336 Korean elementary school students was conducted using 18 Metaverse measurement factors, followed by statistical analysis including mean differences and independent sample T-tests. The results showed that 97.9% of students had used Metaverse before and 95.5% of them considered it close to everyday life. The application of Metaverse in education is enjoyable for students because they

		are exposed to a form of entertainment even though some students face technical difficulties.
4	Effectiveness of Virtual Laboratories in Science Education: A Meta-Analysis[24]	A survey of 2642 students was conducted to determine the effectiveness of using virtual laboratories compared to traditional laboratories by grouping subjects and grades. Meta-analysis showed moderate results ($g = 0.587$) which means that virtual laboratories are not often used. Even so, virtual laboratories allow students to conduct scientific research like traditional laboratories, with lower costs, minimal dangers, and are not constrained by place and time.
5	Technologies for teaching during a pandemic[25]	Virtual teaching is conducted using the virtual world by Nagaoka University of Technology, Japan. Students aged 16-18 are doing some problem-solving activities and other learning activities. Teachers stated that this helps students actively participate throughout the learning because the virtual space makes online learning more interesting and engages students better.
6	Metaverse for social good: A university campus prototype[26]	CUHKSZ Metaverse is used to experiment with creating a university ecosystem using Unity. The existence of Metaverse infrastructure, interactions, and ecosystems in universities can effectively enrich the lives of students and faculty, however, still under development and not all locations can be visited.
7	Exploring problem-based learning curricula in the metaverse: The hospitality students' perspective[27]	The findings show that metaverse-based PBL is an effective learning method that helps students not only become independent learners by increasing learning motivation but also improving collaboration skills, and these findings are also supported by research (Silver-Hmelo, 2004; Kivela & Kivela, 2005; Nadda et al., 2022). And this study provides an in-depth understanding of students' learning experiences in metaverse-based PBL. More specifically, this study identifies not only students' learning outcomes but also their cognitive and affective experiences in the metaverse-based PBL learning process.
8	Elevating students' lives through immersive learning experiences in a safe metaverse[28]	Researchers note that Metaverse characteristics, such as interactivity and persistence, have a clear impact on educational outcomes. Likewise, the immersive experiences we observed are consistent with research by Golf-Papez et al. (2022), which demonstrated the Metaverse's ability to create realistic digital learning encounters.

9	'Co-creating' experiential learning in the metaverse- extending the Kolb's learning cycle and identifying potential challenges[29]	This study emphasizes that co-creation in the Metaverse as part of an experiential learning cycle fosters a sense of community and social learning, which can enhance the management education experience and prepare learners for success in a variety of contexts and can help foster a sense of community and social learning. Although the emergence of the metaverse promises to stimulate interactions in the virtual world and generate new opportunities, its widespread adoption also poses many challenges as highlighted in this study. To make the most of this technology we need to properly regulate and govern the platform.
10	The possibilities of changes in learning experiences with Metaverse[30]	This study aims to define the Metaverse, presenting the role of AR, MR and VR, as well as the concepts of digital twins and lifelogging. The evolution of Metaverse applications in various sectors, especially gaming, has created the possibility of using the Metaverse for Education. Some of its limitations may be weaker social connections, as well as concerns about privacy and security. The great potential offered by Metaverse technology is the immersive content experience and social interaction.
11	Metaverse or Simulacra? Roblox, Minecraft, Meta and the turn to virtual reality for education, socialization and work[31]	Metaverse was originally a technology created with a focus on creating a virtual environment where each user can connect with each other with different virtual experiences. The absorption of this new virtual reality presents very flexible and broad opportunities to be applied to many aspects of life. Such as in games, organizational meetings, to the world of education.
12	The Metaverse: An Urban Revolution Effect of the Metaverse on the Perceptions of Urban Audiences[32]	Metaverse is a technological revolution that can change civilization. The transition from physical technology to digital technology is growing with the presence of Metaverse. Reconstruct the world is a term that comes with this Metaverse phenomenon. The virtual world through advanced technology from AR and VR is a new world that will be created by Metaverse technology.

Below is a percentage of the results from a study by the Ministry of Education in an article titled "Study of Education Using Metaverse for Effective Communication in Convergence Issues" conducted online from 10 to 14 August 2020 is about "awareness, use and experience is". has come to Distance Education" with respondents including 2,881 instructors and 28,418 students at several universities around the world.

Table 4. Distance Learning Experiences in the Metaverse

Indicator	Teacher		Student	
	Yes	No	Yes	No
Distance learning experience in Virtual Space (teaching/learning)	59.3%	40.7%	87%	13%

In this study, teachers' and students' experiences of using virtual rooms during distance learning were evaluated. Table 4 shows that 59.3% of the teachers gave positive feedback from their experience, while the percentage of students was higher at 87%, which shows that they like using the virtual room as a distance learning tool.

Table 5. Distance Learning Difficulties

Reason	Having Trouble	Neutral	No Difficulty
Lack of interaction with lecturers or other students.	59.2%	24.7%	16.1%
Decreased memory and concentration.	54.3%	25.5%	20.2%
Problems using the device (e.g. poor connection, lights out, camera/mic not working)	49.7%	25.2%	25.1%
Difficulty in completing tasks because there are no people or resources available to help.	44.8%	29.5%	25.7%
Tired and dizzy from not being used to using digital devices for too long.	43.7%	26.1%	30.2%
Online learning materials are less than face-to-face classes which teach heavier and denser materials.	35.5%	29.2%	35.3%
There is no safe place, stable internet, and away from distractions to attend classes.	29.2%	28.4%	42.4%

4.2 Discussion

A number of studies have been conducted to measure the problems of distance education. As can be seen in Table 5, the main cause of problems is lack of communication with teachers and other students, 59.2% of the respondents chose this issue, and the least reason is the lack of space permanent to join the classes. Already 29.2. The percentage of respondents agree with this statement.

Table 6. Distance Learning Difficulties

Reason	Having Trouble	No Difficulty
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Lack or absence of communication and interaction with lecturers or other students.	30%	70%
Difficulty and delays in completing assignments due to lack of people or resources to help.	28%	72%
Ease of learning to use Metaverse tools and technologies.	15%	85%

Table 6 shows the reasons that were effective after using online applications as a tool for the distance learning process, and the positive results for each reason.

RQ1. What are the advantages and disadvantages of online meeting/virtual room applications compared to traditional teaching methods?

Many simulations can be used from universities to online virtual spaces such as Metaverse. These experiences are very important because they provide a better understanding of the materials being used. By sharing knowledge about 3D immersive environments, teachers play an important role in increasing students' motivation to learn. Based on psychology, students can explore more, ask questions and find out more about the answers because the visuals and game simulations are unique and exciting, making students more excited to learning.

Here are some techniques teachers can use to improve. effective teaching and learning process:

1. Realistic Environment

The virtual classroom environment is not restricted to the appearance of cartoon graphics, so it does not distract the students from learning. The teacher chooses the metaverse, but the teacher who has control over the space has the power to design an amazing environment to attract students. The design of the learning environment should be tailored to the course to support the lecture and engage students by allowing them to explore this virtual world independently.



Figure 3. 3D documentation of the tomb of Pashdou III in the History of Architecture course.[9]

2. Physical Interaction

Beyond the visual experience, the virtual world is more interactive. VR headsets and controls are designed to feel comfortable with hands and fingers when students use the devices. As a result, teachers can create learning experiences that require sign language, such as teaching students to write or express sign language. Some early VR prototypes can also capture human facial expressions, allowing teachers to see if a student is tired, asleep, or engaged. When students leave the virtual world and return to the real world, memory takes hold of the muscles, and repeating what they have learned is no different.

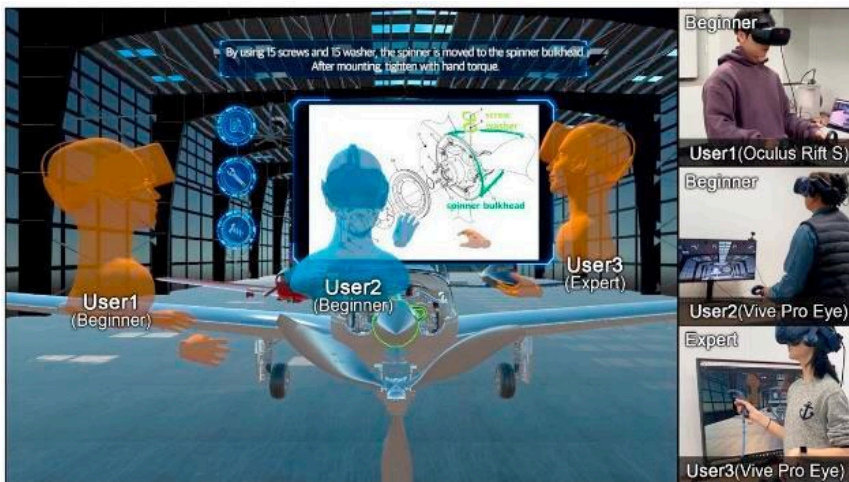


Figure 4. Aircraft maintenance simulation carried out by students using VR and the proposed system.[9]

Online learning environments can also increase safety in ways that physical learning cannot. Here, teachers have full control over student interactions and can limit inappropriate student activity for remedial purposes by simply changing some online permission settings. This way, students can focus on learning instead of worrying about distractions.

When studying how virtual spaces can help students and teachers effectively carry out teaching and learning, these virtual worlds also have disadvantages to consider :

1. Physically Handicapped Students with disabilities such as hearing and vision impairments require special arrangements that may not be available. If a deaf child from Indonesia wants to enroll in a virtual class run by a school in the United States, the American school may not be willing to accept the student. In this case, dealing with the disabled child is the responsibility of the parents, not the school. This is unfortunate, as most schools offer alternatives for students with disabilities.
2. Addiction to the Virtual World Considering that most people are addicted to using electronic devices, addiction to the metaverse is likely. If a student uses a virtual reality headset for education and entertainment, he will spend ten hours per week in the digital world and forget his life. This imbalance can lead to negative behaviors such as anti-social behavior, wasting and health problems or mental illness.
3. Access Of course, not all online schools require students to use virtual reality, because some virtual rooms are only accessible through the Internet, but to get a good and emotional experience -internally, of course, technology and equipment are needed, namely, VR. . VR is still expensive and rare, so people are still finding and developing cheaper VR models. If implemented, this virtual knowledge of the virtual world will only be available to some students.

RQ2. How does the impact of student and teacher interaction in online learning affect academic achievement?

One of the papers has conducted research on undergraduate students regarding student interaction and student satisfaction in online learning activities. The results of descriptive statistical analysis of data on student interaction variables, lecturer attendance, student involvement, and student satisfaction in online learning are presented in Table 7.

Table 7. Descriptive Statistics Results

Variables	N	Min	MaxMean	Std. Deviation
Student Interaction	253	1.75	5.003.75	0.63
Lecturer Presence	253	1.00	5.003.69	0.62
Involvement Student	253	1.67	5.003.36	0.61
Student Satisfaction	253	1.20	5.003.28	0.70

When viewed from the average value, the student interaction variable has the highest score, which is 3.75 on a scale of 1-5 with a standard deviation of 0.63. Then followed by the

lecturer attendance variable with an average value of 3.69 with a standard deviation of 0.62 and the student involvement variable with an average value of 3.36 with a standard deviation of 0.61. The lowest average is obtained by the student satisfaction variable with a value of 3.28 with a standard deviation of 0.70. This shows that on a scale of 100, student satisfaction is at a score of 65.6. This means that student satisfaction with online learning has not reached the optimal level.

Another paper also discusses Student Learning Motivation and Academic Achievement in Offline and Online Learning. The results of the distribution of respondents based on research variables are shown in Table 8.

Table 8. Spearman Correlation Between Virtual Learning Activities and Specific Module Outcomes

Variables	Category	N	%
Offline academic achievement	Very good	53	70.7
	Good	22	29.3
	total	75	100
Online academic achievement	Very good	18	24.0
	Good	57	76.0
	total	75	100
Offline learning motivation	Very good	57	76.0
	Good	18	24.0
	total	75	100
Motivation to learn online	Very good	14	18.7
	Good	61	81.3
	total	75	100

Based on Table 8, it shows that in offline learning, most have very good academic achievement (70.7%) and high learning motivation (76.0%), then during online learning, most respondents have good academic achievement (76.0%) and low learning motivation (81.3%). According to Ricardo & Meilani (2017), there are eight important indicators to measure learning motivation, namely; duration of learning, level of aspiration to be achieved with the activities carried out, level of achievement qualification/product (output) achieved from the activities carried out, frequency of learning, persistence in learning activities, fortitude, tenacity and ability to face obstacles and difficulties, devotion and sacrifice to achieve goals, and direction of attitude towards activity targets.

After conducting univariate analysis, bivariate analysis is continued. Bivariate analysis aims to see the relationship between independent and dependent variables. The results of the bivariate analysis can be seen in Table 9.

Table 9. Fee Analysis

						P value
Academic Achievement						
Very good		Good		Total		
n	%	n	%	n	%	

Offline Learning Motivation	Tall	46	80.7	11	19.3	57	100	
	Low	7	38.9	11	61.1	18	100	0.001
	total	53	70.7	22	29.3	75	100	
Motivation to Learn Online	Tall	8	57.1	6	42.9	14	100	
	Low	10	16.4	51	83.6	61	100	0.001
	total	16	24.0	57	76.0	75	100	

Table 9 shows that most respondents during the offline learning period had a high level of learning motivation with very good academic achievement of 46 respondents (80.7%). The results of the chi square test obtained a p-value of 0.001 ($p < 0.05$). This value indicates that there is a relationship between offline learning motivation and academic achievement where high learning motivation is followed by very good academic achievement.

During the online learning period, it was found that most respondents had a low level of learning motivation with good academic achievement of 51 respondents (83.6%). The results of the chi square test obtained a p-value of 0.001 ($p < 0.05$). This shows that there is a relationship between online learning motivation in the Covid-19 situation and academic achievement where learning motivation becomes low followed by academic achievement that decreases from very good to good.

4.2.1 Comprehensive Analysis of Study Findings

Based on the results of the literature review that has been conducted, there are several trends and patterns that have emerged regarding the use of virtual spaces and digital technology in education, especially before, during and after the COVID-19 pandemic.

1. **Positive Trends in Adoption of Virtual Spaces:** Overall, the literature shows an increasing interest and adoption of virtual spaces in education. The studies reviewed indicate that both educators and students are increasingly recognizing the potential of virtual spaces in creating more interactive and immersive learning experiences. This is in line with findings from various studies that show that students are more motivated and engaged in the learning process when using virtual spaces compared to traditional methods.
2. **Patterns of Difficulty in Implementation:** While there are positive trends in the adoption of virtual spaces, patterns emerging in the literature indicate significant difficulties in implementing this technology. Key challenges include technical issues such as unstable internet connections, lack of training for educators, and limited access to technological devices. These difficulties are major barriers to maximizing the potential of virtual spaces in education.
3. **Gap in Learning Satisfaction and Motivation:** Analysis of the literature shows a significant gap in learning satisfaction and motivation between online and offline learning. Although virtual spaces can increase interaction and engagement, several studies have shown that students' satisfaction with online learning is still suboptimal. Factors such as lack of direct social interaction and difficulty in adapting to new technologies contribute to this low satisfaction.
4. **The Need for a More Inclusive Approach:** One gap that needs to be addressed is the lack of an inclusive approach in the design and implementation of virtual spaces. Several

studies have shown that current virtual spaces do not fully account for the needs of students with disabilities or those with limited access to technology. This suggests the need for further development to create solutions that are more inclusive and accessible to all.

4.2.2 Implications of Findings for Stakeholders

Implications of the findings for various stakeholders, including educators, students, policy makers, and technology developers, we can formulate several important points as follows:

1. **Implications for Educators:** These findings suggest that the use of virtual spaces and digital technologies in education has great potential to enhance interactions between educators and students. Educators can leverage virtual spaces to create more immersive and interactive learning experiences, which in turn can increase students' motivation to learn. However, educators also need to be aware of the challenges that arise, such as the need to adapt to new technologies and ensure that every student can access these technologies without barriers.
2. **Implications for Students:** For students, these findings suggest that virtual spaces can provide more engaging and immersive learning experiences, which can enhance their understanding and academic achievement. However, there are also risks to be aware of, such as the potential for technology addiction and lack of real-world social interaction. Therefore, students need to be guided in using this technology so that its benefits can be maximized without sacrificing other aspects of their lives.
3. **Implications for Policymakers:** Policymakers in the education sector need to consider these findings in formulating policies that support the adoption of digital technologies in learning. Policies that support training for educators, wider access to technology for all students, and the development of adequate infrastructure are important to ensure that the benefits of virtual spaces can be felt by all stakeholders in education.
4. **Implications for Technology Developers:** Technology developers have a crucial role to play in creating solutions that are inclusive and accessible to all users. Based on these findings, developers need to pay attention to designs that are not only visually appealing but also support a diversity of users, including those with disabilities. Additionally, technology should be designed in a way that supports meaningful interactions between students and educators, and not just be a tool for entertainment.

4.2.3 Implications for Future Research

Based on these findings, there are several areas that require further research:

1. **Research on Adaptation Strategies:** Further study is needed to develop effective strategies to help educators and students adapt to virtual space technology. This includes research on the training needed for educators and the development of curricula that are more suited to virtual learning.
2. **Research on Long-Term Effects:** It is important to explore the long-term effects of virtual space use on student achievement and well-being. More in-depth research can help identify the positive and negative impacts of this technology in the long term.

3. Inclusive Technology Development: Further research is needed to develop more inclusive virtual space technologies. This includes developing devices and platforms that are accessible to students with a range of needs, including those with disabilities.

5 Conclusion

This study has shown that virtual space and digital technology, especially Metaverse, have great potential to be used as a learning platform in education. Based on the Systematic Literature Review (SLR) conducted, most students stated that they enjoyed and understood the material better when using virtual space compared to traditional learning methods. However, there are significant challenges in implementing this technology, especially related to technical issues, training needs for educators, and limited access to technological devices.

The results of the study also showed differences in satisfaction and learning motivation between online and offline learning. Although online learning through virtual spaces has the potential to increase student interaction and engagement, student satisfaction with online learning is still not optimal. This finding emphasizes the importance of guidance from educators and parents to ensure that students can make the most of this technology without sacrificing other aspects of their lives.

In addition, this study also found that the current virtual space is still not fully inclusive, especially for students with disabilities or who have limited access to technology. Therefore, further development is needed to create solutions that are more inclusive and accessible to all students.

Overall, virtual spaces have great potential to be explored further in the future in education. However, the development of this technology must be done carefully, considering the challenges that exist, and ensuring that all students can access and use it effectively. Further research is needed to develop effective adaptation strategies, explore the long-term impacts of virtual space use, and create more inclusive technologies.

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