

UNVEILING METAVERSE LEARNING: A TEXT ANALYSIS PERSPECTIVE

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ABSTRACT

The Metaverse has long captured the attention of educators. Furthermore, Facebook's rebranding as Meta significantly accelerated interest in this domain, particularly within education. With growing public enthusiasm, there is a pressing need to analyse the Metaverse's potential and research landscape in education. Although several studies have conducted literature reviews to summarise findings on the Metaverse broadly, none have examined public perspectives, discussions, and concerns specific to its role in education. Addressing this gap, this study investigates the Metaverse in education through three novel approaches: content analysis of news articles, LDA-based clustering, and a comparative study with academic publications. These methods highlight the evolution of research, key themes and applications, and possible future directions. The findings contribute to a deeper understanding of the Metaverse's educational potential and guide scholars in advancing future research.

KEYWORDS

Metaverse; Education; Virtual reality; Learning; Immersive Experience.

1. INTRODUCTION

The concept of a metaverse is not new; it first appeared in science fiction literature, most notably in works such as *Snow Crash* (Stephenson, 1992). It later gained popularity with the cinematic adaptation of another novel, *Ready Player One*. After that, *Second Life*, the massively multiplayer online role-playing game *World of Warcraft*, were already well-known and popular, attracting millions of users (Wiederhold, 2022). Despite this, Mark Zuckerberg's official introduction of the Metaverse project in October 2021 propelled the phrase into popular consciousness. Subsequently, each field-initiated experiment with Metaverse. This sparked a surge of interest among educators and academics, who began to consider various future agendas and implementation possibilities for their educational methods. The growing curiosity in the educational environment can be linked to the various possibilities afforded by virtual spaces, which provide lifelike representations of individuals and have the ability to improve the social dimension of teaching and learning. Despite this growing interest, the word "Metaverse" is still relatively new, necessitating an investigation of the present status of research in this topic, which is the focus of this study. The phrase "Metaverse" is derived from the prefix "meta," which implies transcendence, with the word "universe," which denotes a parallel or virtual environment that is intertwined with the actual world. The notion of the Metaverse in education is not new, since many scholars and educators have investigated its influence on learning. An instance of such research was carried out by Kemp and Livingstone in 2006. The study investigated the incorporation of the Metaverse, specifically through a virtual world called "Second Life," into learning management systems to enhance the learning process (Kemp,

2006). Thereafter, many researchers explored the application of the metaverse in educational settings (González Crespo et al., 2013; Siyaev & Jo, 2021). According to Statista, the number of users in the metaverse education market is predicted to reach 14.84 million by 2030 (Statista, 2025). Amidst the enormous problems of the COVID-19 epidemic, it became clear that non-face-to-face interactions were necessary (Koo, 2021). Significantly, there was a notable surge in interest in 2021, marked as the first year of the metaverse, which aligns with the introduction of Facebook's Meta project (Zhang et al., 2022). Within the expanding field of global metaverse study, the metaverse is gaining prominence as a promising trend in education, demonstrating significant potential for the future (Dwivedi et al., 2022).

2. RESEARCH GAP AND OBJECTIVES

Despite the increasing interest, the studies related to the metaverse in the education domain are relatively new, prompting a need to examine the state-of-the-art in Metaverse research (Akhil et al., 2024). Also, no study captures the public's perspectives, discussions, and concerns related to the development of the metaverse in the education sector. To fill this gap in the literature, the following research questions lead the current investigation of our study:

RQ1: How has the concept of the metaverse in education been understood and put into action?

RQ2: What are the most common themes and topics related to the metaverse in education?

RQ3: Do the main themes identified through our analysis correspond to the dominant topics and research areas discussed in academic publications on metaverse education?

The contribution of this research focuses on an in-depth analysis of the Metaverse in the educational domain from three perspectives. Firstly, by conducting content analysis of news articles on the metaverse in educational settings it provides an analysis of the evolution and current state of research in the field. Secondly, unlike previous studies, through LDA clustering, this research seeks to review and summarise the major themes and different methods on the metaverse in education from multiple angles, which highlights its originality. Lastly, as the field of metaverse in education is in its initial stages, this paper's text statistics and comparison with research articles offer a deeper understanding of the subject and valuable insights for scholars to guide their future research endeavours. The remaining sections of the paper are organised as follows: In the first and second parts, the study is introduced, including its objectives and research questions. The third section describes the methodology, outlining the search procedures employed to identify relevant literature and sources on the Metaverse in education. In the fourth section, the results are presented, followed by limitations and conclusions of emerging topics identified. Lastly, potential avenues for future research are suggested.

3. DATA COLLECTION AND METHODOLOGY

It was recognised that the news plays a critical role in distributing information about developing technologies, affecting public discourse, and potentially shaping individuals' decisions to embrace innovation (Geiß et al., 2013). The study used web scraping technologies to retrieve data from articles published in the weekly periodical *The Economic Times* and *Financial Express*. Following a careful screening process, 120 papers relevant to our research topic were selected. This strategy enables researchers and analysts to receive comprehensive insights while keeping up with the newest technical breakthroughs and obtaining real-time perspectives on industry trends, public mood, and competitor activity (Guo et al., 2012). Furthermore, after applying careful screening, 311 journal articles from Scopus and Web of Science were collected to structure existing literature and to validate the findings. The current study uses latent Dirichlet allocation (LDA), a statistical topic model as methodology, to find latent topics in the news articles. LDA is a well-known method for identifying hidden themes in scholarly literature

that draws on concepts from Latent Semantic Indexing (LSI) and probabilistic Latent Semantic Indexing (pLSI) algorithms (Deerwester et al., 1990; Hofmann, 1999). LDA uses a hierarchical Bayesian analysis, based on a generative process in which topics are derived from a Dirichlet distribution over words, and each document is derived from a distribution of topics. This mixed-membership model enables words to belong to various themes, giving it an advantage over single-membership clustering. The model evaluates the chance that each word belongs to a certain topic, allowing words to be ordered based on their correlation with the topic. Then, each issue is profiled by determining the most associated phrases, revealing the underlying debates. Furthermore, LDA provides probabilities for each document relating to each topic, which helps researchers find the most discussed themes inside each publication (Blei et al., 2003). Additionally, VOSviewer software was used for performing text analysis. The LDA model was run using Python code. After running this model, the most correlated terms for each topic were identified. Furthermore, the collected research articles were used to further validate the findings. The news topics were classified according to the theme with which they were most closely associated.

4. RESULTS AND INTERPRETATION

4.1. Word Cloud

The word cloud generated from the news article text corpus suggests the words with the most frequency are “metaverse”, “Student”, “education”, “technology”, “virtual”, “learning”, “experience”, “digital”, “new”, and “platform”(Fig 1(a)). “Metaverse” is the central idea in the text, and it refers to a hypothetical future of the world that is more immersive and interactive than the current world. The word “Education” indicates that the text corpus is focused on the use of the metaverse in an educational setting. The word “Learning” further suggests that the metaverse can be used to create new and innovative ways of learning. Further, the “technology” word highlights the role of technology in the metaverse, as it is the foundation for creating immersive and interactive experiences, as highlighted in the articles. The “skill” word suggests that the metaverse can be used to help students develop the skills they need to succeed in the 21st century. The “virtual” word refers to the fact that the metaverse is a virtual world, which means that users can interact with it through avatars. In general, the word cloud indicates that the news articles suggest that the metaverse has the capacity to transform education. The metaverse can enhance students' learning by providing engaging and interactive educational experiences, enabling them to acquire knowledge more efficiently and cultivate the necessary skills for future success. A word cloud was also created from the compiled research papers (Fig. 1(b)), displaying similar words that are more prominent. This substantiates our findings, indicating that the present use of the metaverse holds the potential to revolutionise education through technological advancements and novel learning methodologies.

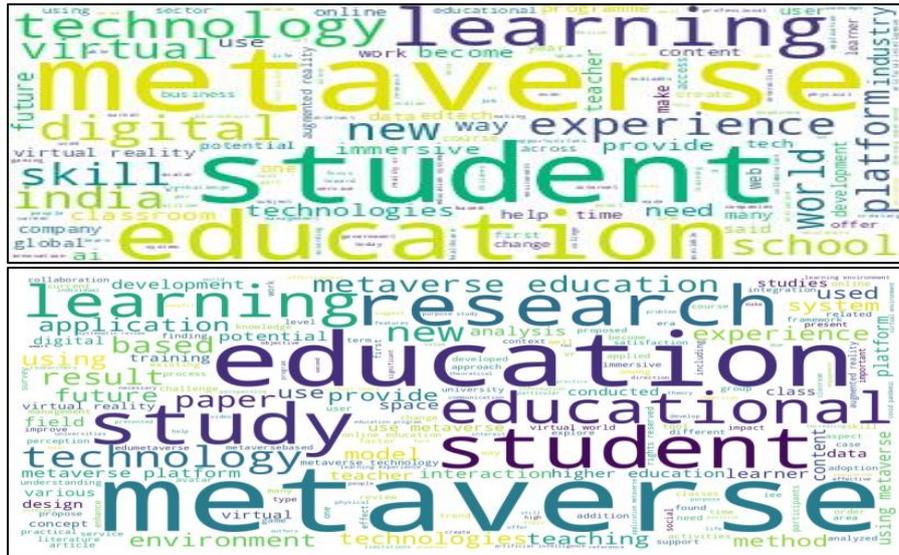


Fig. 1(a)Word cloud made from news articles collected (b) Word cloud made from collected research articles.

4.2. Co-Occurrence Network Graph

The co-occurrence network graph was made using the Vosviewer Software (Fig 2 a)). The graph shows there are three prominent clusters that are forming based on the news articles retrieved. The first cluster in blue colour has prominent keywords “Education sector”, “gamification”, “learner”, “child”, “teacher”, “educator”, “parent”, “classroom”, “education system”. This cluster suggests using gamification in the education sector for children and younger learners. It highlights the importance of collaborative teaching, involving both parents and the classroom environment within the larger education system. The second cluster in green has major keywords occurring together as “ student”, “knowledge”, “india”, “ministry”, “government”, “skill”, “development”. This cluster emphasises the role of the government and ministry in promoting skill development through targeted courses and initiatives focused on student knowledge. Since news articles are prominently from the Indian context, it highlights the skill development in India through the metaverse. The third cluster formed in red has words like “VR”, “Blockchain”, “research”, “organisation”, “data”, “physical world”, “healthcare”, “virtual world”. This cluster explores the intersection of VR and blockchain with research and organisations. It delves into the impact of the virtual world on data, the physical world, and various fields like healthcare and gaming, showing the greater impact of the metaverse. Furthermore, the co-occurrence network graph from the research articles shows similar findings, which validate the findings(Fig 2(b)).

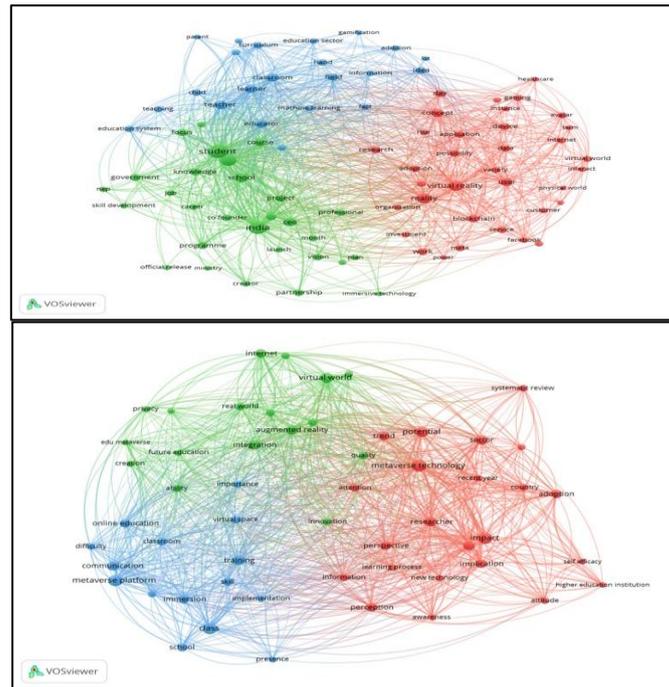


Fig. 2(a) Co-occurrence network graph made from news articles collected (b) Co-occurrence network graph made from research articles collected.

4.3. Lda Topic Modelling

4.3.1. T1: The Future Of Education In The Metaverse

This part explores the basic principles that form the foundation for integrating the metaverse into educational settings. This topic establishes a strong basis for comprehending the transformative capacity of the metaverse in the educational domain. The subject of discussion revolves around the capacity of the metaverse to provide immersive and interactive learning opportunities. This highlights the immersive quality of metaverse education, demonstrating its capacity to transform the learning process. The theme highlights the crucial significance of technology, namely artificial intelligence, in defining the future of education by integrating it with the metaverse. The research articles suggest that the Metaverse has mostly been studied and implemented in the domains of natural science, mathematics, and engineering. It has subsequently been used in general education, as well as in the arts and humanities. The inclination towards Metaverse utilisation in natural science, mathematics, and engineering is motivated by its ability to provide technical assistance in these fields. This support includes the provision of computer programmes for 3D modelling in courses(Sourin, 2017), helping students make links between experiments and virtual objects, and providing autonomous tutoring systems through the analysis of user interaction data(Schaf et al., 2012). In contrast, within the realm of arts and humanities, the widespread utilisation of the Metaverse is seen in language learning settings. The Metaverse is advantageous for enabling communication between individuals who speak different languages in virtual spaces and presents new opportunities for learning foreign languages (Cruz-Lara et al., 2011a). Overall, the Metaverse is widely used in the education industry due to its ability to combine the virtual world with traditional classrooms, creating new possibilities for collaborative, cooperative, and problem-solving learning methods(Araya, 2018).

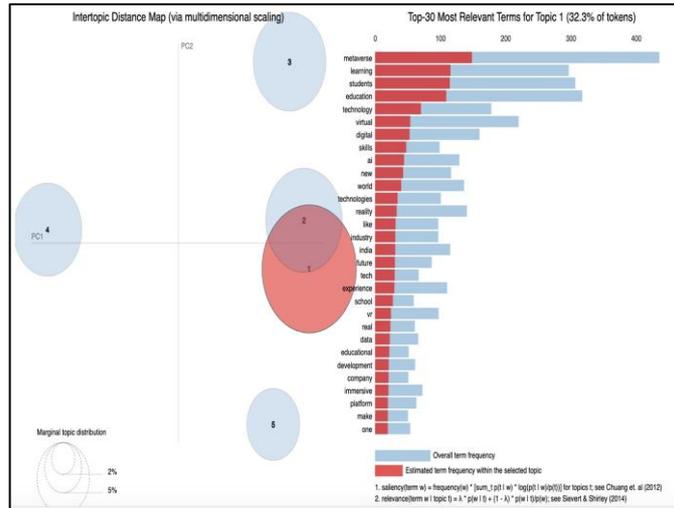


Fig. 3. Intertopic distance map for Topic 1.

4.3.2. T2: Skills Development In The Metaverse

The topic mostly revolves around preparing students for the changing job market by utilising metaverse-based learning. It delves into the ways in which metaverse education provides students with crucial abilities necessary for effectively navigating the uncertainties of the future labour market. The focus of this issue is on the utilisation of cutting-edge teaching methods and approaches enabled by the metaverse. This text explores metaverse pedagogy, evaluating how educators might utilise the distinctive characteristics of the metaverse to improve educational methods. Further it delves into the integration of the metaverse into the broader digital environment, scrutinizing its harmonious interactions with other digital educational endeavours. This comprehensive perspective offers valuable insights into the interrelation between metaverse education and wider digital trends. According to Díaz et al. (2020), learners possess the skills to perform a range of abilities in the virtual environment, including flying, walking, obtaining different goods, and personalizing their clothing and look in order to interact with objects in the virtual world. Within the domain of game-based learning, the Metaverse platform holds promise as a tool to augment students' drive to study and cultivate their communication abilities (Estudante& Dietrich, 2020a).

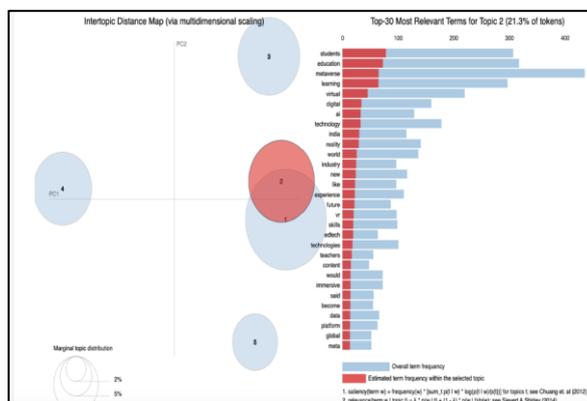


Fig. 4. Intertopic distance map for Topic 2.

4.3.3. T3: Addressing The Indian Context

This topic explores the advantages and disadvantages of introducing metaverse education in India, with a particular focus on the Indian context. The articles in this cluster focuses on the distinct educational environment in India and examine how metaverse solutions might be customised to cater to the special requirements of Indian students and institutions. In the realm of metaverse education in India, the news articles emphasise the capacity for personalized and immersive learning encounters. It examines the potential of metaverse technology to develop student-centered learning environments that address individual needs and improve the overall educational experience. The articles also highlight the importance of inclusivity and emphasise the utilisation of the metaverse as a means to address the digital divide in India. The study examines the potential of metaverse education in promoting equal access to educational resources and correcting discrepancies in digital infrastructure across various parts of the country. Upon analysing the educational dimension in research publications, it was found that the majority of Metaverse research is carried out at the tertiary education level. Our observations in the Indian setting contradict this finding, as we predominantly notice the use of the Metaverse at the school level. Research articles indicate that incorporating the Metaverse in higher education promotes interactive and immersive experiences. This enables educators and students to explore novel teaching methodologies, information and communication technologies, as well as emerging technologies(Díaz, 2020a). Furthermore, it is important to highlight that the Metaverse plays a significant role in the field of online learning, specifically through synchronous and asynchronous methods. This effectively addresses the drawbacks and inefficiencies of 2D learning environments, which are described as "spanning in-plane digital windows with width and height but without any depth" (Mystakidis et al., 2021). This viewpoint indicates that the Metaverse has the capability to alleviate the limitations and inefficiencies linked to conventional 2D online learning. Nevertheless, it is crucial to acknowledge that there has been a scarcity of studies conducted on the application of the Metaverse in the context of early childhood, primary, and secondary education.

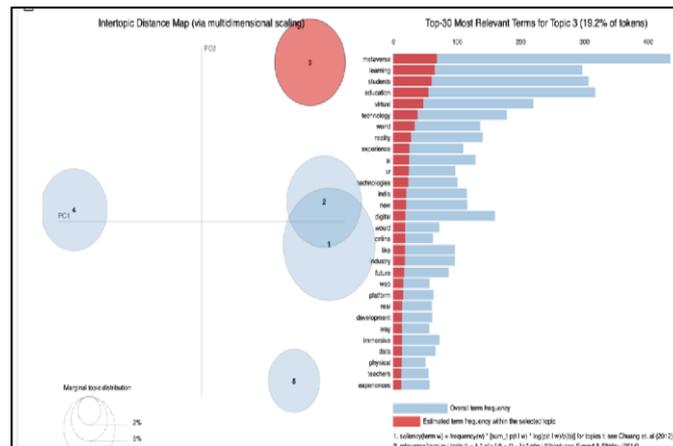


Fig. 5. Intertopic distance map for Topic 3.

4.3.4. T4: VR, Education, And TheNext Generation

This topic specifically examines the practical uses and influence of virtual reality (VR) in educational settings within the metaverse. This study examines the impact of VR technology on creating immersive educational experiences within the larger metaverse framework. Further articles explores the precise methods by which VR technology improves educational

involvement and results. This theme focuses on the creation of metaverse learning experiences specifically designed to cater to the tastes and features of Generation Z and upcoming generations. It analyses ways for providing engaging and relevant educational content within the metaverse, matching with the increasing requirements and expectations of contemporary and forthcoming student cohorts. The Metaverse is commonly utilised in virtual learning environments across most educational contexts. The main reason for this is the ability of powerful servers to utilise the Metaverse, allowing students to interact with a wide range of digital materials in virtual environments (Díaz, 2020a). Simultaneously, virtual learning scenarios commonly combine collaborative learning methodologies. This is demonstrated by using the Metaverse as a platform for social collaboration. In this platform, students form relationships in a virtual environment, get instruction, and give feedback using an autonomous tutoring system that analyses user interactions using data mining techniques (Schaf et al., 2012). For example, educators can allocate learning subjects and distribute instructional materials within the Metaverse, enabling students to retrieve resources using virtual tools on the internet (Díaz et al., 2020). In addition, students have the opportunity to engage with their friends and share academic material using internal social networks within the Metaverse, which promotes collaborative learning experiences (Díaz et al., 2020).

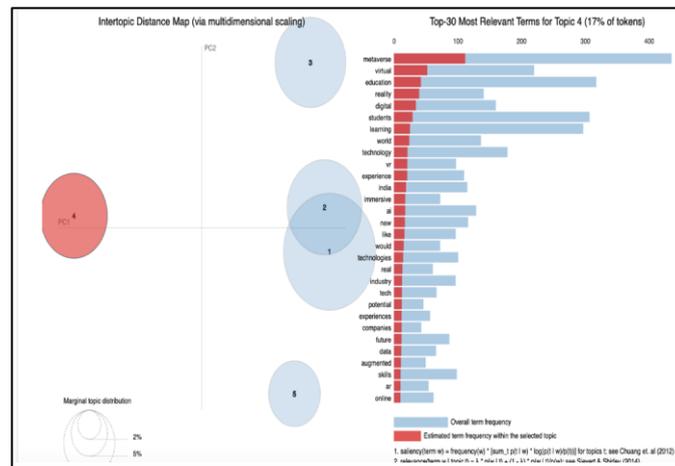


Fig. 6. Intertopic distance map for Topic 4.

4.3.5. T5: Technology, Ethics, And TheFuture Of Learning

This topic delves into the fundamental infrastructure and tools required for successful metaverse learning, with a focus on technological foundations. The news articles explore the necessary technology needs and factors for smoothly incorporating metaverse experiences into educational environments. Further news articles critically analyse the ethical components of metaverse education, specifically focusing on the potential ethical implications and issues it presents. Also, it shows that the government and industries play a huge role in impacting the adoption of the metaverse in educational settings. The metaverse integration in education comprehensively explores the ethical environment by addressing considerations relating to privacy, equity, and other elements. Further, it examines the fusion of learning experiences by combining metaverse encounters with standard physical learning environments. Within the wide range of educational opportunities facilitated by technology, users may encounter many risks, including identity theft, data breaches, and financial scams. In addition, the tracking of participants' emotions and gestures in class using sensors can give rise to privacy concerns. Furthermore, the use of augmented objects in a digital classroom can increase the potential of privacy breaches. Hence,

it is imperative for researchers and practitioners to exercise caution regarding these hazards while developing the Metaverse for educational purposes in order to establish a safe and protected environment for learning and teaching (Bermejo Fernandez et al., 2021).

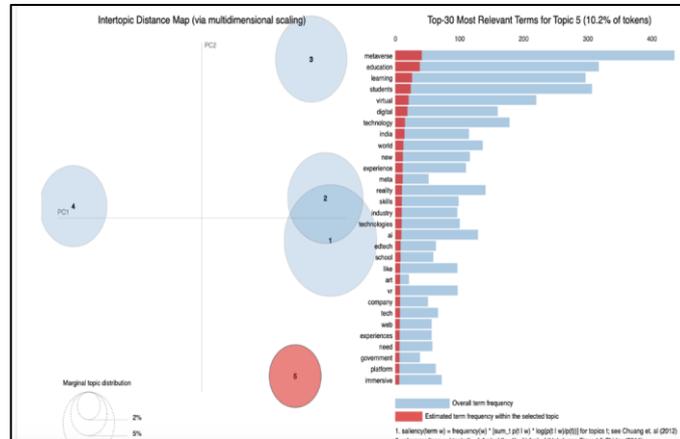


Fig. 7 Intertopic distance map for Topic 5.

5. LIMITATIONS, CONCLUSION AND FUTURE RESEARCH

This study, although offering useful insights into the role of the Metaverse in education, acknowledges its limits. The findings are limited to news articles sourced exclusively from two weekly publications: Financial Express and Economic Times, with a specific emphasis on the Indian settings. Further, the study uses research articles from databases like Web of Science and Scopus for validating the findings. The limited number of studies in prominent educational technology publications may be attributed to the novelty of the research issue. This study proposes new avenues for investigating the integration of the Metaverse into educational settings. An analysis of Metaverse in education demonstrates that its integration can effectively address longstanding obstacles, broaden educational prospects, and resolve practical issues inside virtual settings. A deficiency in study is found in the use of lifelogging technology in educational settings, necessitating further investigation using new technologies such as AI, blockchain, and IoT. The study highlights the necessity of technical supervision, both synchronous and asynchronous training, and a dynamic environment to effectively implement the Metaverse. The crucial problems that require empirical examination include security, privacy, ethical considerations, and potential consequences on society and psychology. The study emphasises the presence of a digital gap and advocates for the creation of an inclusive and easily accessible Metaverse platform that caters to all students, particularly those in poor nations such as India. To summarise, the study highlights the early stage of Metaverse implementation in education, emphasising the importance of addressing crucial investigations prior to its general acceptance and adoption. While recognising the potential advantages, it warns against blindly embracing the novelty, as the Metaverse may lead to unforeseen negative outcomes, making it "Metaworse."

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