

EXPLORING STUDENTS' READINESS FOR METAVERSE INTEGRATION IN EDUCATION: A TECHNOLOGY ACCEPTANCE AND BEHAVIORAL INTENTION PERSPECTIVE

Saima Mehboob¹; Alberto Fornasari²

¹Phd student, Department of Educational Sciences, Psychology, Communication, University of Bari Aldo Moro, Italy

²Associate Professor of Experimental Pedagogy, Department of Educational Sciences, Psychology, Communication, University of Bari Aldo Moro, Italy

ARTICLE INFO	ABSTRACT
<p>Article History:</p> <p>Received 15.09.2025 Accepted 15.12.2025 Published 10.03.2026</p> <p>Keywords:</p> <p>Metaverse, Augmented Reality (AR), Virtual Reality (VR), Technology Acceptance Model (TAM), Student Readiness</p>	<p><i>The rapid development of immersive technologies, particularly Augmented Reality (AR) and Virtual Reality (VR), has positioned the metaverse as a potential tool to transform teaching and learning. This study investigates university students' readiness to adopt metaverse platforms in education, focusing on technological self-efficacy, perceived usefulness, perceived ease of use, attitudes, and behavioral intentions. A quantitative, cross-sectional design was employed using a stratified random sample of 246 students. Data were collected via an online questionnaire adapted from the Technology Acceptance Model (TAM) and Theory of Planned Behavior (TPB), with high reliability across all constructs (Cronbach's $\alpha > .85$).</i></p> <p><i>Results show that students describe their technological self-efficacy as above neutral ($M = 4.98, p < .001$) but saw metaverse tools as being useful ($M = 4.35$), although experience with AR/VR was low ($M = 2.96$). Correlational analysis demonstrated a significant positive relationship between technology self-efficacy, perceived usefulness, and ease of use ($r = .686-.774, p < .001$). Multiple regression analysis revealed that attitudes ($\beta = .726, p < .001$) and perceived behavior control ($\beta = .278, p < .001$) were significant predictors of behavioral intention, accounting for 83.8% variance ($R^2 = .838$). These findings indicate that it is essential to build a positive attitude and digital confidence for an effective metaverse application in education.</i></p> <p><i>The Paper contributes to the emerging discussion around AR/VR in higher education by identifying a readiness gap, especially in terms of (limited) hands-on experience with immersive technology, and by underscoring how attitudes and perceived control in students mould the adoption. The practical implications are that digital literacy programs need to be structured, AR/VR resources made available, and institutional strategies need to encompass inclusivity to ensure equitable access to metaverse-enhanced learning</i></p>

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1. Introduction

The rapid rise of digital technologies has revolutionized education by promoting e-learning platforms, artificial intelligence, augmented reality (AR), and virtual reality (VR). One of the most recent and arguably groundbreaking concepts is the metaverse, a shared online universe where people can interact with computer-generated worlds and other users using avatars in real-time. Though its first advent was in gaming and social avenues, the idea of the metaverse is catching on as a way to make education more engaging, interactive and collaborative for students and teachers.

Institutions around the world are testing metaverse platforms for simulations, virtual labs, and global collaboration. Yet successful adoption is determined not only by technological capability, but also, and potentially more importantly, by its current primary users, teachers, and students. Research interests are also rapidly increasing, with the main application areas of AR and VR (Chamola et al., 2025). Educational Metaverse has developed through generations, yet there is an identified gap in research on lifelogging applications, as well as given little attention to mobile, hybrid, and micro learning (Tlili et al., 2022).

However, it also means challenges. Immersive applications, Metaverse, can improve the motivations, abilities, and learning outcomes of the students, yet higher education must keep in mind the possible blunders, such as privacy invasion and addiction (Camilleri, 2023). Digital self-efficacy is associated with positive academic achievement, since students are better able to use digital resources and cope with learning activities with confidence due to the increased self-efficacy (Iraola-Real et al., 2023). Training on digital self-efficacy may decrease hopelessness and anxiety and improve the general self-efficacy of stressed university students (Rohde et al., 2024). Digital self-efficacy bridges the gap between digital skills and academic or professional performance, enabling time management, resilience, and adaptability in a digital environment (Galindo-Domínguez & Bezanilla, 2021).

Technology acceptance is the most popular study framework that deals mainly with technology in education. It emphasizes two concepts, which include perceived usefulness (how useful something is to an individual) and perceived ease of use (how easy it is to use) (Granić, 2022)(Rosli et al., 2022)(Sukendro et al., 2020). E-learning, m-learning (mobile learning), learning management systems (LMS), video conferencing, AR/VR, blockchain, and the metaverse have all been investigated regarding technology acceptance (Chahal & Rani, 2022)(Alsharida et al., 2021).

Usefulness perception, conceptualized as the extent to which a technology is believed to improve performance or learning, regularly emerges as the most important determinant of intention to use educational technologies such as e-learning, mobile learning and video conferencing tools (Lei et al., 2022),(Humida et al., 2022). It determines the perception of users towards technology, satisfaction, and their persistence in using the same. As an instance, satisfaction of students on online distance learning and well-being in the classroom is directly correlated with the degree to which students find the technology useful to them (Hashim et al., 2023)(Gashi et al., 2024).

VR, AR, mixed reality, and lifelogging are the most familiar metaverse tools in education. They can be employed in simulations, virtual labs, collaborative problem solving, language learning, and even meeting the needs of students with autism or special needs (Samala

et al., 2023)(Zhang et al., 2022). The positive student attitude towards technology (determined by perceived usefulness, perceived ease of use, and enjoyment of technology) highly affects student intention in adoption and use of educational technology (Patricia Aguilera-Hermida, 2020). The influence of peers and the workplace encouragement of the instructors and the institutional policy play an important role in the development of attitudes and intentions. Social influence becomes an issue in teamwork or culturally collectivist situations (Al-Adwan & Al-Debei, 2024).

1.1 Problem Statement

Although there is a rise in interest in the metaverse, there is a paucity of empirical evidence on the readiness of the profession in general and students in particular to adopt the metaverse as a learning technology. Several institutions face challenges, including gaps in digital literacy, limited access to immersive hardware, and concerns regarding pedagogical integration. Arguably, students may have a better awareness of online platforms, but teachers may experience the steepest hurdles regarding both pedagogical and technological issues. It is therefore important to understand these dynamics if the metaverse is to be used in an effective and more inclusive way in educational contexts.

1.2 Purpose of the Study

This study aims to measure student readiness for the introduction of metaverse technology in education, and specifically focuses on perception, digital skills, and access as determining factors. With the stratified random sampling representing students and teachers of all disciplines, statistical analysis tools are used to analyze differences in readiness among groups and readiness for this digital change.

1.3 Objective of the Study

1. To examine the technological competence and self-efficacy of students in using digital and metaverse technologies.
2. To compare students' perceptions of the usefulness and ease of use of metaverse platforms in an educational context.
3. To assess students' attitudes and behavioral intentions regarding the adoption of the metaverse in education.

1.4 Research Questions

1. What is the level of technological self-efficacy among students concerning the use of digital and Metaverse Technologies?
2. How do students perceive the usefulness and ease of use of the metaverse in an educational context?
3. What are the prevailing attitudes and behavioral intentions among students regarding the adoption of the Metaverse for teaching and learning?

1.5 Research Model

Based on the Technology Acceptance Model (TAM) (Greener, 2022) and Theory of Planned Behavior (TPB), an extended model is proposed to explore the factors that influence students' readiness to adopt the metaverse for educational purposes (Bosnjak et al., 2020). It

includes core acceptance factors: self-efficacy, perceived usefulness, ease of use, attitude, and behavioral intentions.

Initially, consistent with TAM, Technological Self-Efficacy (TSE) is hypothesized to positively affect Perceived Ease of Use (PEOU) and Perceived Usefulness (PU) because students who feel more confident in their digital skills will tend to find the metaverse easier and more useful. PEOU is also expected to have a positive impact on PU and students' ATT towards the metaverse (Al Shamsi et al., 2022). PU is also supposed to affect ATT, suggesting that metaverse adoption would improve both performance and perceived learning value.

The rise of the metaverse (boosted by AR/VR) as a game-changing educational tool that takes engagement and collaboration to the next level. It recognises issues such as digital literacy disparities and privacy concerns, while highlighting the importance of examining student readiness in terms of perceptions, self-efficacy, and acceptance, all of which are embedded within the TAM/TPB lens.

2. Method and Materials

2.1 Research Design

The study employed a cross-sectional survey design to capture students' perceptions and readiness regarding metaverse technology at one point in time ("Cross-Sectional Design," 2020)("Cross-Sectional Research Design," 2021), which allowed for measuring data related to the metaverse as well as the perceptions and readiness of students regarding the metaverse at a specific moment in time. It allows measurement of perceptions and readiness at a snapshot in time. The research instrument was a structured questionnaire (Mailizar et al., 2021). This design is compliant with the well-recognized survey research methodology for studying technology acceptance in institutions. The design has made it possible to subject the subgroups to statistical comparisons and testing of the hypothesized relationships between important constructs (e.g., self-efficacy, perceived usefulness, etc.) and have an objective and standardized administration of the survey.

2.2 Participants and Sampling

The sample of the study was stratified random sampling (Ahmad et al., 2024), in which the participants were University of Bari students from different disciplines in the year 2024, from undergraduate to PhDs. A total of 246 students (excluding incomplete responses) participated in the survey. Stratification ensured that there was a proportionate representation of the important subgroups of the student population made available in the sample (Steen et al., 2024).

2.3 Instrument

The questionnaire measured technological self-efficacy, perceived usefulness, perceived ease of use, attitude toward the metaverse, and behavioral intention. Measures TAM items were adapted from existing scales, i.e., usefulness and ease of use (Davis, 1989; Mailizar et al., 2021), self-efficacy items (Compeau & Higgins, 1995), and prior studies using TAM/TPB for behavior and attitude intention. All items were measured by a 7-point Likert scale and each variable consists of 7 items (1 = Strongly Disagree, 7 = Strongly Agree), and higher scores

indicate more confidence, perceived value, ease, or positive attitudes toward the metaverse competence. This guaranteed content validity and comparability with previous research.

2.4 Procedure

Online data were collected using Google Forms, and students were invited via email to log in with the link. This enabled participants to complete the survey at their convenience and on multiple types of devices. The decision to use Google Forms was made because of its accessibility and relative efficiency for data collection (Padak et al., 2025). It has been observed that this platform is very simple in use and effective in academic survey studies (Fitria, 2023). When the survey was closed, the responses were downloaded and subjected to a screen check for completeness and attention (e.g., by eliminating any cases that might have too much missing data).

2.5 Data Analysis and Discussion

The descriptive statistics (means, standard deviations, and frequencies) were applied to the data, followed by inferential testing. Independent and one-sample t-tests were used to compare groups and ANOVA for intergroup differences. Later, multiple regression determined the impact of self-efficacy, usefulness, and ease of use on attitude and intention as per TAM/TPB. Reliability An internal consistency estimate for the self-efficacy scale was computed with Cronbach's $\alpha = .755$), confirming measurement validity.

Table 1- Descriptive Statistics Summary for Metaverse Study

Item	M	SD	N
Confidence in using digital devices	4.96	1.76	246
Capability to learn new digital tech	4.74	1.75	245
Solving technical problems	4.11	1.73	245
Experience with VR/AR	2.96	1.82	245
Adapting to software/hardware updates	4.24	1.75	244
Skills to use metaverse effectively	4.08	1.83	243
Confidence customizing digital tools	4.06	1.72	243
Metaverse enhances social interaction	4.34	1.81	244
Metaverse improves professional activity	4.49	1.68	244
Metaverse enhances quality of life	4.01	1.66	241
Intend to use metaverse in future	4.17	1.69	242
Recommend Metaverse to others	4.38	1.64	242
Control over metaverse use	4.26	1.68	243
Confidence despite tech difficulties	4.05	1.59	243
No problem using metaverse even if learning	4.21	1.67	241
Access to resources for metaverse	4.52	1.80	242
Capable of overcoming metaverse obstacles	4.04	1.59	241
Metaverse fits lifestyle	3.92	1.64	243
Autonomy over metaverse use	4.52	1.74	242

Source: own elaboration

2.5.1 Technological self-efficacy among students concerning the use of digital and metaverse technologies

The t-test results indicated that students had a high level of digital self-efficacy in general ($M \approx 4.87$, $p < .001$) and neutral confidence for technical problem-solving ($M = 4.11$, $p = .318$). VR/AR experience was limited ($M = 2.96$, $p < .001$).

Table 2- One-Sample T-Test Results for Technological Self-Efficacy

Item	M	t	p	Interpretation
Confidence in using digital devices	4.98	8.79	< .001	Significant
Capability to learn new technologies	4.76	6.82	< .001	Significant
Solving technical problems	4.11	1.00	.318	Not Significant
Experience with VR/AR	2.96	-8.94	< .001	Significant

Source: own elaboration

2.5.2 Descriptive statistics of the perceived usefulness and Ease of Use

The participants found the metaverse to be moderately useful ($M = 4.14-4.49$), but somewhat easy to use ($M = 3.90-4.26$). There was strongly correlation between higher digital self-efficacy and higher perceived usefulness ($r = .686$ to $.774$, $p < .001$).

Table 3- Pearson Correlation Matrix

	1	2	3
1. Technological Self-Efficacy	—	.686***	.710***
2. Perceived Usefulness	.686***	—	.774***
3. Perceived Ease of Use	.710***	.774***	—

Source: own elaboration

2.5.2 Perceived usefulness and perceived ease of use of the metaverse with the students

The statistical test conducted showed that there was statistically significant variance between the two constructs, $t(241) = 3.76$, $p < .001$. The mean score obtained on perceived usefulness ($M = 4.35$) was more than that of perceived ease of use ($M = 4.11$), which was significant. It might imply that, although students tend to think that the metaverse is a good (valuable) thing, there might be a bit more challenge to understand how to use it.

Table 4 - Paired-Samples T-Test Results

Variables	M	SD	t	p
Perceived Usefulness vs. Ease of Use	4.35 vs. 4.11	—	3.76	< .001

Source: own elaboration

Table 5 - Descriptive Statistics for Attitude and Perceived Behavioral Control

Item	Mean (M)	Standard Deviation (SD)
I have a positive attitude toward using the metaverse.	4.26	1.65
I feel excited about the possibilities and potential of the metaverse.	4.34	1.61
I am willing to explore the metaverse to its fullest extent.	4.44	1.67
I believe that engaging with the metaverse will enhance my quality of life.	4.03	1.67

I believe I have sufficient control over my decision to use the metaverse.	4.26	1.68
I feel confident that I can use the metaverse even if there are technical difficulties.	4.05	1.59
I think that using the metaverse would not be problematic for me, even if it requires learning new skills.	4.21	1.67
I have access to the necessary resources (e.g., hardware, internet connection) to use the metaverse effectively.	4.52	1.80
I feel capable of overcoming any obstacles to use the metaverse regularly.	4.04	1.59
I think that using the metaverse fits well with my current lifestyle and routines.	3.92	1.64
I have the autonomy to decide when and how to use the metaverse.	4.52	1.74

Source: own elaboration

2.5.3 Attitude Toward the Metaverse and Behavioral Control

Both the Attitude ($\alpha = .931$) Perceived Behavioral Control ($\alpha = .941$) scales showed good internal consistency and high positive correlation ($r = .874$, $p < .001$). Results: Regression analysis was applied to test the hypotheses. H1 and H2 were supported. Significant predictors of behavioral intention are attitude ($\beta = .73$) and perception of control ($\beta = .28$), jointly accounting for 83.8% of its variance ($R^2 = .838$). It adds strong evidence in support of the Theory of Planned Behavior, with attitude as the highest determinant of adoption intention.

Table 6- OLS Regression Predicting Behavioral Intention

Predictor	B	SE B	t	p	95% CI
Attitude	0.73	0.06	12.80	< .001	[0.61, 0.84]
Perceived Behavioral Control	0.28	0.06	4.71	< .001	[0.16, 0.39]

Source: own elaboration

Reliability and mean values of important constructs: technological self-efficacy, ease of use, usefulness, attitude, and behavioral intention are presented in Figure 1. Cronbach's alpha exceeded for all the scales from 0.89 to 0.92, above the .70 thresholds. Average ratings ($\approx 4.1-4.3$) imply that students were digitally confident, perceived the metaverse as useful and ease to use, and their intention to adopt it was positive.

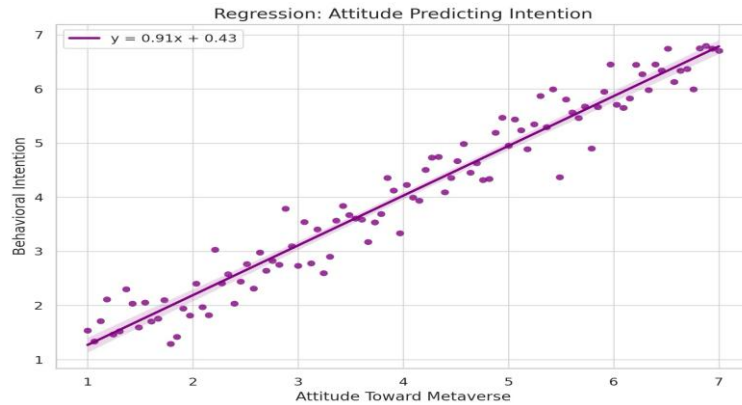
Figure 1: Combined reliability (Cronbach's α) and mean scores across five key constructs.



Source: Author's own elaboration using Python (2025)

Figure 2 depicts a simple linear regression of attitude towards the metaverse predicting behavior intention. The scatterplot plots a highly positive relationship: the higher the attitude goes, the stronger the intention becomes ($R^2 = .838$, $p < .001$). The tightness of the fit for data points indicates attitude is a major predictor and is congruent with the Theory of Planned Behavior, emphasizing cultivating positive perceptions to facilitate metaverse acceptance.

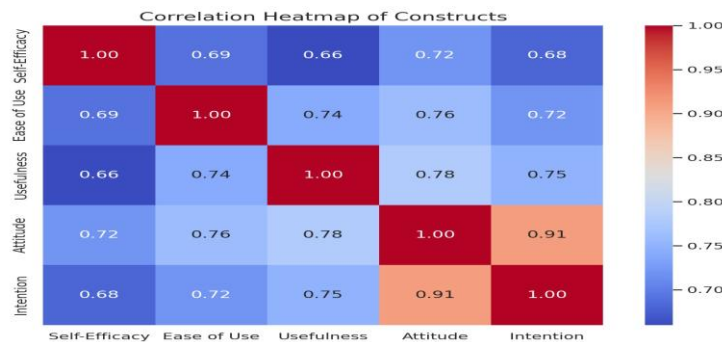
Figure 2: Scatterplot with regression line showing Attitude predicting Behavioral Intention.



Source: Author's own elaboration using Python (2025)

The findings supported robust and positive associations among all the constructs ($r = 0.66-0.91$). Attitude was the strongest correlate of intention ($r = 0.91$), making it the central adoption factor. The relationships between self-efficacy, perceived ease of use, and perceived usefulness may explain the sources of support for the TAM/TPB framework and clarify digital confidence in shaping beneficial utility beliefs, attitudes, and acceptance.

Figure 3: Correlation heatmap of Technological Self-Efficacy, Ease of Use, Usefulness, Attitude, and Intention.



Source: Author's own elaboration using Python (2025)

4. Conclusion

This research explored students' readiness to accept metaverse technology in education by using TAM and BI models. The results reveal that perceived technological self-efficacy affects perceived ease of use, perceived usefulness, and attitude towards using. This study found that students were confident about their digital skills and perceived the metaverse as educationally useful. Attitude had the most powerful effect on behavioral intention and

perceived behavioral control, which also accounted for 84% of the variance. Attitude was the highest predictor for BI, followed by PBC, and accounted for 84% of the variance. These results assert that cultivating a positive attitude is fundamental to promoting the adoption, and ease of use and usefulness are pivotal in the promotion.

The study did not include teachers, whose views are important regarding both pedagogy and technical challenges. The next research step is to involve the teachers and conduct longitudinal or intervention designs to gain knowledge of sustained engagement and real usage. Tactically, universities need to invest in digital literacy, train for immersive technologies, and introduce small pilot experiences to reduce barriers. With deliberate application, colleges and universities can use the metaverse as a powerful agent of positive change to facilitate inclusive and design effective pedagogy.

5. Future direction of the Study

Future study needs to extend beyond students to teachers and adopt a longitudinal design so real adoption could be traced. There needs to be a move in research from intention-based investigation to the study of pedagogical integration and learning outcomes, as the authors have begun to do with their avatar-based storytelling design experiment.

6. Challenges of the Study

Study confined to a single university, absence of teacher views. A cross-sectional design prevents causal claims. Beliefs about attitudes and subjective norms do not predict behavioral intentions if they are based on self-reported intentions. Students had limited VR/AR exposure, which may have tainted the perception. Concrete challenges like cost and access in the real world were not fully delved into.

7. Acknowledgement

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