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RESEARCH ARTICLE

Metaverse Technologies: Overcoming Barriers and Shaping Educational Innovation

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ABSTRACT
The study examines the impact of Metaverse technologies on higher education, with a focus on the challenges posed by an underfunded education system in Albania. To explore these problems in depth, the study surveyed 207 university students from across Albania to gather their views on the application of Metaverse tools in education, the impact of these tools on their learning, and the barriers that hinder further use of the technology. As results indicate, students are quite positive about adopting Metaverse technologies. From their perspective, the main factors these technologies contribute to are increased motivation, improved teamwork, and enhanced problem-solving. Along with identifying these major benefits, students also highlight the serious barriers they perceive, including the high costs associated with using technology and privacy concerns. Focusing on Albania's specific situation, this research offers practical guidance for educators, policymakers, and developers seeking to introduce immersive learning to more students in resource-constrained settings.

Keywords: Metaverse, Educational Technologies, Immersive Learning, Technology Adoption, Data Privacy

1. Introduction

Immersive technologies profoundly transform higher education worldwide by revolutionizing how knowledge is delivered, experienced, and retained. At its core, the Metaverse combines a continuum of Extended Reality (XR) technologies, including Augmented Reality (AR), Virtual Reality (VR), and Mixed Reality (MR), to create layered, interactive learning experiences that transcend traditional classroom boundaries [1, 2]. Real-time simulations, hands-on engagement, and personalized learning pathways make the Metaverse possible to overcome traditional educational limitations, preparing students with future-ready skills [3, 4, 5, 6, 7]. However, despite its transformative potential, the adoption of Metaverse technologies in higher education is limited and uneven, particularly in developing nations like Albania. However, challenges like high infrastructure costs, data privacy concerns, and unequal access to technology continue to widen existing digital divides [8, 9]. This paper addresses a critical gap by exploring the challenges and opportunities associated with the adoption of the Metaverse in Albania's higher education sector. While substantial research has examined the adoption of the Metaverse in technologically advanced nations, a significant gap remains regarding its application in developing contexts. This study offers novel insights into the barriers and opportunities for Metaverse adoption in Albanian higher education, thereby contributing to the growing body of literature on immersive learning technologies in under-resourced environments.

The research specifically explores the following questions:

- How do privacy concerns and ethical considerations regarding Metaverse platforms affect students' engagement and adoption in higher education?
- How does Metaverse technology enhance higher education learning experiences, motivation, and collaboration?
- What are the critical barriers and future opportunities for adopting Metaverse technology in higher education?

By answering these questions, this study provides evidence-based insights into Metaverse adoption, informs institutional strategies, and offers actionable recommendations for policymakers. Unlike previous research focusing on advanced economies, this study uniquely explores Metaverse adoption in a developing context, highlighting its transformative potential while addressing barriers to equitable access. Ultimately, this research positions the Metaverse as a transformative force for fostering inclusive, innovative, and future-ready education systems. By examining its potential and challenges, the study provides a roadmap for higher education institutions to integrate immersive technologies, equipping students with the skills needed to thrive in an increasingly digital-first world.

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2. Literature Review

The Metaverse, a dynamic ecosystem at the intersection of immersive technologies and virtual collaborative spaces, has the potential to enhance the education sector by enabling interactive, student-centered learning [3, 1]. At its core, the Metaverse integrates a continuum of XR technologies, encompassing AR, VR, and MR [2]. These three technologies offer distinct features with varying levels of user immersion [10]. AR enhances the real-world environment through digital overlays, bringing interactive learning materials and 3D models into classroom spaces [11]. VR operates at the opposite end of the spectrum by generating fully virtual environments that immerse learners in practical experiences through virtual laboratories and simulations [4]. MR bridges the gap between AR and VR by combining physical and digital elements that interact seamlessly in real time, allowing students to manipulate virtual objects in real-world settings [10].

Using XR technologies, especially AR and VR in education, the Metaverse may help transcend traditional teaching paradigms, enabling interactive, personalized, and immersive learning [11]. These enable students to conduct scientific simulations practically, apply what they have learned to construct meanings virtually, visit places unconstrained by physical limitations, and interact with history and its contexts in new ways [12]. Such immersive experiences deepen theoretical understanding and bridge the gap between abstract concepts and real-world applications, fostering critical skills such as problem-solving, collaboration, and analytical thinking. By integrating AR and VR into curricula, the Metaverse elevates the quality of education and better aligns student competencies with the demands of the modern workforce [13]. This transformative approach holds substantial promise for educational institutions seeking to create dynamic, inclusive, and engaging learning environments. These innovations enhance learning outcomes and equip students with the skills needed to navigate the complex challenges of the 21st century, positioning the Metaverse as a cornerstone of future-oriented education.

2.1. Transforming Learning and Engagement Through the Metaverse

The Metaverse represents a transformative shift in education that aligns closely with established learning theories. Its immersive, interactive features directly support Experiential Learning Theory, which holds that learners construct knowledge through concrete experiences and reflective practice [14]. By offering virtual simulations, 3D models, and interactive labs, the Metaverse creates authentic contexts where students can experiment and apply theoretical knowledge, an approach that has been shown to deepen understanding and skill development [2]. In addition, the Metaverse enables rich social interaction, resonating with Vygotsky's Social Constructivism, which emphasizes that knowledge emerges through collaboration and dialogue [15]. Virtual campuses and tools, such as Mozilla Hubs, illustrate this in practice. For example, Poolsawas and Chotikakamthorn (2023) [16] found that students working in a 3D virtual classroom showed greater peer-to-peer engagement than those using traditional video conferencing. Queen Mary University of London [17] has further demonstrated this potential by integrating Mozilla Hubs for cross-cultural, collaborative group projects, where students reported feeling more socially present and motivated than in conventional online meetings. This aligns with the Community of Inquiry (CoI) framework [18], which highlights how immersive platforms strengthen social presence, cognitive engagement, and teamwork skills essential for today's connected learning environments.

The Metaverse's dynamic visualizations and real-time feedback also align with Cognitive Load Theory, which emphasizes how instructional design can help learners manage complex information more effectively [19]. For instance, 3D anatomical models allow medical students to explore human systems interactively, reducing extraneous cognitive load and enhancing conceptual understanding [12].

One of the Metaverse's most profound contributions is its ability to foster global collaboration. Through virtual platforms, students from diverse geographical and cultural backgrounds can engage in meaningful interactions, thereby enhancing their communication and teamwork skills and capabilities, which are essential for success in an increasingly interconnected world [10]. These collaborative environments prepare students for a globalized workforce while improving engagement and academic performance [20, 21]. Moreover, gamification and interactive activities within the Metaverse further motivate learners, making complex concepts more accessible [20, 22, 23]. Personalized learning pathways, where students control their own pace and adapt to dynamic environments, represent a significant advancement in STEM disciplines, particularly in those where experiential learning is crucial [24, 11].

Recent European Union (EU)-funded initiatives such as the COWEB (Collaborative Online International Learning in the Western Balkans) Erasmus+ project (2022-2025) [25], which integrates virtual collaborative learning modules across Albania, Kosovo, and the Western Balkans, and the VALEU-X (Virtual Albanian European University Exchange) project (2020-2022) [26], which piloted flipped classrooms and hybrid virtual labs, illustrate how immersive, Metaverse-like practices are actively taking root in the region. These projects have contributed to building digital and intercultural skills, reducing barriers for students with limited mobility opportunities, and equipping faculty with the pedagogical capacity to design engaging hybrid and virtual experiences. As a result, they have created an enabling environment for future Metaverse-based education by normalizing collaborative online learning and demonstrating its practical value within the unique context of higher education in Albania and the Western Balkans. These tangible outcomes, including increased student mobility, enhanced faculty digital competence, and shared XR resources across Balkan institutions, demonstrate how regionally grounded collaborations can reduce infrastructural gaps and build readiness for large-scale Metaverse integration.

2.2. Barriers to Metaverse Adoption in Higher Education

Despite its transformative potential, the adoption of the Metaverse in higher education is hindered by several critical challenges. High infrastructure costs, limited device affordability, and the demand for advanced computational resources remain significant obstacles, particularly in low-resource settings [27, 12, 1]. These limitations have been repeatedly confirmed by studies showing that insufficient digital infrastructure can deepen the digital divide rather than close it [6]. For example, the VALEU-X project in the Western Balkans (2020-2022) demonstrated that targeted institutional funding and EU-backed grants can help bridge these gaps by supporting virtual labs, shared XR facilities, and faculty training [26]. Building on this model, universities in Albania and similar contexts could form inter-university consortia to share expensive XR equipment and technical expertise, making adoption more financially sustainable over time.

Another major concern is data privacy and ethical governance. The collection and use of sensitive personal information, such as biometric and behavioral data, necessitate the development of robust frameworks to ensure student protection [28, 29]. To overcome this, Wang et al. (2023) [8] highlight the importance of developing clear data governance protocols, strong encryption standards, and transparent user consent mechanisms. At the policy level, EU regulatory efforts, such as the European Commission's 2023 Web 4.0 and Virtual Worlds Strategy [30], provide a useful blueprint for protecting privacy and promoting the ethical use of immersive technologies. While Albania does not yet have a dedicated framework for XR or Metaverse-specific governance, adapting these EU-level guidelines to its national legal and educational context is achievable and necessary. Aligning with the General Data Protection Regulation (GDPR) [31] and Albania's Digital Agenda 2022–2026 [32] would help ensure compliance with broader European standards while reflecting local realities. This would strengthen institutional trust, protect students' data rights, and help create a safer and more resilient digital learning ecosystem tailored to Albania's higher education sector.

Additionally, the lack of equitable access to Metaverse technologies poses a significant challenge to its integration. Many institutions in developing regions face financial and logistical constraints that prevent the deployment of immersive educational tools. To bridge this gap, institutions must prioritize investments in scalable and affordable infrastructure. Beyond financial constraints and privacy considerations, lack of faculty readiness and institutional capacity have emerged as significant impediments, limiting the potential for transformative Metaverse-based pedagogy [10]. EU-funded projects like VALEU-X [26] and the COWEB Erasmus+ project [25] offer valuable examples of how regional collaboration, targeted funding, and faculty training can help overcome these barriers. For example, the COWEB project has enabled universities across Albania, Kosovo, and the Western Balkans to co-create virtual collaborative modules and build staff and student capacity for XR use. Inspired by these initiatives, Albanian universities could collaborate through shared frameworks to pool XR resources, technical expertise, and training opportunities, supported by EU funding. The positive results achieved through VALEU-X and COWEB, such as establishing virtual labs and co-designed collaborative modules, provide practical blueprints for addressing structural barriers and sustaining digital transformation within Southeast European universities. This approach would make Metaverse adoption more realistic and sustainable while addressing critical infrastructure, skills, and governance gaps.

Addressing these barriers requires coordinated efforts from universities, policymakers, and the private sector to ensure equitable access and scalability. By championing digital equity initiatives and developing affordable, regionally relevant XR solutions, all students, regardless of their socioeconomic or geographical backgrounds, can benefit from the transformative potential of Metaverse-based education.

2.3. Market Trends and the Future of the Metaverse in Education

The global Metaverse education market is experiencing unprecedented growth, valued at USD 4.38 billion in 2023, with a projected annual growth rate of 38.7% through 2030 [33]. This rapid expansion is primarily driven by North America, which is leveraging its advanced technological infrastructure and significant investments in educational technology. Similarly, Europe and the Asia-Pacific are accelerating their adoption of Metaverse platforms, supported by robust government policies and institutional initiatives. Advancements in 5G networks and AR/VR technologies in the Asia-Pacific have enhanced the accessibility and scalability of virtual education, benefiting diverse student populations [33].

The European Commission's Web 4.0 and Virtual Worlds Strategy, unveiled in July 2023, positions the EU as a leader in the global digital transition. This initiative emphasizes the development of an open, secure, and inclusive ecosystem that surpasses the capabilities of Web 3.0, thereby establishing an interconnected, intelligent economy [30]. Projections indicate that the global virtual worlds market will expand from €27 billion in 2022 to over €800 billion by 2030, potentially generating 860,000 new jobs by 2025 [34]. To maintain a competitive edge, the European Commission advocates for enhanced collaboration between academia and industry, supported by regulatory "sandboxes" to pilot and refine emerging technologies. Initiatives like "Destination Earth" and "CitiVerse" exemplify the broader societal impact of Metaverse innovations, showcasing their utility in areas such as urban planning and public management [30].

The Metaverse's rapid growth is further fueled by ongoing technological advancements and the rising demand for innovative learning methods. Key enabling technologies, including VR and AR devices, are becoming more cost-effective and user-friendly, facilitating broader adoption in educational settings. By 2023, hardware accounted for over 47% of global market

revenues, reflecting manufacturers' prioritization of affordability and accessibility, which enables the seamless integration of these tools into classrooms [33].

The Metaverse is expected to become a pivotal component of the educational ecosystem by 2030 [35]. It offers transformative opportunities for teaching and unparalleled flexibility in knowledge acquisition. By creating virtual environments that support interaction, collaboration, and personalized learning experiences, the Metaverse is poised to fundamentally reshape educational methodologies [11, 35]. To fully realize its potential, the Metaverse's development can be categorized into three key stages [35]:

- Emergent Phase: In this initial stage, technologies such as AR, VR, and blockchain remain in the early stages of adaptation within educational settings, requiring further stabilization and refinement.
- Advanced Phase: Technologies begin to integrate more effectively, enabling more sophisticated user experiences, such as cross-platform interactions and personalized student engagement.
- Mature Phase: The Metaverse achieves full integration into daily life and educational systems, offering a secure, sustainable, and accessible infrastructure that supports anytime, anywhere learning.

This trajectory highlights the Metaverse's potential to revolutionize education by providing greater accessibility, enhanced personalization, and advanced collaborative opportunities worldwide.

2.4. Legal and Regulatory Considerations

The rapid expansion of Metaverse technologies in education has introduced complex legal and regulatory challenges, necessitating innovative solutions to ensure their responsible, secure, and ethical implementation. The European Parliament's resolution on virtual worlds provides a critical framework for establishing standards and guidelines that facilitate the safe integration of Metaverse platforms in higher education [36]. This section explores key legal and regulatory issues related to data privacy, intellectual property rights (IPR), and ethical concerns, while proposing actionable strategies for their effective implementation.

2.4.1. Data Privacy and Security

Privacy and personal data protection are paramount concerns [37] in adopting Metaverse technologies, particularly for student users. Metaverse platforms collect vast amounts of sensitive data, including biometric and behavioral information, essential for delivering immersive and personalized learning experiences [10]. While the EU's General Data Protection Regulation (GDPR) [31] provides a solid framework, the unique challenges presented by the Metaverse require advanced safeguards to protect student rights [12]. Educational institutions must prioritize proactive data governance policies to ensure compliance and accountability, as well as to safeguard students' privacy, ultimately encouraging greater engagement with these platforms.

2.4.2. Intellectual Property Rights (IPR)

The regulation of IPR within the Metaverse raises unique challenges for higher education. In immersive learning spaces, user-generated content, such as 3D models, avatars, student projects, and collaborative simulations, often blurs the lines between individual and institutional ownership. [36, 12]. Unlike traditional learning materials, digital assets created on Metaverse platforms can be co-created, modified, and reused in multiple contexts, complicating copyright, licensing, and fair use [10].

Several recent studies highlight that universities often lack clear policies for managing student-generated virtual assets, storage, and licensing [10, 6]. Lee et al. (2021) [27] also note that although immersive VR courses are growing, guidelines for co-authorship and derivative works remain underdeveloped.

In practice, developing institutional IPR policies and licensing agreements for Metaverse-based coursework can help ensure students retain appropriate rights over their work while allowing educators to reuse or showcase high-quality examples responsibly. The European Parliament's 2024 [36] resolution on virtual worlds calls for frameworks that balance the protection of creators' rights with open educational resource (OER) principles, an especially relevant approach for Albania, where sharing digital content can help reduce costs and broaden access. For Albanian universities, adapting these models into local IPR policies, staff training, and student consent processes will ensure creativity and innovation thrive in fair, transparent, and inclusive immersive learning environments.

2.4.3. Ethical Concerns and Governance

The ethical design and secure implementation of virtual environments are critical to ensuring safe, inclusive, and equitable learning spaces. Metaverse-based education must uphold fairness, accessibility, and student well-being, while actively mitigating risks related to inappropriate content, algorithmic bias, and misuse of student data [28, 10]. Unlike traditional online tools, the Metaverse involves the collection of extensive biometric and behavioral data, which raises heightened ethical considerations [8].

Recent research by Chen et al. (2023) [10] highlights that when students interact through avatars and digital twins, new questions emerge regarding the ownership of user-generated content and the long-term storage of behavioral data, often without clear consent from the students. This aligns with OECD (2024) [12], which emphasizes that immersive platforms can blur identity boundaries and amplify risks of unintended surveillance.

Policy frameworks, such as the European Commission's Web 4.0 and Virtual Worlds Strategy [30], now offer practical and scalable models for privacy protection and ethical governance in these virtual environments. For Albania, aligning local institutional policies with the EU's GDPR [31] and the Digital Agenda 2022–2026 [32] is an essential first step. However, as Chen et al. (2023) [10] stress, most universities in developing contexts still lack tailored ethical review processes for XR and Metaverse-based learning. To close this gap, there is a need for clear local guidelines and staff training to ensure fair use of student data, explicit consent procedures for collecting and storing immersive interaction data, and transparent licensing for student-generated content. This would strengthen trust in the safe and ethical integration of Metaverse platforms in Albanian higher education, supporting an inclusive, rights-respecting digital transformation.

The following hypotheses guide this study, focusing on the transformative potential and challenges associated with the adoption of Metaverse-based platforms in higher education:

- H1: Strong privacy regulations and ethical considerations influence students' willingness to adopt and engage with Metaverse-based educational platforms. ($\alpha = 0.05$)
- H2: Students who regularly engage with Metaverse-based educational platforms exhibit significantly higher levels of critical thinking, creative problem-solving, and collaborative skills compared to students who do not regularly engage with these platforms. ($\alpha = 0.05$)

3. Materials and Methods

This study employs a quantitative research approach to investigate how students perceive, understand, and feel prepared to utilize Metaverse technologies within university education. Its primary objective is to examine the potential of the Metaverse to support improved learning outcomes, foster meaningful collaboration, and enhance student engagement, all while considering key concerns such as data privacy, accessibility, and ethical implications. To ensure this objective is met, the research design applies a well-structured survey instrument, informed by relevant empirical studies and best practices in educational technology research, to collect measurable data. Combining carefully developed survey measures with appropriate statistical analyses, the study systematically captures students' views and provides practical evidence on how immersive technologies may reshape their learning experiences.

3.1. Instrument Development

A structured questionnaire was developed as the primary tool for data collection, drawing directly from a detailed review of recent research on the use and adoption of Metaverse technologies in university education [10, 24, 3, 11, 4, 6]. This approach ensured that the instrument captured factors identified as relevant in the literature and reflected students' experiences and concerns.

The questionnaire consisted of three main parts. The first section collected demographic information, including gender, field of study, and employment status, to provide background context about the participants.

The second section focused on students' general perceptions and awareness of Metaverse technologies. It included 8 statements, each rated on a five-point Likert scale (ranging from "strongly disagree" to "strongly agree"), to measure students' familiarity with Metaverse tools, their perceived usefulness and ease of use, and their willingness to adopt these technologies in their university studies.

The third section explored four specific dimensions that recent studies have consistently highlighted as influencing students' readiness to adopt immersive technologies: technological competence, skill development, personalized learning, and data privacy and security. Each dimension was measured with 8 Likert-scale statements adapted from questions used in the reviewed studies:

- Technological competence items assessed students' confidence in accessing, navigating, and using Metaverse platforms effectively.
- Skill development items examined whether students believe these tools can help them develop practical, collaborative, or discipline-specific skills.
- Personalized learning items focused on whether students feel immersive environments can be adapted to their individual learning needs and preferences.
- Data privacy and security addressed students' awareness of potential privacy risks and concerns about managing their data in virtual environments.

These four dimensions were selected because they reflect the potential benefits students expect and the concerns that might limit adoption. They are interrelated: students are more likely to adopt and engage with new technologies if they feel confident using them, believe they offer real educational value, and trust that their personal data will be handled responsibly. The instrument demonstrated excellent reliability, with a Cronbach's α of 0.967, confirming strong internal consistency across all questionnaire sections.

3.2. Sampling

The study surveyed 207 students from higher education institutions across Albania, representing various academic disciplines, including Information Technology, Computer Engineering, Business Management, Finance, Communication, and Applied Informatics. This interdisciplinary sample was chosen to provide a comprehensive understanding of how students from various fields perceive the adoption of Metaverse technologies in higher education. The sample consisted of 78 females (37.7%) and 129 males (62.3%), with 112 participants (54.1%) also employed, providing insight into how professional experience influences perceptions of Metaverse adoption. This diverse sample ensured the collection of a broad range of perspectives, reflecting both technology-focused and non-technical disciplines, and highlighting the challenges and opportunities of Metaverse integration.

3.3. Data Collection and Statistical Analysis

The data were collected through an online questionnaire from July to October 2024. This period was intentionally selected to align with the Albanian higher education calendar. July marks the time when many students complete their final exams, participate in make-up courses, or prepare enrollment documentation. October coincides with the start of the new academic year, when students return to campus and are fully engaged. This timing helped maximize participation and ensured that the sample reflected students actively involved in their studies during a relevant and representative period. Ethical standards were rigorously adhered to, including obtaining informed consent, guaranteeing voluntary participation, and ensuring the confidentiality of participant responses. Participants were informed of their right to withdraw at any stage without penalty. All responses were analyzed using JASP 0.19.1.0, a free, open-source statistical software package well-suited for analyzing perception-based survey data [38]. JASP was selected because it combines an intuitive interface with robust non-parametric and correlation tests, making it appropriate for studying students' perspectives on emerging Metaverse technologies in university education. Its ability to produce clear visualizations and transparent results supports reproducibility and trust, essential when investigating new digital learning environments and addressing privacy and ethical concerns. A significance level of $\alpha = 0.05$ and a 95% confidence interval were applied to ensure the findings were statistically reliable and to minimize the risk of Type I errors.

The Mann-Whitney U test was used to compare students' reported levels of critical thinking, creative problem-solving, and collaboration between two independent groups: students who regularly engage with Metaverse-based educational platforms and those who do not. This test was chosen because the data were collected using Likert-scale items, which produce ordinal data that often do not meet the normality assumptions required for parametric tests, such as the t-test. By comparing median ranks rather than means, the Mann-Whitney U test provides a robust method for detecting meaningful differences in skills and perceptions [39]. This makes it especially suitable for perception-based studies that examine how students' regular use of innovative technologies, such as Metaverse platforms, may be linked to skill development. Additionally, Spearman's Rho correlation [40] was used to assess the strength and direction of the relationship between key variables, specifically students' perceptions of strong privacy regulations and their willingness to adopt and engage with Metaverse-based educational platforms. This test was selected because it is suitable for ordinal data that do not require normal distribution and can capture monotonic relationships between variables. This makes Spearman's Rho especially suitable for perception-based studies that examine how students' attitudes and trust concerns interact when considering the adoption of immersive learning environments.

3.4. Limitations of the Study

Although this study primarily focuses on Albania, its robust design, diverse sample, and rigorous analytical methods provide a foundation for broader applicability. However, the findings may not be fully generalizable to other regions with differing cultural, economic, and technological contexts.

4. Results

This section presents the main findings of the study, organized around the research questions and tested hypotheses. Descriptive data are summarized in tables and explained through a clear narrative interpretation. Each subsection opens with a brief overview, followed by the relevant tables, and closes with a concise summary of the key results. This approach ensures that evidence supports each finding well and helps illustrate students' perceptions of Metaverse adoption, privacy concerns, and skill development.

4.1. How do privacy concerns and ethical considerations regarding Metaverse platforms affect students' engagement and adoption in higher education?

Integrating Metaverse platforms in higher education offers significant potential for immersive learning experiences, but it also presents privacy and data ethics challenges. Table 1 presents the mean scores for students' concerns related to privacy and ethical data practices. These results highlight key issues that may influence the adoption and use of these platforms, providing valuable insights into the unique challenges faced by students in Albania.

Table 1: Privacy Concerns and Ethical Considerations Regarding Metaverse Platforms

Statement	Number of Participants	Mean
Concerns about the illegal use of personal data	207	4.35
Concerns about data collection practices	207	3.604
General privacy concerns when using metaverse platforms	207	3.643
Concerns about third-party data collection	207	3.638

- Concerns About the Illegal Use of Personal Data:

The concern regarding the illegal use of personal data emerged as the most significant issue, with an average score of 4.35 on a 5-point Likert scale. This suggests that for Albanian students, the potential misuse of personal information by Metaverse education platforms is the primary barrier to adoption.

- Concerns About Data Collection Practices:

Respondents showed moderate concern regarding the extent to which Metaverse platforms collect personal data, with a mean score of 3.60. Although students are not overwhelmingly worried about the volume of data collected, there is significant awareness and discomfort about the data collection processes.

- General Privacy Concerns When Using Metaverse Platforms:

Privacy concerns while using Metaverse platforms were also significant, with a mean score of 3.64. This suggests that students are aware of the privacy risks inherent in virtual environments, although they may not fully understand the extent of these risks.

- Concerns About Third-Party Data Collection:

Concerns about third-party data collection were similarly significant, with a mean score of 3.64. This highlights that students are concerned about external parties accessing their personal data through Metaverse platforms.

4.2. How does Metaverse technology enhance higher education learning experiences, motivation, and collaboration?

The findings from adopting Metaverse-based platforms in Albanian higher education suggest a substantial potential for improving the overall educational experience. Table 2 presents the mean scores for students' perceptions of how Metaverse platforms may support independent learning, personalized approaches, motivation, and collaboration. Students responded positively to the various aspects of Metaverse technology, particularly immersive learning, motivation, and collaboration. (Table 2).

Table 2: Metaverse Technology

	Number of Participants	Mean	Std. Deviation	Coefficient of variation
Metaverse-based education platforms support independent learning	207	3.483	0.769	0.221
I can find personalized learning methods on Metaverse-based platforms	207	3.541	0.811	0.229
Metaverse platforms enable the creation of diverse roles	207	3.647	0.673	0.184
Metaverse-based platforms can be both engaging and educational	207	3.72	0.756	0.203
I would collaborate with peers using Metaverse-based platforms	207	3.454	0.798	0.231
I would communicate with classmates on Metaverse-based platforms	207	3.464	0.793	0.229
Metaverse enhances motivation for academic subjects	207	3.377	0.844	0.25
Metaverse makes subject content more engaging	207	3.531	0.736	0.208

- Immersive Learning Experiences and Personalization

The results suggest that students generally perceive Metaverse platforms as supportive of independent learning, with a mean score of 3.48, reflecting positive feedback. However, the moderate standard deviation (0.769) and coefficient of variation

(0.221) indicate variation in how these platforms are perceived across different learners. While many appreciate the opportunities for self-directed learning, the effectiveness varies based on individual learning preferences and experiences. Furthermore, personalized learning through Metaverse platforms was also highly rated, with a mean score of 3.54, indicating that students believe these platforms can accommodate various learning styles. However, the moderate variability (CV = 0.229) suggests that personalization may be more effective for some students, depending on their individual learning needs and the way content is delivered.

Examples of immersive learning include Google Earth VR, which enables students to explore geographical environments, offering experiences that extend beyond traditional textbooks and maps (Figure 1).

Figure 1. Google Earth VR: Virtual Exploration of Geographical Environments

Similarly, using 3D Anatomical Models allows students to engage in real-time exploration of the human body, enhancing their understanding of complex medical concepts and providing a deeper level of interactive learning (Figure 2).

Figure 2. 3D Anatomical Model: Interactive Learning of Human Anatomy

- Motivation through Engaging and Interactive Learning

Students perceive Metaverse platforms as motivating and engaging. The ability to combine education and entertainment was widely appreciated, with a high mean score of 3.72, indicating that students find these platforms both enjoyable and educational. This dual appeal highlights the potential of the Metaverse to engage students in ways traditional learning methods may not.

Moreover, the ability of Metaverse platforms to make academic content more engaging was reflected in a mean score of 3.53, indicating that students perceive these platforms as effective tools for enhancing learning interactivity and accessibility. This is particularly relevant in the Albanian context, where traditional pedagogical methods sometimes fail to captivate students' attention. The interactive nature of Metaverse environments fosters engagement, making complex academic content more relatable and stimulating for students.

- Collaboration in Virtual Environments

Collaboration and Communication: Students also expressed positive views regarding collaboration in virtual spaces, with mean scores of 3.45 for collaboration with peers and 3.46 for communication with classmates. However, the moderate coefficients of variation (CV = 0.231 and 0.229) indicate some variation in how students perceive these collaborative aspects, which may depend on factors such as their familiarity with the technology or the nature of the course content.

4.3. What are the critical barriers and future opportunities for adopting Metaverse technology in higher education?

The study identified several significant barriers to adopting Metaverse technology in higher education, as well as opportunities for future integration (Table 3). Table 3 presents the mean scores for statements about barriers and perceived opportunities.

Barriers to Metaverse Adoption

- Technological Immaturity: The perception that Metaverse technology is still in its early stages was a significant barrier. Students expressed concerns about the stability and reliability of the technology, with a mean score of 3.68. This suggests that while Metaverse platforms are promising, they believe the technology is not sufficiently robust for widespread academic use.

Table 3: Critical Barriers and Future Opportunities for Adopting Metaverse Technology in Higher Education

Statement	Number of Participants	Mean	Std. Deviation	Coefficient of variation
Metaverse technology is still in its early stages	207	3.676	0.792	0.216
Metaverse platforms are biased towards entertainment	207	3.333	0.757	0.227
Public opinion/news will influence my use of Metaverse platforms	207	3.063	0.871	0.284
I would share my virtual identity on Metaverse platforms with my classmates	207	3.324	0.816	0.246
Metaverse will be used in classrooms in the near future	207	3.643	0.768	0.211
Metaverse platforms are affordable and accessible	207	3.101	0.809	0.261
Metaverse should be integrated into education	207	2.473	0.743	0.3
Metaverse platforms are not yet universal	207	3.367	0.831	0.247

- Entertainment Bias: A common concern was that students perceive Metaverse platforms as biased toward entertainment rather than educational use. With a mean score of 3.33, many students questioned the educational value of these platforms, perceiving them as recreational tools rather than learning resources.
- Influence of Public Perception: Public opinion and media portrayals significantly influenced students' willingness to use Metaverse platforms in education. The mean score of 3.06 suggests that students are sensitive to external influences, which may affect their decisions to adopt technology for learning purposes.
- Privacy and Identity Concerns: Concerns over privacy and data security were prevalent, with students expressing moderate hesitation about sharing their virtual identities on Metaverse platforms. The mean score of 3.32 highlights that students believe robust privacy protections are necessary to build trust in the technology.
- Accessibility and Affordability: Accessibility and affordability were significant challenges, with a mean score of 3.10. Notably, many students in Albania reported being willing to spend between $1 and $600 on Metaverse products (Figure 3), suggesting that while some find the technology affordable, others consider it too costly. The financial burden underscores the need for cost-effective solutions and infrastructure support among government and industry stakeholders.

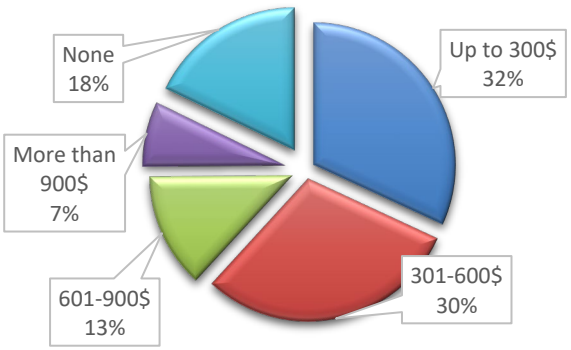

Figure 3. Price Considerations for Metaverse Adoption

- Skepticism About the Necessity of Metaverse in Education: A significant barrier to adopting Metaverse technology in education is skepticism regarding its necessity. The results show a relatively low mean score of 2.47 (CV = 0.30),

indicating divided opinions on the value of the Metaverse in educational contexts. This indicates that while some support its integration, others remain unconvinced about its relevance or potential impact.

- General Barriers: As illustrated in Figure 4, other critical barriers identified include detachment from real life, technology dependency, and privacy/security risks. The figure reveals that these issues are central to students' concerns about integrating Metaverse platforms into academic settings. Detachment from real-life concerns can lead students to become overly reliant on virtual environments, potentially affecting their engagement with real-world experiences. Technology dependency highlights the risks of becoming overly reliant on digital solutions, with some students expressing concern about the growing role of technology in education. Finally, privacy/security risks reflect concerns about the safety of personal data and the potential for misuse within virtual spaces.

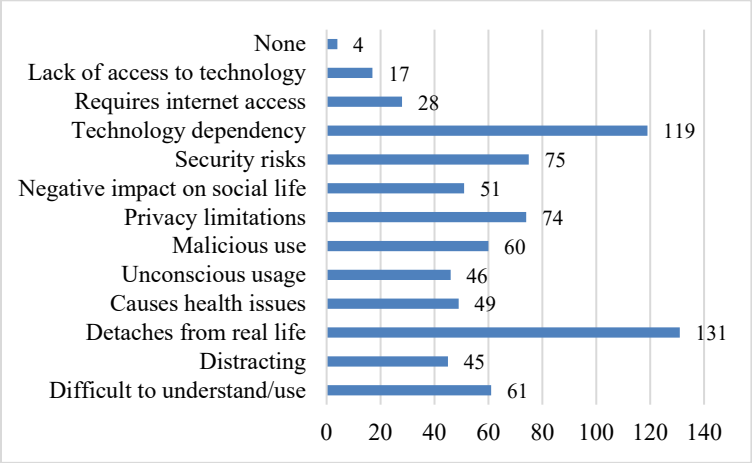

Figure 4. Barriers to Metaverse Adoption

Opportunities for Metaverse Adoption

- Future Classroom Integration: There is optimism among students about the future integration of Metaverse technology in higher education. With a mean score of 3.64 (CV = 0.211), students expressed confidence that these platforms could play a larger role in classroom environments. This should be viewed as an aspirational expectation, contingent upon the readiness of infrastructure and policy.
- Growing Universality: While Metaverse platforms are not yet universally accessible, students expect the technology to become more widespread as it matures. The mean score of 3.37 (CV = 0.247) reflects students' anticipation that, as platforms evolve and become more affordable, their adoption in academic settings will increase globally, making them more accessible to a broader audience.
- Enhanced Learning Opportunities: Metaverse platforms offer substantial potential for enhancing learning experiences through flexibility, visualization, and gamified engagement. Students strongly believe in the ability of Metaverse technology to provide personalized learning experiences, allowing them to engage with educational content in innovative ways. This opportunity highlights the flexibility of Metaverse environments in accommodating diverse learning styles and making complex subjects more engaging (Figure 5). However, this optimism depends on effective implementation and policy support.

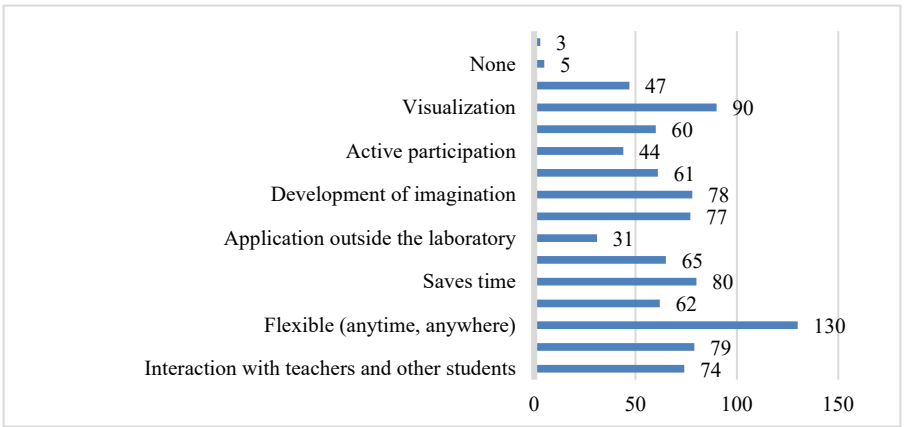

Figure 5. Advantages of Metaverse in Higher Education

4.4. H1: Strong privacy regulations influence students' willingness to adopt and engage with Metaverse-based educational platforms. (α = 0.05)

The statistical analysis presented in Table 4 reveals a significant relationship between privacy regulations and students' willingness to engage with Metaverse-based educational platforms.

The data show a positive correlation ($r = 0.33$, $p < .001$) between students' perception of privacy regulations and their readiness to adopt and use these platforms. This indicates that as privacy safeguards become more robust, students are more likely to engage with Metaverse technologies. The findings suggest that students' trust in the platform, when they perceive strong privacy protections, is a key factor in encouraging their adoption. These results provide strong empirical support for H1, affirming that privacy regulations are crucial in shaping students' engagement with Metaverse platforms. Educational institutions must therefore prioritize the development of comprehensive privacy protocols, transparent data handling practices, informed consent mechanisms, and stringent security measures to increase students' willingness to adopt these technologies.

Table 4: Spearman's Correlations

Variable		Students' Willingness to Adopt and Engage with the Metaverse	Privacy Regulations
Students' Willingness to Adopt and Engage with the Metaverse	n	—	
	Spearman's rho	—	
	p-value	—	
Privacy Regulations	n	207	—
	Spearman's rho	0.33***	—
	p-value	< .001	—
* p < .05, ** p < .01, *** p < .001			

4.5. H2: Students who regularly engage with Metaverse-based educational platforms exhibit significantly higher levels of critical thinking, creative problem-solving, and collaborative skills compared to students who do not regularly engage with these platforms. (α = 0.05)

The results of the Mann-Whitney U test (Table 5) indicate that students who regularly engage with Metaverse-based educational platforms exhibit significantly higher levels of critical thinking, creative problem-solving, and collaborative skills than those who do not.

Table 5: Mann-Whitney U test

	U	p	Group	N	Mean
Critical Thinking	4132	0.005	Non-regular users of Metaverse-based platforms	88	3.352
			Regular users of Metaverse-based platforms	119	3.58
Creative Problem-Solving	3364	< .001	Non-regular users of Metaverse-based platforms	88	3.261
			Regular users of Metaverse-based platforms	119	3.748
Collaboration	3325.5	< .001	Non-regular users of Metaverse-based platforms	88	3.159
			Regular users of Metaverse-based platforms	119	3.689

This analysis reveals significant differences between students who regularly engage with Metaverse platforms (Group 2) and those who do not (Group 1) in the context of Albania's higher education.

- Critical Thinking

The Mann-Whitney U test revealed a significant difference between the two groups, with a U-value of 4132 and a p-value of 0.005. Students in Group 2 (mean = 3.58) demonstrated higher perceived levels of critical thinking than those in Group 1 (mean = 3.352). These results suggest that Metaverse platforms contribute positively to the development of critical thinking skills, which are crucial for academic success and workforce readiness.

- Creative Problem-Solving

A significant difference was also found in creative problem-solving skills, with a U-value of 3364 and $p < 0.001$. Students who engaged regularly with Metaverse platforms reported significantly higher perceived problem-solving capabilities (mean = 3.748) than their non-regular counterparts (mean = 3.261). This highlights the effectiveness of Metaverse platforms in fostering innovative thinking and problem-solving abilities.

- Collaboration

The analysis showed that Metaverse platforms significantly improve collaboration, with a U-value of 3325.5 and $p < 0.001$. Students in Group 2 (mean = 3.689) exhibited significantly stronger collaborative skills than those in Group 1 (mean = 3.159). This suggests that Metaverse platforms provide an excellent environment for real-time collaboration, teamwork, and the development of social learning skills.

These findings support H2, confirming that students who regularly engage with Metaverse-based educational platforms exhibit significantly higher levels of critical thinking, creative problem-solving, and collaboration. These results highlight the perceived educational potential of Metaverse platforms, especially in enhancing student engagement and supporting academic performance in Albania's higher education system.

5. Discussion

This study demonstrates that students regard Metaverse-based educational platforms as valuable tools for developing essential skills such as critical thinking, creative problem-solving, and collaboration, particularly within the context of Albanian higher education. The findings align with existing research, highlighting the transformative potential of immersive technologies for developing essential competencies in higher education [3, 11]. For example, students who engage regularly with these platforms reported higher analytical and evaluative abilities, consistent with prior research showing how virtual environments can enhance active learning through realistic and interactive scenarios [4, 41].

Beyond cognitive benefits, students indicated that using Metaverse-based tools encourages innovative thinking and problem-solving. This aligns with the work by Lampropoulos and Kinshuk (2024) [20], who found that interactive virtual spaces provide opportunities to explore complex ideas safely and engagingly. Likewise, the study suggests that these platforms can strengthen collaboration by allowing students to connect and work together in real time, an increasingly important aspect in today's interconnected educational and professional landscapes [21, 7]. This is particularly valuable for developing future-ready skills, as Metaverse technologies provide students with realistic scenarios to tackle challenges, which has been shown to foster creativity and innovative thinking [10].

However, turning this potential into practice requires tackling important barriers. One of the most pressing issues is data privacy. The significant positive relationship found between perceived privacy safeguards and students' willingness to engage with Metaverse platforms ($r = 0.33$, $p < .001$) underscores the importance of robust data protection in building trust in virtual learning environments [28, 8]. This aligns with Kye et al. (2021) [9], who emphasize that privacy concerns can hinder the uptake of new educational technologies. Although Albania's legal framework includes Law No. 124/2024 "On Personal Data Protection" [42], institutional policies and detailed guidelines for implementation remain limited. Universities should update their governance policies, train staff and students on safe data practices, and ensure alignment with EU GDPR standards [31].

Addressing affordability and infrastructure barriers is critical to ensure that Metaverse technologies do not deepen existing educational inequalities. In this study, students reported concerns about the cost of Metaverse products (mean = 3.10), echoing findings from other developing contexts where high hardware and connectivity costs can restrict access [1]. Practical strategies to overcome these challenges include offering subsidies for headsets and related equipment, expanding broadband infrastructure to underserved areas, and creating shared VR and AR laboratories on university campuses to provide all students with hands-on experience, regardless of their personal financial means.

Albania's participation in regional initiatives such as the Valeu-X [26] and COWEB [25] projects demonstrates the country's commitment to cross-border collaboration and digital learning innovation. These projects have validated the feasibility of immersive and collaborative learning within the Western Balkans and produced measurable impacts, including increased access for students with mobility constraints, the development of shared XR infrastructure, and faculty upskilling to design engaging virtual environments. Such outcomes strengthen the case for scaling Metaverse adoption through sustained regional partnerships. By illustrating how well-structured virtual exchange and hybrid learning models enable institutions with varying resource levels to co-develop and share immersive content, these initiatives provide a practical roadmap for broader implementation. As Díaz, Saldaña, and Ávila (2020) [23] emphasize, virtual world projects can enrich hybrid education by enabling universities to pool expertise, support staff capacity building, and reach wider student groups. Building on these experiences can help Albania align its digital education strategies with best practices in Southeast Europe, while ensuring that data protection frameworks, such as Law No. 124/2024 "On Personal Data Protection" [42] and the GDPR [31] requirements, are fully implemented and effectively monitored. Albanian universities can make immersive education more sustainable, equitable, and relevant to their local context by strengthening these regional networks and translating lessons learned into practical policies and funding models. These actions are also consistent with the priorities outlined in Albania's Digital Agenda 2022–2026 [32], which emphasizes digital transformation, secure data management, and investment in broadband and digital skills across the education sector.

This study also highlights several opportunities for the future integration of Metaverse platforms. Students reported a moderately positive view about the potential classroom integration of Metaverse technologies (mean = 3.64). This aligns with the growing literature predicting immersive technologies will play an increasingly central role in higher education [35, 11]. Furthermore, students agreed that Metaverse platforms will likely become more universally accessible as the technology

matures (mean = 3.37). These results are supported by market trends showing significant growth in the virtual worlds sector, particularly in regions such as Europe and Asia-Pacific [33]. As VR and AR technologies become more affordable and widespread, institutions can create more inclusive and dynamic learning environments that respond to diverse student needs.

Although the Metaverse presents notable barriers to adoption, especially concerning privacy, affordability, and technological maturity, its potential to transform higher education in Albania remains strong. Universities should strengthen privacy protections, develop robust infrastructure, and integrate Metaverse tools thoughtfully into curricula to maximize their educational impact.

6. Conclusion

This study reveals that Albanian students view Metaverse-based educational platforms as valuable tools for developing essential skills, including critical thinking, creative problem-solving, and collaboration. These results are consistent with existing literature on the transformative potential of immersive technologies in higher education [3, 11]. Regular engagement with these platforms appears to be linked to higher perceived levels of analytical and evaluative abilities [4, 41], and students indicated that such environments can foster innovation, creativity, and real-time collaboration [20, 21].

However, this potential can only be realized if persistent barriers are addressed. Concerns about data privacy remain a major factor influencing students' willingness to adopt Metaverse platforms, highlighting the importance of alignment with GDPR standards [31] and Albania's Law No. 124/2024 [42].

Limitations related to affordability and technological infrastructure also emerged, reflecting trends in other developing contexts [1]. Regional collaboration, as evidenced by the concrete outcomes of VALEU-X [26] and COWEB [25], demonstrates that targeted, region-specific initiatives can expand digital equity, boost institutional capacity, and create scalable models for immersive learning that address the unique challenges and opportunities of the Balkans. Albania's active participation in these projects demonstrates how cross-border partnerships can foster virtual mobility, facilitate the sharing of expertise, and encourage resource pooling among regional universities. Evidence from Díaz, Saldaña, and Ávila (2020) [23] further supports the notion that well-structured virtual learning environments can enhance hybrid education models and benefit institutions with varying levels of technological readiness.

While Metaverse technologies hold significant promise for enriching learning experiences, coordinated policy development, investment in institutional capacity, and sustained regional cooperation will be essential to ensure that these tools help create meaningful, equitable, and future-ready educational opportunities for Albanian higher education.

6.1. Recommendations

Based on the study's findings on Albanian students' perceptions, this section provides practical, evidence-based recommendations for universities, educators, and policymakers to guide the effective adoption and integration of Metaverse technologies in higher education.

First, universities should strengthen institutional data privacy and governance policies. Since privacy concerns have emerged as a significant barrier to students' willingness to engage with Metaverse platforms, institutions must review and update their data protection frameworks in accordance with Albania's Law No. 124/2024 and EU GDPR principles. This should include developing clear guidelines for collecting, storing, and sharing student data, as well as regular training for staff and students to build trust and awareness.

Second, improving affordability and access to infrastructure is vital to ensure that immersive learning does not widen educational inequalities. Students reported moderate concerns about the cost of Metaverse-compatible devices and the reliability of supporting infrastructure. Universities should consider creating shared VR and AR laboratories, offering on-campus lending programs for headsets and equipment, and exploring partnerships with government or industry to expand broadband access and reduce student costs.

Third, institutions should integrate Metaverse tools into teaching and learning in a purposeful and evidence-based manner. The study suggests that students appreciate these platforms for their support of independent learning, personalization, motivation, and collaboration. Universities should pilot blended and hybrid courses that combine immersive tools with traditional teaching methods and invest in faculty development programs to help educators design engaging and interactive learning experiences.

Fourth, regional and cross-institutional collaboration should be leveraged to build capacity and share best practices. Albania's participation in initiatives such as VALEU-X [26] and COWEB [25] demonstrates the value of partnerships for developing virtual mobility programs, co-creating content, and pooling resources among Southeast European universities. Expanding such collaborations can strengthen institutional readiness and sustainability for immersive learning.

Finally, the scope of stakeholder engagement and future research should be broadened. While this study focused on students' perceptions, further research should also include faculty attitudes, institutional capabilities, and policy alignment to provide a comprehensive understanding of Metaverse integration. Comparative and cross-cultural studies can help validate these

findings in different contexts. At the same time, longitudinal research will be essential to examine the evolving impact of Metaverse adoption on student engagement and learning outcomes over time.

By acting on these recommendations, Albanian universities and other institutions in similar contexts can address key barriers, enhance the benefits of immersive learning, and ensure that Metaverse technologies contribute to more inclusive, engaging, and future-ready educational environments.

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