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Scenarios to Implement Metaverse into the Saudi Educational System

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ABSTRACT

In recent years, technological advancements have profoundly reshaped various facets of daily life. An emerging innovation in this realm is the integration of the metaverse—a virtual reality space enabling immersive digital interactions—into language classrooms. This integration promises transformative opportunities for enhancing vocabulary learning through interactive and immersive experiences. However, the literature on metaverse integration in English language education remains underexplored, particularly regarding its implementation nuances and impacts. This paper reviews existing literature on metaverse technology in education, focusing on its potential to enhance vocabulary acquisition and the associated challenges in the Saudi educational system. Drawing insights from studies on virtual reality (VR), augmented reality (AR), and metaverse-based platforms like Minecraft and Roblox, the paper explores the pedagogical implications and technological affordances for English language classrooms. It also discusses the practical considerations and limitations of metaverse integration, highlighting the need for innovative strategies to optimize its educational benefits. By synthesizing current research, this paper aims to provide a comprehensive understanding of metaverse technology's role in English language education, offering five suggested scenarios for implementing Metaverse into the Saudi educational system giving insights for educators and policymakers to navigate its implementation effectively.

Keywords: Metaverse; Saudi educational system; Vocabulary learning; Augmented reality; Virtual reality; Immersive learning

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1. Introduction

In recent years, the vast improvement of technology has reshaped various aspects of our lives, especially now during the technological age in combination with the result of the pandemic Covid-19. The pandemic affects many sectors around the world, including the educational sector. The pandemic also reinforced the use of technology in the teaching-learning process. Language learning where using technology becomes a requirement. One area where technology plays a significant role is in enhancing vocabulary learning, as vocabulary is an essential part of language learning (Castillo-Cuesta, 2020). Prayogi and Wulandari (2021), stated that to master a language, learners need to have an adequate knowledge of the vocabulary, and technology offers them various activities and methods to improve their vocabulary knowledge. An interesting improvement is the integration of the metaverse in language learning. The metaverse refers to a virtual reality space where learners can interact with digital environments and engage in immersive experiences, by leveraging many tools and resources learners can now engage in immersive and interactive experiences that facilitate vocabulary learning (Onggirawan et al., 2023). Such as applying online learning platforms and applications. This integration of metaverse offers enormous potential for enhancing vocabulary learning. Therefore, educators must provide innovative and practical strategies with the use of metaverse to help students in their vocabulary learning.

This paper presents a literature review related to the integration of metaverse technology into English language classrooms. Beside its ability to enhance vocabulary learning and the types of vocabulary knowledge that can be used. As well as the factors that affect the implementation of the metaverse.

1.1 Educational system in Saudi Arabia

The Saudi educational system is overseen by the Ministry of Education and is structured into three main levels: primary, intermediate, and secondary education, followed by higher education. It places a strong emphasis on Islamic studies, Arabic language, and national culture, alongside science, mathematics, and other subjects. In recent years, the system has undergone significant reforms aimed at improving quality, expanding access, and incorporating technology

to meet the evolving needs of the country. These efforts align with Saudi Vision 2030, which seeks to modernize education, promote critical thinking, and equip students with skills for the global economy.

In the Saudi educational system, English is introduced as a compulsory subject starting from the fourth grade of primary school. Initially, the focus is on basic language skills such as vocabulary, grammar, and simple sentence construction. As students progress through intermediate and secondary levels, the English curriculum becomes more comprehensive, incorporating reading comprehension, writing, listening, and speaking skills.

At the secondary level, English education becomes more rigorous, with a stronger emphasis on academic and professional language skills. Students engage with more complex texts, practice critical analysis, and work on developing their fluency and accuracy in communication. English is also a core subject in many higher education institutions in Saudi Arabia, where it is often used as the medium of instruction for science, engineering, medicine, and business programs.

The teaching of English in Saudi Arabia has evolved significantly over the years, particularly with the government's push towards improving language proficiency to meet the demands of a globalized world. Efforts include updated curricula, teacher training programs, and the introduction of technology-enhanced learning tools. These initiatives aim to ensure that students are equipped with strong English language skills, which are essential for accessing higher education opportunities, participating in the global economy, and contributing to the country's development goals under Saudi Vision 2030.

Traditional teaching methods may struggle to engage students, leading to decreased motivation and interest in learning. The Metaverse offers immersive and interactive learning experiences, making education more engaging and enjoyable. There is a disparity in the quality of education across different regions in Saudi Arabia, partly due to resource limitations and the availability of skilled teachers. The Metaverse can bridge this gap by providing equal access to high-quality educational content, regardless of geographical location.

Many educators may not be adequately trained in the latest teaching methods and technologies, limiting their effec-

tiveness in the classroom. The Metaverse can be used to create immersive training environments for teachers. Cultural norms and social expectations can sometimes limit students' exposure to global perspectives and interactions, which are essential for a well-rounded education. The Metaverse can facilitate cross-cultural exchanges and global collaborations in a controlled virtual environment. Students can interact with peers from different cultures, participate in virtual exchange programs, and gain a broader understanding of the world, all while adhering to cultural sensitivities. Moreover, Traditional assessment methods may not fully capture a student's abilities and learning progress. The Metaverse can offer innovative assessment tools that go beyond standard tests. Virtual simulations, collaborative problem-solving tasks, and interactive projects can provide a more comprehensive evaluation of student learning

1.2 Saudi Vision 2030

Saudi Vision 2030 is a strategic framework launched by the Kingdom of Saudi Arabia in 2016, aimed at diversifying the nation's economy and reducing its dependence on oil. The vision focuses on three key pillars: a vibrant society, a thriving economy, and an ambitious nation. It seeks to develop sectors such as education, healthcare, tourism, and entertainment, while fostering innovation, entrepreneurship, and investment. Vision 2030 also emphasizes social reforms, including increasing women's participation in the workforce, enhancing quality of life, and promoting cultural and recreational activities. Through these initiatives, Saudi Arabia aims to transform its economy and society, positioning itself as a global leader by 2030.

Saudi Vision 2030 places a strong emphasis on technology advancement and educational reform as key drivers of the Kingdom's transformation. Recognizing the importance of a knowledge-based economy, the vision outlines strategic initiatives to integrate cutting-edge technologies across various sectors, including education, to prepare the nation for the future.

One of the central goals of Vision 2030 is to foster innovation and digital transformation. The Kingdom aims to become a hub for technology and innovation, with significant investments in sectors such as artificial intelligence (AI), robotics, biotechnology, and smart infrastructure. The government is also encouraging the development of a digital economy, with initiatives to improve internet connectivity, expand broadband access, and promote the use of e-services across public and private sectors. The plan includes establishing tech-driven cities like NEOM, a futuristic city that will leverage the latest advancements in AI, IoT, and renewable energy to create a sustainable and high-tech living environment.

In the realm of education, Vision 2030 seeks to modernize the Saudi educational system to better align with global standards and equip students with the skills needed for the future job market. The focus is on enhancing the quality of education through curriculum reform, promoting critical thinking, creativity, and problem-solving skills. There is also a strong push towards STEM (Science, Technology, Engineering, and Mathematics) education to prepare students for careers in high-demand fields.

Digital learning is a key component of this transformation, with plans to integrate technology into classrooms through e-learning platforms, virtual classrooms, and digital resources. The introduction of advanced technologies like AI, virtual reality (VR), and augmented reality (AR) in education is aimed at creating immersive and personalized learning experiences. These tools are expected to make learning more engaging, accessible, and tailored to individual student needs.

Moreover, the vision underscores the importance of lifelong learning and continuous professional development. Initiatives are being implemented to upskill the workforce, ensuring that both educators and students are equipped to navigate and thrive in a rapidly changing technological landscape.

Overall, Saudi Vision 2030's focus on technology and education aims to create a future-ready generation that can contribute to the Kingdom's economic diversification and global competitiveness.

1.3 Significance and justification of the study

The integration of Metaverse technologies into the educational system, particularly in language learning, represents a transformative shift in how educational content is delivered and experienced. This study is vital for several reasons:

1. **Addressing Current Educational Challenges:**

Traditional language learning methods often struggle to fully engage students, especially in a world where digital

interactions dominate their daily lives. The immersive nature of the Metaverse can significantly enhance student engagement and motivation by providing interactive and gamified learning experiences. Many students have diverse learning needs and paces. The Metaverse offers opportunities for personalized learning experiences, allowing students to learn at their own pace with content tailored to their individual strengths and weaknesses.

2. **Meeting the Goals of Saudi Vision 2030:**

Saudi Vision 2030 emphasizes the importance of innovation and technology in transforming the education sector. Integrating the Metaverse aligns with this vision by introducing cutting-edge technologies that can revolutionize how students learn and interact with educational content. The Metaverse can be utilized to create immersive cultural experiences that not only teach language but also instill a deeper understanding and appreciation of Saudi heritage and values.

3. **Global Competitiveness:**

The study contributes to equipping students with critical 21st-century skills such as digital literacy, collaboration, and critical thinking. By learning in a virtual environment, students can develop the technological fluency needed to thrive in a globalized world. Through virtual language exchanges and global collaborations facilitated by the Metaverse, students can gain a broader perspective and enhance their language skills in authentic contexts, making them more competitive in the international arena.

2. Literature review

2.1 Metaverse in education

Several studies have discussed the term metaverse in the context of education significantly, Mystakidis (2022), defines Metaverse as "the post-reality universe, a perpetual and persistent multiuser environment merging physical reality with digital virtuality" (p. 486). It is a combination of technologies like Virtual Reality (VR) and Augmented Reality (AR), which allow for multimodal interactions with digital objects, people, and virtual environments. He claims that Metaverse in education enables students to own a virtual environment and to create a customized curriculum, as well as to have intense and active learning experiences. Also, Zhang et al. (2022), define metaverse in education as a combination of learning environments attached with the use of technology,

learners can access educational environments without being constrained by time or place. Learners can engage in real time interactions with a variety of content, such as virtual learning resources and avatars by utilizing digital identities. They conclude that teachers may use metaverse advantages to overcome educational obstacles, but they must look at the issues it poses as well. In addition, Sarıtaş and Topraklıkoğlu (2022), indicate that metaverse is a combined word which means beyond the universe, and it refers to several meanings depending on the context and discipline. In the context of educational technology, it refers to "a multi-user platform and technological innovation, which is a digital reality environment beyond physical reality" (p. 587). They contend that integrating the use of metaverse technology into educational settings might be more attainable once they are designed for prolonged use. Despite their contributions in identifying metaverse in the field of education, still there is a need to understand metaverse in English vocabulary classroom environment. Just as revealed by Li and Yu (2023), who explore metaverse in blended English learning in the post pandemic period, in regard with learners' engagement and learning outcomes. They found that metaverse provides English learners with rich learning experiences that improve learners' engagement and enhance positive learning outcomes. Particularly when learners are acquiring English vocabulary and grammar. Accordingly, we can account metaverse as a promising tool for promoting blended learning.

The integration of the Metaverse in language learning offers a dynamic and immersive environment that can significantly improve vocabulary acquisition. Through virtual simulations and interactive scenarios, students are exposed to vocabulary in context, which is crucial for deeper understanding and retention. For instance, in a virtual marketplace scenario within the Metaverse, students can learn vocabulary related to shopping, bargaining, and cultural interactions in a realistic setting. The Metaverse also allows for repeated exposure to new words in various contexts, reinforcing learning through practice and application. Additionally, the use of avatars and virtual interactions encourages students to use new vocabulary in conversations, enhancing their active language use and retention. Furthermore, the Metaverse can provide instant feedback and corrective suggestions through AI-driven tools, helping students learn from their mistakes and solidify their understanding of new terms. By combin-

ing visual, auditory, and kinesthetic learning modalities, the Metaverse caters to different learning styles, making vocabulary acquisition more effective and engaging.

Yue (2023) discusses the analysis of Meta-Cosmos empowering basic English teaching and learning through the use of metaverse technology. It was highlighted how metaverse technology provides a new learning scenario using virtual reality, augmented reality, and artificial intelligence to enhance English language teaching. The study also mentioned the benefits of social interaction in the metaverse environment for developing students' intercultural communication skills. However, challenges such as the cost of technological equipment and teacher training are noted. The study further emphasized the need for further research to maximize the effectiveness of metaverse technology in English language teaching.

Fan & Chiang (2023) explored the application of metaverse in language education, focusing on research topics, methodologies, common tools, impacts, and challenges. The review concluded that South Korea and China the two countries that made the main contributions to the metaverse and language education, primarily involving university students. Platforms such as Ifland, Gather Town, and Metaverse Studio, along with tools like VR, are commonly used for metaverse construction. The review also highlights the need for further research in this area.

Therefore, the present study tried to purpose different scenarios to implement metaverse in the Saudi educational system. Implementing the Metaverse in the Saudi educational system is a strategic move that aligns with the goals of Saudi Vision 2030 and addresses key educational challenges identified in previous studies. Research indicates that the Metaverse can revolutionize education by providing immersive, interactive learning experiences that engage students in ways traditional methods cannot. It offers personalized learning paths, promotes critical thinking, and fosters global collaboration, all of which are essential skills for the 21st century. Moreover, the Metaverse's ability to create culturally immersive environments supports Saudi Vision 2030's emphasis on preserving and promoting national heritage while embracing technological innovation. By integrating the Metaverse, Saudi Arabia can advance its educational system, making it more adaptive, inclusive, and capable of preparing students for a competitive global landscape.

2.2 Virtual Reality (VR) and Augmented Reality (AR)

Utilize VR and AR technologies to create immersive experiences for English language learning. The study of Kamińska et al. (2019), identifies the term virtual reality as "the computer simulation displaying an environment through which one can walk and interact with objects and simulated computer-generated people" (p. 2). With the use of head-mounted display (HMD) systems and tracker for head and hands movements, users can view different virtual worlds. They note that VR is an effective world to facilitate the process of learning and teaching. They also present a type of virtual reality platform which can be used to advocate learners' theoretical knowledge such as rules and terminologies. For example, VR in medical education shows a realistic view of the heart and bones, it helps learners with memorizing the name of each part and understanding the relationship between different parts. Furthermore, Madini and Alshaikhi (2017), investigate the effectiveness of VR on students' vocabulary mastery that are related to their field. They remark that VR might revolutionize learning experiences, with the use of VR tools. Their study involved twenty ESP postgraduates' Saudi females who were associated with virtual objects by viewing 360-degree videos about their major. They conclude that using VR videos expand students' vocabulary knowledge and improve their learning outcomes. Moreover, Alizadeh and Cowie (2022), reported that VR influences language learners positively, and it promotes their vocabulary learning initially. Illustrated by the immersive environment and multimodal interaction in VR which facilitates learners' vocabulary acquisition. They have noticed that among language skills, vocabulary acquisition is the most often mentioned. They also observe in the field of language learning there is little attention given to specific language skills.

Recently, Rudnik (2023), demonstrated the ability of AR technology in teaching foreign language skills, especially grammar, vocabulary and phonology. Also, its ability as a tool for puzzles, games and storytelling has been proven. She defined AR as the combination of real world and digital data that is interpreted by technology, without the need for wearable devices. The study revealed that AR technologies in foreign language teaching increased students' motivation and interaction which lead to greater learning outcomes. Similar study conducted by Karacan and Akoğlu (2021), shows the

efficacy of AR tools in learning language skills, speaking and listening, reading, and writing, vocabulary and grammar. Specifically, vocabulary learning where there are different activities available in AR to support students developing their vocabulary knowledge, like flashcards and spelling games. However, they claim that some activities in teaching EFL require more than the use of AR, and AR technology should be developed more to fully integrate it into classrooms.

2.3 Platforms and applications

Several studies have highlighted the role of metaverse-based platforms and applications in language learning. This can be seen in the study of Al-Gamdi (2019), who suggests the implication of digital games like Pokémon Go and other similar games could motivate students to learn the language, because they are familiar with these kinds of games. It also gives language teachers the chance to design a special learning environment where their students can acquire skills when immersed in a different virtual world that reflects the real world. In the same way Castillo-Cuesta (2020), Interrogate the use of digital games for higher education EFL students to develop their grammar and vocabulary knowledge. The type of games applied in the study were matching tasks, crossword puzzles, unscramble sentences, and close activities. They used it to assist students in differentiating between aspects of grammar like modals, gerunds, phrasal verbs and present perfect. Along with numerous vocabulary types, such as vocabulary related to languages, jobs, education, health, and diet. The study results showed that implementing digital games has improved students' performance in both grammar and vocabulary knowledge.

Another study by Bilanti et al. (2022), which examined the appropriateness of Minecraft adventure map to support English language teaching and learning, particularly high school students' vocabulary learning. The application Minecraft map is a metaverse video game that can be operated on computers, mobile devices and PlayStation. They pointed out that the best way to use the map would be as an additional activity after all the fundamental concepts have been covered in the class. They assert that students find the application useful for learning vocabulary in an entertaining and simplified way. Similarly, Han et al. (2023), assess the efficiency of Roblox platform in educational context. Roblox is a multiplayer game that allows each player to build their own games, and to be involved in social interactive activities which can be used in learning. Consequently, being involved in these activities improves students' team-work skills and their communication skills. Further, Alhadiah (2020), evaluated the platform Quizlet for EFL college students in terms of vocabulary learning. He described Quizlet as a useful vocabulary learning tool containing many features that can help students in vocabulary learning, such as spelling, matching, flashcards and testing. He reported that students who participated in the study look at Quizlet as an enjoyable and beneficial tool for learning vocabulary, and some of them would continue to use it even outside the classroom.

3. Methodology

3.1 Research design

This study employs a retrospective approach, integrating insights from existing literature and the researcher's professional experience in language education and assessment. By synthesizing these sources, the study aims to develop practical suggestions and models for educators grounded in Monitor Theory principles. The literature review encompassed studies published between 2010 and 2023. Databases such as Google Scholar, JSTOR, IEEE Xplore, and Elsevier were used to gather peer-reviewed articles, conference papers, and technical reports. Search terms included "Metaverse in education," "virtual learning environments," "VR in language learning," "Saudi Arabian education technology," and "digital literacy in Saudi Arabia." Studies were selected based on their relevance to Metaverse technology in education, the specific context of Saudi Arabian education, and their focus on language learning and digital literacy. Articles that did not focus on educational applications of Metaverse technology or lacked empirical data were excluded.

3.2 Data collection

Data collection involved conducting a comprehensive review of scholarly articles, books, and reports pertinent to Monitor Theory, language assessment, and test-taking strategies. Additionally, the researcher critically examined their own professional experience and observations in language education and assessment, considering real-world insights alongside academic literature. Primary data was gathered

from existing studies, reports, and articles. Secondary data included reviews and meta-analyses related to Metaverse technology in education. Key findings, methodologies, and conclusions from each study were extracted and tabulated for analysis.

3.3 Data analysis

Thematic analysis was employed to systematically identify recurring themes, theoretical insights, and practical implications from the literature review. Through this process, key concepts and findings were synthesized to inform the development of practical suggestions for educators. The researcher's own experiences and observations were also analyzed and integrated with the literature findings to enrich the analysis. The data was analyzed using thematic analysis to identify common themes, challenges, and opportunities associated with the integration of Metaverse technology in education. Open coding was used to categorize data into themes such as technical challenges, ethical concerns, accessibility issues, and educational outcomes. Patterns and trends were identified by comparing and contrasting findings across different studies. Data from multiple sources was triangulated to validate findings and ensure consistency. This included cross-referencing information from peer-reviewed articles, expert opinions, and case studies.

To ensure reliability, only studies with robust methodologies and clear data collection processes were included. The validity of the study was ensured by selecting a diverse range of sources and using well-established research methods in the analysis.

3.4 Limitations of methodology

While efforts were made to comprehensively review relevant literature and draw upon extensive professional experience, the study is subject to certain limitations. These include potential biases in the selection and interpretation of literature, as well as the retrospective nature of the analysis. The generalizability of findings may be influenced by the scope and depth of the literature review and researcher experience. Additionally, the practical suggestions developed may require adaptation to suit specific educational.

4. Results and discussion

4.1 Challenges of integrating Metaverse technology in education

Implementing the Metaverse in the Saudi educational system can bring about transformative changes, but it also comes with various challenges.

Technical challenges

Saudi Arabia faces several challenges in terms of technological infrastructure. Limited access to high-speed internet in some regions hinders seamless access to the Metaverse. Additionally, the hardware requirements for a comprehensive Metaverse experience, such as Virtual Reality (VR) and Augmented Reality (AR) devices, might be expensive and not readily available for all students (Cai et al., 2022).

Digital literacy and skills

There is a significant gap in digital literacy and skills among educators and students. Educators may not be adequately trained to use Metaverse technologies for educational purposes, leading to a gap in digital literacy. Similarly, students might face challenges adapting to the new virtual learning environment, impacting their ability to navigate and utilize Metaverse tools effectively (Kaddoura & Al Husseiny, 2023).

Content development and quality

Developing high-quality educational content compatible with the Metaverse can be resource-intensive and requires specialized skills. Aligning the virtual content with the existing curriculum and ensuring it meets educational standards is crucial but challenging (Shi et al., 2023).

4.2 Ethical concerns

Privacy and security

Privacy and security are major concerns in the Metaverse. Storing and managing sensitive student data raises issues about privacy and data security, necessitating robust safeguards. Virtual environments are also susceptible to cyber threats, which could compromise the integrity of educational activities and student information (Onggirawan et al., 2023).

Cultural and societal considerations

Cultural norms and values must be considered to ensure the successful integration of the Metaverse. Virtual environments should reflect cultural values to ensure acceptance and avoid potential conflicts. There might also be disparities in access to technology and digital resources among different socioeconomic groups, potentially exacerbating existing educational inequalities (Cai et al., 2022).

4.3 Accessibility issues

Accessibility for students with disabilities

Using Metaverse technology in education can present accessibility challenges for students with disabilities. The requirement for VR devices, which can be expensive, might limit access for some students. Additionally, there are concerns about the usability of these technologies for students with various disabilities (Onggirawan et al., 2023).

Time and health concerns

Excessive use of Metaverse and electronic devices can lead to health issues, such as eye strain and addiction. Balancing virtual and real-world interactions is essential to prevent negative health impacts (Shi et al., 2023).

4.4 Overcoming challenges

Innovative implementation plan

Addressing these challenges requires a collaborative effort from educators, policymakers, technology providers, and the community. Developing comprehensive strategies, providing adequate resources, and fostering a culture of adaptability are essential components of overcoming these challenges. An innovative plan includes:

• Developing a Metaverse platform that provides virtual collaborative spaces.
• Implementing a comprehensive training program for teachers.
• Distributing VR kits to schools and collaborating with technology companies to make VR kits accessible and affordable.
• Creating immersive experiences to explore and learn about Saudi Arabia's cultural and historical heritage.
• Implementing assessment tools within the Metaverse to evaluate students' performance and progress.
• Establishing a virtual community hub for parents, educators, and students to collaborate.

This approach aligns with the goals of Saudi Vision 2030, fostering collaboration, creativity, and critical thinking skills essential for the 21st-century workforce.

4.5 Five scenarios to implement Metaverse in Saudi educational system

In Saudi Arabia, the integration of Metaverse technology into English language classrooms presents unique opportunities and challenges. Here I suggest five scenarios tailored to the Saudi educational context.

In the first scenario, the "Cultural Immersion Hub," Saudi educators may use the Metaverse to create immersive cultural experiences for language learners. Students can explore virtual replicas of historical sites like Al-Ula or the Masmak Fortress, engage with local communities, and practice language skills in authentic contexts. Special attention is given to accommodating students with special needs, ensuring accessibility and inclusivity in virtual environments. Studies such as those by Tai & Chen (2021) have shown that immersive virtual environments can significantly enhance language acquisition by providing contextual and cultural experiences that textbooks cannot. By exploring virtual replicas of places like Al-Ula or Masmak Fortress, students can engage with the language in meaningful ways, which has been shown to improve retention and practical usage of vocabulary and grammar

The second scenario involves a "Virtual Language Exchange," where Saudi schools collaborate with international institutions to establish virtual language exchange programs. Students connect with peers from English-speaking countries, fostering cross-cultural understanding and language proficiency. The Metaverse facilitates real-time communication and collaboration, breaking down geographical barriers and promoting global citizenship (Zhang et al., 2023)

In the third scenario, "Personalized Language Learning," Saudi schools may implement AI-driven language learning platforms within the Metaverse to offer tailored educational experiences that accommodate the diverse needs and abilities of all learners. The goal is to create inclusive virtual environments where students with special needs can thrive alongside their peers. Li & Yu (2023) advocate that

Metaverse-based blended English learning can enhance academic success through high learner engagement in immersive virtual environments, but requires support from educational institutions and platform designers to overcome digital literacy challenges.

Key components of this personalized language learning approach include adaptive learning technologies, inclusive virtual classrooms, individualized support and accommodations, adherence to Universal Design for Learning (UDL) principles, and collaborative professional development for educators. AI tutors and virtual assistants provide personalized feedback, adaptive lessons, and customized learning pathways based on individual student profiles. Assistive technologies, such as text-to-speech and speech recognition software, support students with disabilities, ensuring equal access to educational content and activities.

Inclusive virtual classrooms feature customizable interfaces, adjustable font sizes, and color contrast options to accommodate students with visual impairments or dyslexia. Multi-modal learning materials cater to diverse learning styles and preferences, ensuring engagement and comprehension for all learners. Real-time collaboration tools facilitate peer interaction, group projects, and cooperative learning experiences, fostering socialization and teamwork skills among students with special needs. Sghaier et al., (2022) state that intelligent metaverse learning system improves achievement for students with disabilities compared to traditional methods.

Individualized support services and accommodations are provided to students with special needs, including individualized learning plans, extra time for assignments, and alternative assessment formats. Dedicated learning support specialists and inclusion coordinators collaborate with classroom teachers to implement appropriate accommodations and modifications, ensuring that every student receives the support they need to succeed. Virtual counseling services and peer mentorship programs offer additional emotional and academic support, promoting self-confidence, resilience, and self-advocacy skills.

Curriculum design and instructional strategies adhere to UDL principles, emphasizing flexibility, accessibility, and multiple means of representation, expression, and engagement. Learning activities are scaffolded to accommodate diverse learning needs, offering varied entry points, differentiated instruction, and scaffolded support to promote mastery and success for all learners. Assessment practices are designed to be fair, equitable, and inclusive, allowing students to demonstrate their knowledge and skills through multiple modalities and formats.

Saudi educators participate in ongoing professional development and training programs focused on inclusive pedagogies, assistive technologies, and disability awareness. Collaborative learning communities and peer mentoring networks provide opportunities for educators to share best practices, exchange resources, and support one another in implementing inclusive practices within the Metaverse. External partnerships with disability advocacy organizations, academic institutions, and assistive technology providers enrich professional development initiatives and promote a culture of inclusion and diversity in education.

The anticipated outcomes of this approach include enhanced learning outcomes, increased accessibility and equity, and empowered educators. Students with special needs demonstrate improved language proficiency, academic achievement, and self-efficacy as a result of personalized learning experiences tailored to their unique strengths and needs. Adaptive learning technologies and inclusive instructional practices promote engagement, motivation, and active participation among all learners, fostering a positive learning environment conducive to student success. Virtual classrooms and learning materials are designed to be accessible to students with diverse learning needs, ensuring equitable access to educational opportunities and resources for all learners, regardless of ability or disability (Hilliard, 1992)

In the fourth scenario, "Tech-driven Language Labs," Saudi schools may invest in state-of-the-art language labs powered by holographic technology and AI assistants. Virtual classrooms simulate authentic language environments, enabling interactive role-plays, language games, and collaborative projects. Educators integrate assistive technologies to support students with special needs, ensuring equal participation and engagement in language learning activities. Dolly et al. (2023) claim that immersive virtual reality environments for language learning can lead to more spontaneous language use, mediation between learners, and higher levels of production and comprehension compared to traditional classroom activities.

In the fifth scenario, "Hybrid Learning Ecosystem,"

Saudi education embraces a hybrid approach, combining traditional classroom instruction with Metaverse-enhanced learning experiences. Blended learning models integrate virtual field trips, guest lectures, and interactive simulations into the curriculum, enriching language education. Educators prioritize inclusive practices, offering flexible accommodations and support services for students with special needs in both physical and virtual settings. Banditvilai (2016) notes that blended learning enhances students' language skills, learner autonomy, and motivation through online practice and traditional classroom methods.

Anticipating trends and potential outcomes in Saudi Arabia, authorities establish guidelines and regulations to govern the ethical use of Metaverse technology in education, ensuring data privacy, security, and content moderation. Policies prioritize inclusivity and accessibility, promoting equal opportunities for all learners, including those with special needs. Saudi schools invest in robust IT infrastructure and high-speed internet connectivity to support Metaverse integration. Accessible hardware and assistive devices are provided to accommodate students with special needs, fostering an inclusive learning environment Dolly et al. (2023).

Professional development programs equip Saudi educators with the knowledge and skills to effectively utilize Metaverse technology in language instruction. Training emphasizes inclusive pedagogies, assistive technologies, and cultural sensitivity, empowering teachers to meet the diverse needs of their students. Saudi schools collaborate with parents, caregivers, and disability advocacy groups to ensure the meaningful participation of students with special needs in Metaverse-enhanced language learning. Community outreach initiatives raise awareness and promote acceptance of diverse learning styles and abilities.

By prioritizing personalized language learning experiences within the Metaverse and focusing on the needs of students with special needs, Saudi educators can create inclusive, supportive, and empowering learning environments. This approach aligns with the goals of Saudi Vision 2030, fostering collaboration, creativity, and critical thinking skills essential for the 21st-century workforce.

4.6 Contributions of the study

1. For Teachers

Teachers will gain access to innovative tools and platforms that can enhance their instructional methods. The Metaverse provides a dynamic environment where traditional teaching materials can be brought to life, making lessons more engaging and effective. This study can serve as a foundation for developing professional development programs that train teachers in using Metaverse technologies, ensuring they are equipped to integrate these tools effectively into their curricula.

2. For Students

Students will benefit from highly immersive and interactive learning experiences that go beyond the limitations of physical classrooms. This approach can lead to improved language acquisition, retention, and practical usage. The study emphasizes the potential for the Metaverse to create inclusive learning environments, particularly for students with special needs. By providing accessible and adaptable virtual classrooms, all students can have equal opportunities to succeed.

3. For Educational Institutions and Policymakers

The research provides valuable insights into the challenges and opportunities of integrating Metaverse technologies, guiding educational institutions and policymakers in making informed decisions about investments and strategies for future educational technologies. The study offers a framework for successfully integrating Metaverse technologies into the existing educational system, addressing technical, ethical, and cultural considerations to ensure a smooth and effective transition.

4. For the Saudi Educational system

The integration of Metaverse technology in education has been explored in various contexts, but the unique cultural, technological, and educational landscape of Saudi Arabia offers a novel perspective that has not been extensively studied. This paper differentiates itself from existing studies through several key aspects:

The Saudi Arabian educational system, influenced by Saudi Vision 2030, emphasizes modernization and technological innovation. This national vision provides a fertile ground for the integration of Metaverse technology, aimed at fostering creativity, critical thinking, and global competitiveness. Unlike Western contexts, Saudi Arabia presents unique cultural and linguistic considerations that shape the implementation of Metaverse technology. For example, the use of Arabic as the primary language and the emphasis on

preserving cultural values necessitate the development of culturally sensitive virtual content.

5. **Specific Use Cases for English Vocabulary Learning**

This paper explores innovative applications of Metaverse technology specifically for English vocabulary learning in Saudi Arabia. Unlike general studies on Metaverse in education, we focus on:

- **Virtual Storytelling Sessions**: Creating immersive story environments where students can interact with characters and objects to learn new vocabulary.
- **Immersive Vocabulary Games**: Designing gamified experiences that allow students to practice vocabulary in engaging and interactive ways.
- **Interactive Language Simulations**: Simulating real-life scenarios, such as shopping or traveling, where students can practice vocabulary in context.

5. Conclusion

This paper reviewed the integration of metaverse technology into English language classrooms, focusing on its potential to enhance vocabulary learning and the factors affecting its implementation. Studies showed that the metaverse enables students to engage in intense and active learning experiences by providing virtual environments and customized curricula. However, there is a need to understand the application of metaverse technology specifically in English vocabulary learning contexts.

Metaverse-based platforms and applications, such as digital games and VR tools, are effective in language learning. Games like Pokémon Go and Minecraft adventure maps motivate students and improve their vocabulary and grammar knowledge through interactive and engaging activities. Platforms like Quizlet offer various features that aid vocabulary learning, making the process enjoyable and effective.

Despite the benefits, integrating metaverse technology into education faces challenges such as technical difficulties, ethical concerns, and accessibility issues. Ensuring high-speed internet access, affordable VR/AR devices, and robust digital literacy are essential for successful implementation. Privacy and security, content development, and cultural considerations are also critical factors that need to be addressed.

According to the literature reviewed above, metaverse is a promising tool for education that improves learning outcomes and in particular vocabulary learning. The contextualized vocabulary practice, social interaction, multimedia integration, and personalized learning experiences offered by the metaverse can enhance learners' vocabulary acquisition. For that reason, English teachers should think of ways to implement this tool into their classrooms. With the assistance of metaverse technologies like VR and AR, learners can understand and memorize vocabulary related to their major. In addition, metaverse-based applications and platforms like Minecraft, Roblox, and Quizlet that are regarded as effective in enhancing vocabulary knowledge. However, implementing these technologies in the classrooms could bring several challenges, including technical and ethical issues, security and privacy issues, issues related to accessibility and disability. There should be a plan of how to integrate such technologies before applying them. Importantly, learners who have disabilities must be considered when implementing metaverse technologies into the classroom. All these challenges need to be addressed and resolved in future studies.

The recent research on the application of the Metaverse in education has highlighted its potential to revolutionize the learning experience by transcending the limitations of time and space, offering immersive and interactive environments for students. The Metaverse is envisioned as a digital counterpart to the physical world, where users can interact as avatars in a virtual space that mirrors real-time global statistics and allows for immersion, thus linking the physical and digital realms (Samala et al., 2023).

Studies have identified various world types within the Metaverse that can be utilized for educational purposes, such as survival, maze, multi-choice, racing/jump, and escape room world types. These are designed to deliver gameful experiences that can enhance learning motivation and provide equal educational opportunities, aligning with the fourth sustainable development goal (Zhang et al., 2022).

The integration of Extended Reality (XR) and the Internet of Everything (IoE) within the Metaverse is expected to significantly impact education, training, and skill development. The immersive user experience facilitated by high-speed communication and multimedia streaming capabilities makes the Metaverse an ideal platform for these purposes (Mustafa, 2022).

Furthermore, the Metaverse's ability to integrate various information technologies is leading to the creation of

smart education ecosystems. These ecosystems are characterized by resource collaborative interaction, virtuality-reality integration experience, and ubiquitous spatial inquiry, supported by core technologies that foster a new mode of virtuality-reality symbiosis, trans-spatial fusion, and collaborative inquiry (Abraham et al., 2023).

Personalized learning spaces are also being developed within the educational Metaverse, leveraging multimodal human-machine interaction and intelligent evaluation. By utilizing biometric signals such as heart rate, these spaces aim to improve learners' emotional engagement and cognitive levels, offering a more effective learning experience compared to traditional classroom settings (Zhou, 2022).

Despite the promising applications, the Metaverse in education also faces challenges, including the need for clear definitions, frameworks, and understanding of its features. Potential applications have been identified in blended learning, language learning, competence-based education, and inclusive education. However, the challenges posed by this emerging technology must be addressed to fully realize its potential in educational contexts (Rahman et al., 2023).

In Saudi Arabia, the integration of metaverse technology into English language classrooms presents unique opportunities and challenges. Developing a comprehensive strategy that includes innovative teaching methods, accessible hardware, and ongoing professional development is crucial. Personalized learning, cultural immersion, and virtual language exchanges are some scenarios that can enhance language learning. Addressing challenges related to technological infrastructure, digital literacy, and inclusivity is vital for the successful implementation of metaverse technology in Saudi education.

By leveraging the immersive and interactive capabilities of the metaverse, educators can create engaging and effective language learning experiences. This approach aligns with Saudi Vision 2030, promoting collaboration, creativity, and critical thinking skills essential for the 21st-century workforce.

In conclusion, the Metaverse presents a transformative opportunity for the education sector, promising to enhance learning experiences through innovative, immersive, and personalized environments. As research continues to evolve, it is expected that the Metaverse will play a significant role in shaping the future of education, overcoming geographical barriers, and providing quality education to a wider audience, including those in underdeveloped countries (Zahng & Chen,

2022; Pari-Bedoya et al., 2023; Samala et al., 2023; Abraham et al., 2023; Zhou, 2022; Mustafa, 2022).

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