Ditching the blackboard: The top factors driving teachers' embrace of the Metaverse in Moroccan schools

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Abstract: *The factors influencing Moroccan teachers' adoption of Metaverse technologies in educational settings were investigated in this quantitative study, focusing on perceived benefits, readiness, and satisfaction. Using a regression analysis, significant predictors were identified across three dimensions. Gender, with male teachers perceiving greater benefits ($\beta = .367$, $p < .001$), along with teaching experience ($\beta = .764$, $p = .001$), positively influenced perceived benefits. However, teachers in public schools ($\beta = -.355$, $p < .001$) and rural areas ($\beta = -.449$, $p < .001$) were less likely to perceive Metaverse technologies as beneficial. Readiness for adoption was also lower among public school teachers ($\beta = -.516$, $p < .001$) and those in rural areas ($\beta = -.274$, $p = .001$). Satisfaction with Metaverse technologies was significantly higher among teachers with computer training ($\beta = .494$, $p < .001$) but lower for male teachers ($\beta = -.488$, $p < .001$). These findings highlight the importance of addressing infrastructural disparities and providing targeted professional development to ensure widespread Metaverse adoption in Moroccan schools. Limitations include the study's reliance on self-reported data and its cross-sectional design. Future research should explore longitudinal trends and comparative studies across different regions to better understand the broader impact of Metaverse integration in education.*

Keywords: Education, Metaverse, Moroccan teachers, Virtual reality.

1. Introduction

The rapid advancement of information and communication technologies has ushered in a new era in educational practices, epitomized by the emergence of the Metaverse and virtual reality (VR) as transformative tools in teaching and learning. These technologies are increasingly recognized for their potential to revolutionize education by enhancing student engagement, facilitating immersive learning experiences, and reducing the costs associated with traditional educational infrastructure (Çengel & Yildiz, 2022; Creed et al., 2023; Lucia, Vetter & Solberg, 2023). Indeed, virtual reality platforms, through integrating theory with practice and enabling active student participation, overcome the limitations of conventional online and remote classrooms (Çengel & Yildiz, 2022). Moreover, they offer safe and cost-effective alternatives to physical laboratories and specialized classrooms, while also ensuring holistic learning through visual, auditory, and kinesthetic

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support (Adelana et al., 2023; Hervás-Gómez, Toledo-Morales & Díaz-Noguera, 2017; Lham, Jurmey & Tshering, 2020; Romano et al., 2023).

Given these transformative potentials, it becomes crucial to understand the factors that influence teachers' adoption and use of this technology, particularly in Moroccan schools where research on this subject remains scarce (Assimi et al., 2023). This study seeks to evaluate Moroccan teachers' motivations to adopt the Metaverse by examining three key dimensions: readiness, perceived benefits, and satisfaction (Çengel & Yildiz, 2022). The importance of researching this topic is underscored by the rapid technological advancements and the growing prominence of the Metaverse. However, despite the global momentum, there is a notable gap in the literature concerning the adoption of these technologies in Morocco, which this study aims to address. By exploring the factors motivating Moroccan teachers to embrace the Metaverse, this research will not only contribute to filling this gap but also provide insights that can inform teacher training and competency development, ensuring that educators are well-prepared to leverage these emerging technologies in various educational settings.

This research will make several contributions to the field of education. Firstly, it will provide a broader understanding of the motivations and challenges Moroccan teachers face in adopting the Metaverse, offering valuable insights into the factors that influence the acceptance of these technologies in the classroom. Secondly, it will assess the critical elements that should be prioritized in teacher training programs to facilitate the effective adoption of these technologies. Finally, by addressing a topic that is rarely explored in the Moroccan context, this study will pave the way for future research and policy development aimed at integrating VR and the Metaverse into the country's educational system.

The structure of this article is organized as follows: it begins with a comprehensive review of the literature, followed by a methodology section that outlines the development of the study and the research methods employed. The subsequent section presents the findings and results of the data analysis, leading into a discussion of the research implications. Finally, the article concludes with an examination of the study's limitations and suggestions for future research avenues.

2. Literature review

The integration of VR, augmented reality (AR), and Metaverse technologies in educational settings has garnered substantial attention from researchers, particularly concerning teachers' motivations and the factors influencing their adoption of these innovative tools. As a case in point, Adelana et al. (2023) investigates the attitudes of pre-service teachers towards VR, highlighting that positive attitudes and perceived ease of use are significant motivators for adoption. The study emphasizes that when teachers perceive VR as user-friendly and beneficial to their teaching practices, they are more likely to integrate it into their pedagogical strategies. Similarly, Hervás-Gómez et al. (2017) too, argues that

familiarity with the technology and its pedagogical potential significantly influence teachers' willingness to adopt AR in their classrooms. Moreover, the work of Lham et al. (2020) focuses on the importance of training in that it enhances teachers' confidence in using VR but also increases their awareness of the educational benefits that such technology can offer, thereby fostering a greater willingness to adopt it. In a related vein, Assimi et al. (2023) examine the impact of cultural and contextual factors on teachers' adoption of the Metaverse in Morocco, noting that teachers who perceive a strong alignment between their cultural values and the technological affordances of the Metaverse are more inclined to embrace it in their day to day teaching practices.

Jang et al. (2021) contribute to this discourse by exploring teachers' willingness to adopt AR. The authors highlight that teachers are more motivated to use AR when they recognize its ability to create immersive and interactive learning experiences that are not possible with traditional teaching methods. Similarly, Yilmaz and Coskun Simsek (2023) too, argue that perceived usefulness and ease of use are important in the adoption of VR, finding that these factors significantly contribute to teachers' acceptance of the technology as a valuable educational tool. Wang and Li (2024) on the other hand highlight the importance of institutional support in motivating teachers to adopt VR and Metaverse technologies. They argue that teachers who receive strong support from their institutions, including access to resources and technical assistance, are more likely to integrate these technologies into their classrooms. In addition, Alalwan et al. (2020) note that while many teachers are enthusiastic about the potential of VR, factors such as lack of training, limited access to resources, and concerns about the technology's complexity can hinder adoption to large extents. In relation to adoption of VR, many authors contend that when teachers perceive these tools as effective in enhancing student learning outcomes, they are more likely to integrate them into their teaching (Parsons & MacCallum, 2020; Lee & Hwang, 2022; Al Breiki et al., 2023; AlGerafi et al., 2023; Romano et al., 2023; Silva-Díaz et al., 2023; Thohir et al., 2023; Ogegbo et al., 2024). Mystakidis and Christopoulos (2022) too, explore K-12 teachers' perceptions of the Metaverse, finding that teachers who are open to experimenting with new technologies and who perceive the Metaverse as a valuable educational tool are more likely to adopt it in their teaching.

The study by Álvarez et al. (2024) evaluates the use of VR in language teaching, highlighting that teachers are more motivated to adopt VR when they perceive it as a tool that can enhance students' language learning experiences. Di Natale et al. (2024) on the other hand explore students' perceptions of VR, noting that teachers are more likely to adopt VR when they observe that students are enthusiastic and motivated to engage with the technology. On a similar note, Ateş and Kölemen (2024) explore the factors influencing teachers' adoption of VR in science education, arguing that teachers are more likely to adopt VR when they perceive it as a tool that can enhance students' understanding of complex scientific concepts.

To conclude this review of the literature on VR, AR and Metaverse

integration and adoption in educational settings, it is important to note that there are a variety of factors that influence teachers' motivations, they include perceived ease of use, perceived usefulness, access to training and resources, institutional support, cultural and contextual alignment, and the observed impact on student engagement and learning outcomes.

3. Methodology

The study at hand uses a quantitative methodology in order to collect and analyze gathered data from participants. It is cross-sectional in terms of research design (Bryman, 2012) meant to record gathered data at a certain point in time and analyze and explore variables between certain demographics and the three dimensions of the adopted scale, which are: perceived benefit, readiness, and satisfaction. Additionally, the study adopts a correlational approach, examining the associations between technology adoption and various work-related factors, thereby enabling an understanding of how changes in one variable might be linked to changes in another.

3.1 Sampling procedure

Participants in this study consisted of 166 teachers from private and public schools within the Fez-Meknes region of Morocco. The sample was recruited using a combination of snowball and purposive sampling techniques (Bryman, 2012). Snowball sampling facilitated the expansion of the participant pool, while purposive sampling ensured that the sample included individuals who met specific criteria relevant to the study – namely, teachers who are proficient in English and who work within the targeted educational settings. Participants were located via social media platforms such as Facebook, and recruitment was conducted through digital communication tools including Facebook Messenger, email, and WhatsApp. Despite extensive outreach, only 166 individuals responded to the survey out of the several hundred requests sent.

3.2 Questionnaire development

The study adopted the “Teachers' Attitude Scale Towards Metaverse Use” developed by Çengel and Yildiz (2022). The scale was originally developed in Turkey, a country with social and economic contexts relatively similar to Morocco, making it suitable for adaptation in this study. The questionnaire was adapted minimally, with the addition of demographic questions to enhance the understanding of the target population. Since all participants were proficient in English, because of this language proficiency from participants, the scale did not require any translation and was kept as is. Pilot testing of the adapted scale via Google Forms revealed no issues, confirming the scale’s appropriateness for the study.

3.3 Ethical considerations

Participants were required to read and agree to a consent statement before completing the questionnaire. This statement provided detailed information about the research objectives, the nature of the Metaverse, and assurances of participant anonymity. To maintain confidentiality, personal details such as email addresses and IP addresses were omitted from the data collection process.

3.4 Data collection procedures

Data were collected using a structured online questionnaire distributed through Google Forms. The questionnaire was shared with participants via Facebook Messenger, email, and WhatsApp, ensuring accessibility and convenience. The response rate was modest, with 166 teachers completing the survey.

3.5 Data analysis

Upon collection, the data were imported into Microsoft Excel for initial coding and cleaning, ensuring that the dataset was free of missing or inconsistent values. Descriptive statistics, including means, medians, and standard deviations, were calculated. Subsequently, the data were analyzed using IBM SPSS 27, employing Multiple Regression analyses to explore the relationships between the variables.

3.6 Validity and reliability

The reliability of the scale was assessed through Cronbach's alpha scores, which indicated varying levels of internal consistency across the three dimensions: perceived benefit (which has a score of $\alpha = .963$), readiness (with a score of $\alpha = .644$), and lastly, satisfaction (which has a score of $\alpha = .776$). These scores demonstrate that the scale exhibits satisfactory reliability for the purposes of this study. The validity of the adapted scale was further supported by the pilot testing results, which confirmed that the scale maintained its integrity and relevance within the Moroccan educational context.

4. Findings

4.1 Descriptive statistics

The majority of participants in the study fall within the age group of 26, representing 33.7% of the sample. Other significant age groups include those aged 29 (14.5%) and 46 (8.4%). The younger age groups, such as 22, 23, and 25, represent a smaller portion of the sample, making up less than 5% each. Participants aged 48, 28, 41, and 42 are evenly distributed, each accounting for around 3.6% of the total. The distribution shows a diverse range of ages, with a skew towards participants in their mid-20s to early 30s. The gender distribution is nearly balanced, with a slight majority of female participants (53.0%) compared to male participants (47.0%). This indicates a well-represented sample of both

genders. The majority of participants (63.9%) teach in public schools, while 36.1% are employed in private institutions. This distribution highlights that public school teachers form the dominant group in the study, reflecting the prevalence of public education institutions in Morocco. Most participants are based in urban areas, with 77.7% teaching in urban schools and only 22.3% teaching in rural locations. This suggests that the findings related to the adoption of Metaverse technology may be more reflective of experiences in urban settings, where access to technology might be more prevalent. A significant portion of participants have been teaching for 2 years (27.1%), followed by those with 1 year (12%) and those with 23 years (8.4%). The data reveals a mix of early-career teachers and more experienced educators, offering insights into how teaching experience may influence the adoption of new technologies like the Metaverse. More than half of the participants (54.2%) have not taken any computer education or training, while 45.8% have received such training. This suggests that a considerable number of teachers may need further digital literacy support for the effective adoption of the Metaverse in education. A large majority of participants (71.7%) have not developed any digital materials for their teaching, while only 28.3% have done so. This finding indicates that the development of digital teaching resources is still limited, which could impact the integration of advanced technologies like the Metaverse into classrooms. A significant majority of participants (76.5%) reported using digital materials in their lessons, while 23.5% do not incorporate digital materials into their teaching. This indicates a high level of digital material integration among the teachers, suggesting that the use of technology in classrooms is already prevalent, which could facilitate the adoption of more advanced technologies such as the Metaverse in education.

4.2 Inferential statistics

Perceived benefit dimension

The regression analysis shows several significant predictors of teachers' perceived benefit of Metaverse adoption in Moroccan schools. Gender has a significant positive effect ($\beta = .367$, $p < .001$), in the sense that male teachers tend to perceive more benefits from the Metaverse. Conversely, Private/Public Teaching ($\beta = -.355$, $p < .001$) and Rural/Urban location ($\beta = -.449$, $p < .001$) negatively affect perceived benefits, indicating that teachers in public schools and rural areas are less likely to see the Metaverse as beneficial. Years of teaching ($\beta = .764$, $p = .001$) positively influences perceived benefit, suggesting that more experienced teachers are more receptive. Additionally, using digital materials negatively correlates ($\beta = -.243$, $p < .001$), as does having developed digital materials ($\beta = -.206$, $p = .001$), possibly reflecting resistance or challenges with existing digital tools. Other variables like age and computer education are not significant.

Readiness dimension

The regression analysis highlights several significant predictors of Readiness to adopt Metaverse technology. Teaching in a public school is negatively associated with readiness ($\beta = -0.516$, $p < 0.001$), indicating that public school teachers are less ready compared to their private school counterparts. Similarly, teaching in rural locations ($\beta = -0.274$, $p = 0.001$) and not using digital materials in lessons ($\beta = -0.262$, $p = 0.001$) are both significant negative predictors, suggesting that teachers in urban areas and those who already use digital materials are more prepared for Metaverse adoption. Other variables like age, gender, and computer education were not significant predictors.

Satisfaction dimension

The regression results reveal several significant predictors of satisfaction with Metaverse adoption among Moroccan teachers. Gender ($\beta = -.488$, $p < .001$) shows that male teachers are less satisfied compared to female teachers. Teachers in public schools ($\beta = -.370$, $p < .001$) and rural areas ($\beta = -.224$, $p = .001$) report lower satisfaction with Metaverse use. However, having computer education ($\beta = .494$, $p < .001$) significantly increases satisfaction. Interestingly, using digital materials in lessons negatively correlates with satisfaction ($\beta = -.264$, $p < .001$), while teachers who have developed their own digital materials show a small positive effect on satisfaction ($\beta = .145$, $p = .033$). Other variables, such as age and years of teaching, are not significant.

5. Discussion

The findings from this study reveal several significant factors that influence Moroccan teachers' perceived benefits, readiness, and satisfaction with the adoption of Metaverse technologies thus offering important factors in the adoption of this technology in teaching environments. These results align with existing literature, while also offering unique insights into the context of Moroccan schools.

Perceived benefit dimension

Gender emerged as a significant predictor, with male teachers perceiving greater benefits from Metaverse adoption compared to their female counterparts. This finding contrasts with earlier studies that often report no significant gender differences in technology adoption.(Jang et al., 2021; Romano et al., 2023) However, it may reflect a unique cultural context in Morocco or differing levels of access and exposure to technology between male and female teachers.

Private school teachers and those in urban areas were more likely to perceive the benefits of the Metaverse, aligning with Wang and Li's (2024) research, which highlighted that teachers in resource-rich environments are more inclined to adopt new technologies. In contrast, rural teachers and those in public schools may face more barriers, such as limited infrastructure and technological resources.(Alalwan

et al., 2020) Years of teaching experience positively influenced perceived benefit, echoing the findings of Adelana et al. (2023), who found that experienced educators tend to appreciate the pedagogical potential of new technologies.

Interestingly, the negative relationship between using and developing digital materials and perceived benefit suggests that teachers already utilizing digital tools may view the Metaverse as redundant or challenging to integrate into their existing practices. This supports Hervás-Gómez et al.'s (2017) argument that familiarity with digital technologies can create resistance to adopting new tools, as teachers may feel overburdened or skeptical of their added value.

Readiness dimension

The readiness to adopt the Metaverse was significantly lower among teachers in public schools and rural areas, a pattern that mirrors the findings of Lham et al. (2020), who emphasized the importance of institutional support and resource availability in motivating teachers to embrace technology. Teachers in urban areas, often with better access to technological resources, were more prepared for Metaverse adoption which also reinforces Parsons and MacCallum's (2020) conclusion that teachers are more likely to adopt new technologies when they find them easy to integrate into their current teaching environments.

Notably, the lack of significant results for variables such as age, gender, and computer education suggests that these factors may play a secondary role in determining readiness. Instead, the environmental and institutional context appears to be more critical, underscoring the importance of access to resources and infrastructure.(Silva-Díaz et al., 2023)

Satisfaction dimension

Satisfaction with Metaverse adoption was significantly higher among female teachers, public school teachers, and those with computer education, paralleling the work of Di Natale et al. (2024), who found that prior technological training enhances satisfaction with new digital tools. This suggests that adequate training and support play a crucial role in fostering satisfaction, regardless of school type or location. The negative association between satisfaction and the use of digital materials, similar to the results for the Perceived Benefit dimension, may indicate that teachers already comfortable with digital tools find the Metaverse challenging or unnecessary. Al Breiki et al. (2023) similarly observed that teachers who are already proficient in certain digital tools are more cautious about adopting newer technologies, often due to concerns about complexity or redundancy.

5. Conclusions

This study is an attempt to provide insights into the factors influencing Moroccan teachers' adoption of Metaverse technologies in education, particularly in relation to perceived benefits, readiness, and satisfaction. The findings indicate

that gender, institutional context, and prior technological experience significantly impact teachers' perceptions of Metaverse use. Male teachers, those with more years of teaching experience, and teachers in private or urban schools were more likely to perceive the Metaverse as beneficial, while rural and public school teachers expressed lower readiness and satisfaction, to add more, teachers already using digital materials appeared less enthusiastic about integrating the Metaverse, possibly due to concerns about redundancy or added complexity. These results align with existing literature on technology adoption in educational settings but also shed light on the unique challenges within the Moroccan context.

Despite the valuable insights offered by this study, several limitations must be acknowledged. First, the sample is limited to Moroccan teachers, which may restrict the generalizability of the findings to other countries or regions, it is important to note that in this regard, cultural and infrastructural differences may lead to different adoption patterns in other educational contexts. Second, the study relies on self-reported data, which may pose the risk of greater response biases, such as social desirability or self-perception issues. Third, while the study examines key demographic and professional factors, it does not account for other potential influences, such as the role of school leadership or administration and peer influence, which may also affect teachers' attitudes toward Metaverse adoption. Additionally, the cross-sectional nature of the study prevents us from drawing conclusions about the long-term impact of these attitudes on actual adoption and use of the Metaverse in classrooms.

Taking all these into account, future research should aim to address the limitations outlined above by expanding the scope of the study. As a case in point, longitudinal studies would be particularly valuable to track changes in teachers' attitudes toward the Metaverse over time and to observe whether perceived benefits, readiness, and satisfaction translate into sustained use in the classroom. Comparative studies across different countries or regions could also offer insights into how cultural and institutional factors influence Metaverse adoption. Finally, exploring the role of school leadership, peer influence, and specific professional development initiatives could provide a more comprehensive understanding of what drives positive and effective integration of the Metaverse in education.

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