Improving Language Teaching With Virtual Reality And Artificial Intelligence: The Perspective Of Moroccan Teachers

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Abstract. Virtual reality (VR) and artificial intelligence (AI) exert a significant influence on the educational process, particularly by facilitating and enhancing language learning. An investigation, conducted through a questionnaire, was carried out among language teachers to analyze this influence. The main objective was to assess their understanding of VR and AI, focusing on their ability to integrate and effectively use these technologies in language teaching, for both learners and educators. The questionnaire also aimed to uncover the issues encountered in the use of immersive technologies while exploring language teachers' enthusiasm to incorporate VR and immersive activities into their classes. In this perspective, the emphasis is placed on VR first, then on AI, and on the opportunities offered by AI in creating virtual reality activities. The results obtained will help shed light on the existing relationships in this field, while examining the ethical considerations related to learners' use of AI in language teaching. Practical recommendations, formulated by experts in the field, complement this study.

Keywords: Artificial Intelligence, Virtual Reality, Language Education, Educational Challenges

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1 Introduction

The teaching of a given language has undergone massive changes, and nowadays, with the crucial development of information and communication technologies, especially in the educational field, the vision of researchers, education specialists, or didacticians has taken a different track; the more the world becomes increasingly complex, the more there is a need for language didactics that undergo societal changes, mobility, and the needs of today's learners [1]. Trusting technological innovation in favor of teaching/learning in a language class simply smooths the practice in all educational institutions, from middle to high school and university [2]. In fact, these technologies have created an excellent exchange platform by supporting teaching/learning and encouraging learners to immerse themselves in a bath of interaction and intercultural communication [3]; because the goal in any case is to develop language skills, moreover, to become a living being ready for tomorrow's life, it is in this sense that we speak of behavioral competencies or Soft Skills.

In November 2022, with the arrival of the Generative Pretrained Transformer "ChatGPT," which caused a huge buzz and sparked enthusiasm among users worldwide; despite its innovative and significant potential, this model has been the subject of criticism [4]. Education researchers affirm the importance of this model, which has succeeded in creating some competition and rising to challenges; subsequently, numerous projects find their existence, we cite as an example: Bing's Copilot, Google's Gemini recently unveiled, which will be the first model to surpass human experts in MMLU (Massive Multitask Language Understanding), also Midjourney, which has had a significant impact on artistic education in the first place [5]. Indeed, a great interest is observed especially among young people who have mentioned a huge attraction towards various applications of generative artificial intelligence (GAI) that offer users the possibility to generate new content and seek innovation: generating texts, images, audio-visual content, and even 3D models, all of this can be achieved only by a request [6]. This movement remains beneficial especially in the educational field, which must reinvest in every technological advancement.

In connection with artificial intelligence, the immersive world remains highly attractive and garners significant attention; a technology that has surged in recent times and continues to excel by leveraging intelligent systems and artificial intelligence. Through the immersive world, the boundaries between the physical and digital realms diminish; a blend of immersive technologies and artificial intelligence promises to reshape and advance our lives by providing unlimited sources of real-time knowledge and new ways of communication and understanding [7]. We are beginning to discuss a new concept, that of the Metaverse; a kind of immersive combination as it can integrate virtual reality (VR), augmented reality (AR), mixed reality (MR), extended reality (XR), and other digital technologies that enhance the impression of reality [8].

Indeed, the potential of virtual reality (VR) as a language teaching/learning device, supported by generative artificial intelligence (GAI), remains strong by offering various types of interactive media to ultimately achieve a virtual collaborative space [9]. Where learner users can interact with each other seamlessly and with the environment, all through the use of a headset and controller if necessary. Especially since the majority

of studies on these devices indicate a rewarding cognitive engagement and ultimate learner involvement [10]. These studies highlight the social interactions of these technologies: they are multi-user, multilingual, they facilitate communication, particularly in problem-solving, task completion, and project realization [11].
Honestly, most scientific research on language learning via generative artificial intelligence (GAI) and virtual reality (VR) has been applied in a university study context, however, conducting such a study in our high, middle or primary schools remains complex and challenging; we are talking about a public of learners "adolescents or children" whose cognition, knowledge, and emotional intelligence are still in development, these learners need school to nurture them [12]. This means they need a teacher in the classroom to guide them, support them in building their learning, and acquire their language and social skills with the help of artificial intelligence and virtual reality in the classroom. Therefore, the present study aims to examine the impact of the mentioned technologies "artificial intelligence and virtual reality" on language learning from the perspective of teachers of diverse generations and different levels, targeting their ability to integrate these technologies effectively, mentioning the challenges encountered in institutions without forgetting the ethical issues of their use.

2 Conceptual Framework

2.1 Virtual reality

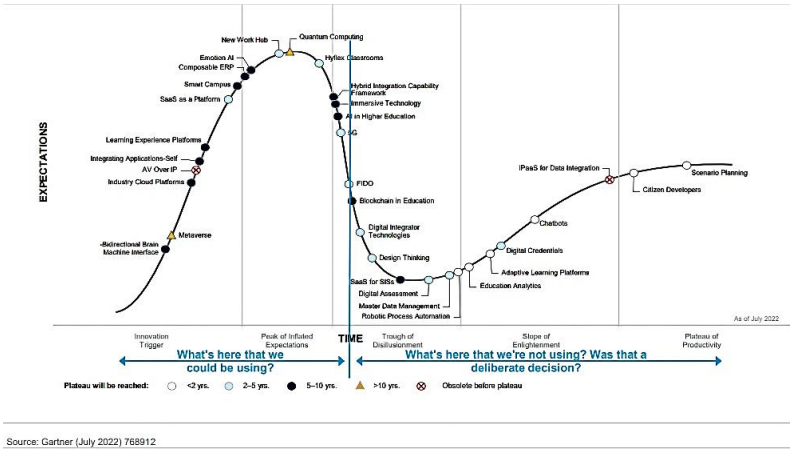
Virtual reality (VR) is a technology that immerses users in computer-generated environments, allowing them to interact with these simulated worlds and experience them in a seemingly physical manner [13]. It encompasses various sensory modalities such as visual, auditory, and tactile feedback, thus creating a multidimensional experience [14]. This technology traces its roots back to Morton Heilig's Sensorama installation in 1962, which laid the conceptual groundwork for the creation of alternative realities [15]. VR holds immense potential for enhancing learning experiences. By simulating real-life scenarios, students can engage in immersive learning activities that are otherwise difficult or impossible to replicate in traditional classroom settings [16]. As technology continues to advance, the integration of VR into education is poised to revolutionize teaching and learning methodologies, making education more engaging, interactive, and effective, especially when it comes to language teaching. Additionally, studies by Pertaub, Slater, and Barker suggest that VR can alleviate anxiety by providing a safe space for students to confront challenging scenarios, such as public speaking [17]. By making abstract concepts tangible, VR enhances understanding, as noted by Mohler in 2001, who emphasizes its role in broadening perceptions and promoting dynamic interaction [18]. Furthermore, the interactive nature of VR fosters engagement and active learning, enabling students to participate in problem-solving scenarios and collaborative simulations, as explained by Grenfell and Warren [19].

2.2 Artificial intelligence

It all began in 1950 when Alan Turing first developed the idea of the "thinking machine," a programmable computer capable of passing and succeeding in a test called the "Imitation Game " [20] [21]. This test is a kind of conversation between an interlocutor, a person, and a machine in separate rooms, during which the interlocutor must distinguish between the real person and the machine. Subsequently, in 1955, John McCarthy succeeded in inventing the first computer that can communicate, reason, and learn, in other words, a machine capable of mimicking human cognitive functions [22]. Education was not exempt from artificial intelligence (AIED), which was particularly interested in developing a set of AI-based tools to improve the quality of teaching, understand, and support the teaching/learning process [23]. Moreover, this technology has significant potential to support learners' language skills, specifically in real-life situations, providing instant feedback tailored to language objectives and creating an exchange and communication environment between teachers and students, which can increase their motivation [24]. These technologies are of interest to researchers, particularly in higher education, which will be addressed in the following section.

2.3 The Hype Cycle for Emerging Technologies in Education

To thrive in a constantly changing techno-educational environment, all institutions must become more innovative, keeping pace with technological changes and advancements, while enhancing teaching and learning practices. Consequently, researchers and computer specialists naturally seek to understand how technology can optimize operational models, and new technologies aid them in doing so. Increasingly, they also examine how technology can enhance competitive advantage, support emerging business models, provide new types of learning environments, and strengthen the experience of teachers and learners simultaneously. This is why Gartner's "Hype Cycle" methodology exists, aiming to track the evolution of technologies, establish a roadmap for modernizing educational institutions in particular. This cycle of excitement and priority matrices estimate when technologies and trends will reach maturity and provide practical guidance to help organizations, especially educational ones, decide when they should adopt them, considering their readiness and potential to help all institutions optimize or transform their activities [25]. Here, as you can see in the following figure, is the 2022 Hype Cycle for Higher Education, which shows a range of technologies to integrate into the educational domain and their expected dominance in teaching practices over time. Let's focus our attention on the use of AI and immersive technologies in higher education: both technologies are positioned positively in this field: both are currently in a phase where expectations are very high, perhaps overly optimistic about these technologies, their practices, and current results. It seems they are in a deployment phase to emerge well in the years to come, from 5 to 10 years according to Gartner's estimation.



Source: Gartner (July 2022) 768912

Fig. 1. HYPE CYCLE FOR HIGHER EDUCATION, 2022 [26]

3 Guidance for Using AI and VR In Language Learning

3.1 A VR Guideline for Language Learning

Integration of VR into Teaching Practices. VR can be integrated into various pedagogical approaches to enhance language learning. For example, teachers can use VR for visual experiences, entertainment, social networking, operation, and creation to engage students in immersive learning activities.

Utilization of VR for Visual Experiences. Teachers can leverage VR to provide students with immersive visual experiences, allowing them to visit inaccessible places and historical sites, which can enhance language skills through real-world context [27]. VR applications such as Google Expeditions offer immersive 360° virtual field trips to various locations worldwide, including historical sites, museums, and landmarks. Additionally, Discovery VR provides immersive virtual experiences through 360° videos of natural wonders, historical events, and cultural sites. Another example is TheBlu, which allows users to explore underwater environments and encounter marine life, providing a unique visual experience.

Incorporation of VR for Entertainment. While VR games are a mainstream application, educators can design or utilize language-learning specific VR games to promote language acquisition and motivation. Applications like Learn Languages VR offer interactive VR games and exercises designed specifically to enhance language acquisition. Similarly, MondlyVR provides immersive language lessons in virtual environments, including scenarios for practicing conversations and vocabulary. Additionally, platforms like VRChat can be utilized within educational settings to create language exchange meetups or cultural immersion events [28].

Exploration of Social Networking in VR. Social VR platforms offer opportunities for real-life-like interactions among language learners, facilitating authentic communication and cultural exchange. Teachers can design collaborative tasks and activities in social VR environments to promote language practice and intercultural understanding. VR applications such as vTime provide a social VR platform where users can meet and interact with others in virtual environments, fostering authentic communication and cultural exchange [29]. Similarly, Rec Room offers various multiplayer games and social activities within VR, providing opportunities for language learners to engage in collaborative tasks and interactions. Additionally, platforms like AltspaceVR allow users to attend events, participate in group activities, and interact with others in real-time, creating a rich environment for language practice and intercultural understanding.

Consideration of Immersive VR for Language Learning. Immersive VR technologies, such as VirtualSpeech and vTime, provide interactive and engaging experiences for language learners. Further research is needed to understand the effects of immersion in social VR on language learning outcomes [30].

3.2 AI language learning Tools

There are many AI-based language learning tools available, each designed for specific educational purposes and with unique features. Here some examples:

Conversational Intelligent Agents and Chatbots. This type of intelligence enhances the teaching and learning processes of students by providing applications and software that facilitate natural language discussions while harnessing the capabilities of AI [31] [32]. Through chatbots, human dialogues are emulated, functioning as automated conversational agents available to foster interaction. The primary objective is to understand learners' needs through AI and respond to them using natural language within various educational contexts. Haristia (2019) in her research indicates that language learners prefer chatbots for learning a specific language for the following reasons: their accessibility and the trust they inspire, compared to direct interactions with "human" tutors [33].

Language Tutoring System. Based on AI algorithms, Woo & Choi assert that this tutoring system can provide learners with personalized language lessons accompanied by feedback [34]. These AI-generated contents are available in various forms, capable of creating articles and quizzes or facilitating creative thinking through interactions that mimic human discussions [35]. This may include interactive lessons, exercises, and quizzes aimed at supporting learners in improving their proficiency in grammar, vocabulary, and oral expression [36]. Intelligent language tutoring systems are available in the form of distinct software, mobile applications, and online platforms. Among the notable examples, we cite Quizizz among several others in Table 1. Through this application, learners can benefit from engaging and meaningful activities. Furthermore, it

demonstrates a positive impact on grammar comprehension and the enhancement of reading skills**.**

Speech Technology. Each of us has likely encountered the term "accessibility" on our mobile phones or other mobile devices. This technique forms the basis of voice technology, which finds practical applications in various communicative contexts, including pronunciation, enhancing oral skills, and vocabulary assessment [37]. Indeed, voice technology serves to recognize, analyze, and understand spoken words or audio inputs. This encompasses automatic speech recognition and speech synthesis, which can be beneficial and serve purposes beyond mere communication. These technologies can notably assist individuals with disabilities, such as the visually impaired.

Virtual Learning Environments. Anywhere in the world, and thanks to Virtual Learning Environments (VLEs), learners can attend their courses or take tests, which offers several advantages to learners. Moreover, VLEs enable learners to interact more easily with their instructors and facilitate access to and acquisition of educational resources [38]. A blend of Artificial Intelligence (AI) and virtual environments has indeed succeeded in enhancing learner engagement in innovative learning through simulated experiences provided by Virtual Reality (VR) and AI techniques, as indicated by the research of Molina and Callejas [39]. These environments have also proven beneficial for digital inclusion of children with specific or special needs, serving as an exemplary platform for social communication for children and adults with autism, among others.

Machine Translation Tools. One of the automated systems utilizes artificial intelligence algorithms to automatically translate text or speech from one language to another, effectively facilitating seamless real-time translation between languages. These tools are typically employed for swift translations to assist learners in acquiring a specific language, encompassing comprehension and construction of complex sentences, spelling accuracy, and pronunciation. Indeed, the capability of automatic translation to generate millions of daily translations and rapidly adapt to new terminology surpasses the capacities of individual learners [40]. Among the most popular automatic translation tools, we cite Google Translate and DeepL.

Consideration should be given to the diverse characteristics of language learners, including age, learning styles, ability levels, and motivation levels, when designing AI and VR-based language learning experiences. Continued Remembering that these technologies are constantly evolving, educators need to keep abreast of new developments and research findings in the field of AI and VR for language teaching in order to continually improve teaching practices and learning outcomes.

Table 1. Examples of software tools used to apply AI technologies for Language learning [32].

Specialty	Name of Applications
Language learning	Quizizz / Cognii / Edwin / Elemental Path / GlobalEnglish / Grammarly / iTutorGroup / KidSense / Lingco Classroom / Linguix / MyGrammarCheck / Newsela / Yabla / Noplag App / Nuance / Pimsleur / QuillBot / Quizlet / Ready4 / Rosetta Stone Language Learning / VIPKID / Word Bricks / CASTLE / I-ETER /Web Passive Voice Tutor / WUFUN (for Chinese university students learning English) /Your Verbal Zone (for Turkish students learning / English vocabulary / E-Tutor (for learning German as a second language) / TAGARELA (for learning Portuguese at theuniversity level) / Robo-Sensei (for Japanese) / Spanish for Business Professionals (SBP) / Duolingo / Busuu / Speexx / Babbel / Memrise / Magiclingua.

4 Research Methodology

The participants were Moroccan foreign language teachers, working in establishments in rural and urban areas, the aim always being to collect different viewpoints; the reason why we launched a survey throughout the region of "Tangier/Tétouan/Al-Hoceima" located in northern Morocco. Our sample is distributed according to different levels of education: primary, secondary, vocational training, and university. Considering this diversity of levels, the survey also allowed us to gather teachers' concerns regarding AI and virtual reality in language teaching in a variety of educational contexts. The survey was in the form of a structured questionnaire, which illuminated to what extent our previously established information is generalizable [41]. The questionnaire includes closed-ended questions and Likert scales in order to evaluate perceived effectiveness, interest in future integration, as well as anticipated challenges.

4.1 Demographic Distribution of Participants

The demographic distribution of teachers participating in the questionnaire consists of 194 individuals, with a predominance of primary school teachers (N = 107; 55.2%) in the sample. Secondary school teachers and higher education teachers constitute (N = 52; 26.8%) and (N = 33; 17%) respectively, while vocational training is almost not represented with only (N = 2; 1%). In terms of experience, a notable plurality (N= 129; 66.5%) of respondents have less than one year of experience. The experience ranges of 1-5 years, 6-10 years, 11-15 years, and over 15 years have decreasing percentages of (N = 27; 13.9%), (N = 17; 8.8%), (N = 13; 6.7%), and (N = 8; 4.1%) respectively. Regarding age groups, the majority of responding teachers (169) are young (87%) in the age group of 20-30 years, followed by (N = 16; 8%) for 30-40 years, (N = 7; 4%) for 40-50 years, and finally, a minority of 1% for those over 50 years old.

Table 2. Demographic Distribution and Experience Levels of Language teachers.

Items	N	%
Levels		
Higher “university”	33	17
Primary	107	55,2
Professional training	2	1
Secondary	52	26,8
Years of teaching experience		
11-15 years old	13	6,7
1-5 years	27	13,9
6-10 years	17	8,8
Less than a year	129	66,5
Over 15 years	8	4,1
Age group		
20-30 years old	169	87
30-40 years old	16	8
40-50 years old	7	4
Over 50 years old	2	1
Total (for each item)	**194**	**100**

4.2 Results and data analysis

Section 1: Virtual Reality

Q1: Have you integrated virtual reality into your language teaching?

Approximately (N = 120; 61.86%) of the teachers in our sample indicated that they have integrated virtual reality into their language teaching. This suggests a relatively high level of adoption of this technology among the teaching population. While 74 participants (38.14%) responded 'No'. This asymmetry indicates a predominant trend in favor of integrating virtual reality, with teachers at the 'Higher University' and 'Primary' levels seeming more inclined to integrate virtual reality into their teaching, with response percentages of 'Yes' at 69.7% and 67.3% respectively. The 'Secondary' level shows a more balanced distribution between 'Yes' (44.2%) and 'No' (55.8%) responses. The 'Professional Training' level appears to have a strong inclination to integrate virtual reality into teaching, with both responses indicating 'Yes'.

The age group "20-30 years" has the highest proportion of "Yes" responses (N = 108; 64.5%), followed by the age groups "30-40 years" and "40-50 years" with lower proportions of 62.5% and 28.6% "Yes" responses respectively. Towards the end, the "Over 50 years" age group shows a proportion of 0% "Yes" responses (2 respondents chose "No"). This indicates that as the age group increases, the attachment to this technology decreases until it disappears.

Table 3. Integration of Virtual Reality in Language Teaching by Educational Level.

Level	No	Yes	Total
Higher "university"	10	23	33
Primary	35	72	107
Professional training	0	2	2
Secondary	29	23	52
Total	**74**	**120**	**194**

Q2: If so, to what extent do you integrate virtual reality into your activities?

The data suggest a diversified approach to VR integration among our participants; The majority of teachers responded "Sometimes" (74 out of 120), indicating occasional integration of virtual reality, with a notable commitment from some teachers who opt for regular integration (32 out of 120) of VR. Meanwhile, (14 out of 120) mentioned rare and infrequent integration. These results reflect the overall openness of teachers to explore and adopt VR technologies to varying degrees, highlighting the potential for VR adoption and integration in educational contexts as familiarity with and access to the technology improve.

Table 4. Virtual Reality Integration Levels in Language Teaching Activities by Educational Level.

Levels	Rarely	Regularly	Sometimes	Total
Higher"university"	0	2	21	23
Primary	10	21	41	72
Professional training	0	1	1	2
Secondary	4	8	11	23
Total	**14**	**32**	**74**	**120**

Q3: Have you ever used virtual reality applications or activities in your language teaching?

Taking into account the total number of respondents (194), the results indicate a significant involvement of virtual reality in language teaching, with more than half of the sample using this technology: The majority of respondents (123 out of 194) have used virtual reality applications or activities in their language teaching. 71 participants have not integrated virtual reality into their language teaching. These results highlight a notable presence of virtual reality as a pedagogical tool in language teaching, indicating a positive trend towards the integration of innovative technologies in education. While also considering the 71 respondents as a potential group for future adoption, requiring awareness and training.

Q4: Please specify the types of virtual reality activities you used:

Teachers have used a variety of virtual reality activities, demonstrating diversity in the integration of this technology into language teaching. Conversation simulations and virtual cultural visits are the most commonly cited activities, with 40 and 42 respondents respectively. Only 13 respondents indicated using interactive virtual environments, suggesting less widespread adoption of this specific category of virtual reality activities. The preference for certain virtual reality activities, such as conversation simulations and virtual cultural visits, may reflect specific priorities in improving linguistic and cultural skills. The preferential choice of certain virtual reality activities, especially conversation simulations and virtual cultural visits, may be influenced by particular objectives related to enhancing learners' linguistic and cultural skills. In other words, this implies that teachers who opt more for these specific types of activities may aim to create learning experiences that emphasize language practice through simulated conversations and cultural exploration through virtual visits.

Table 5. Types of Virtual Reality Activities Used in Language Teaching.

Types of VR activities	N	%
Conversation simulations	40	32,5
Cultural virtual tours	42	34,1
Interactive virtual environments	13	10,6
Virtual pronunciation activities	28	22,8

Q5: In your opinion, can virtual be effective in improving language learning?

The majority of respondents perceive virtual reality as being at least moderately effective (21 out of 123), or even quite effective (51 out of 123), or very effective (47 out of 123), in improving language learning. Although some voices express doubts: 4 out of 123 question its effectiveness, with 1 considering it not effective, lacking any added value, and 3 finding it somewhat ineffective, the overall opinion reflects a marked optimism about virtual reality's ability to enrich language teaching and learning. In summary, among those who have not used virtual reality (71 out of 194), a significant proportion (29 out of 71) believe that VR could be very effective in im-proving language learning. This highlights the diversity of opinions, even among those who have not yet had direct experience with this technology. These results may be important for understanding expectations before actual experience with VR.

Table 6. Perceived Effectiveness of Virtual Reality in Improving Language Learning.

Effectiveness levels	No	Yes	Total
moderately effective	17	21	38
not at all effective	2	1	3
not very effective	4	3	7
Quite effective	19	51	70
Very effective	29	47	76
Total	**71**	**123**	**194**

Section 2: Artificial intelligence

Q6: Have you followed specific training on the integration of artificial intelligence in teaching?

This question explores teachers' interest and commitment to specific training on the integration of artificial intelligence (AI) in teaching. As indicated in (Table 6), the collected data show that 48 respondents are currently undergoing training on AI for education, while a majority of 110 respondents report not having received specific training on the integration of AI in teaching. However, 36 participants indicated having previously undergone such training. These results underscore an active engagement of some teachers regarding the application of AI, while simultaneously high-lighting the potential need to enhance awareness and ongoing training in this evolving educational field.

Table 7. Training Status in Artificial Intelligence Integration for Teaching.

Training status	N	%
In progress	48	24,7
No	110	56,7
Yes	36	18,6

Q7: How do you see the potential of artificial intelligence to improve language teaching?

As seen in (Table 7), the majority of participants perceive positively the potential of artificial intelligence to enhance language teaching, with a predominance of opinions in the categories "Very Effective" (53 out of 194) and "Effective" (86 out of 194). However, moderate opinions and some reservations persist, highlighting the diversity of perspectives on the use of AI in language education. The majority of participants express overall optimism regarding the contribution of AI to improving language teaching. This suggests a strong interest and openness to integrating this technology into the educational field. The moderate opinions and reservations ex-pressed underline the potential need for awareness and training to better inform participants about the current capabilities and limitations of AI in language teaching.

Table 8. Perceived Potential of Artificial Intelligence in Language Teaching.

AI Impact Levels	N	%
Effective	86	44,33
Moderately effective	41	21,13
Not at all effective	2	1,03
Not very effective	12	6,19
Very effective	53	27,32

Q8: Have you ever used artificial intelligence tools to support language teaching?

The analysis of this question appears almost equitable among the participants, with 94 out of 194 (48%) indicating they have never integrated or used AI tools, while 100 participants (52%) have used AI tools to support language teaching. This category underscores the openness and interest in experimenting with this technology to improve language teaching. Additionally, it reflects a recognition of the added value that AI can bring to teaching practices, particularly in terms of personalized learning and teaching effectiveness. Those who have not used AI tools indicate a potential need for encouragement, awareness, or training to promote the adoption of this technology in the linguistic educational context.

Table 9. Utilization of Artificial Intelligence Tools in Language Teaching.

Answer	N	%
Yes	100	52
No	94	48

Q9: In what way do you think that the integration of artificial intelligence could influence learners' motivation to learn the language?

This distribution of responses reflects a diversity of opinions on how artificial intelligence can influence learners' motivation to learn the language. The majority of participants (100) express a positive perception of this impact: 22 participants are very positive about the impact of artificial intelligence on learners' motivation to learn the language. 58 participants believe that integrating artificial intelligence could positively influence learners' motivation to learn the language. 18 participants adopt a neutral perspective on the impact of artificial intelligence on learners' motivation. Only 2 participants believe that integrating artificial intelligence into a language class could have a negative impact on learners' motivation.

Table 10. Perceptions on the Influence of Artificial Intelligence Integration on Learners' Language Learning Motivation.

AI Influence on Motivation	N	%
Negatively	2	2
Neutral	18	18
Positively	58	58
Very positively	22	22

Q10: What challenges do you foresee when integrating virtual reality and artificial intelligence into your teaching?

All anticipated challenges in integrating virtual reality (VR) and artificial intelligence (AI) into language teaching are related primarily to the complexity of software and platforms (59 participants). This may discourage some teachers from integrating these technologies into their practices. Secondly, we find that 48 participants express that teachers nowadays lack adequate technical skills, highlighting the need for technical

training so that teachers can effectively use VR and AI. Thirdly, hardware compatibility issues and the high cost of equipment, mentioned by (43 participants) and (28 participants) respectively. This remains a significant barrier, especially for institutions with limited budgets. It is truly a barrier to the adoption of VR and AI in language teaching. Not to mention that some participants anticipate a combination of challenges, such as software complexity, high equipment costs, and a lack of appropriate technical skills.

Table 11. Anticipated Challenges in Integrating Virtual Reality and Artificial Intelligence in Teaching.

Challenges	N	%
Complexity of software and platforms	59	33,1
Hardware compatibility issues	43	24,2
High cost of equipment	28	15,7
Lack of proper technical skills	48	27

5 Discussion

This study aimed to explore the perceptions of Moroccan teachers regarding the impact of Artificial Intelligence (AI) and Virtual Reality (VR) on language teaching. The findings reveal that teachers in the Tanger-Tétouan-El Hoceima region expressed a largely positive view of the integration of AI and VR in language instruction, considering these technologies as potentially revolutionary vectors for the sector. Social interactions facilitated by VR can emulate face-to-face exchanges, generating comparable emotions and offering enriching opportunities for linguistic practice and social engagement [42]. Moreover, manipulating virtual objects in these environments can reduce learning-related anxiety and enhance performance by allowing students to practice vocabulary and grammatical structures in a safe and controlled setting [43]. AI tools, on the other hand, offer personalized and diversified learning experiences that cater to the specific needs of learners, thereby optimizing learning time and providing targeted support [44] [45]. These technologies not only enhance pedagogical efficiency but also facilitate cultural immersion through interactive and realistic scenarios, promoting a deep understanding and appreciation of diverse cultures.

Despite the numerous advantages presented, the implementation of Virtual Reality (VR) and Artificial Intelligence (AI) technologies in language education faces significant challenges, particularly concerning adequate infrastructure and the availability of essential tools for effective integration into pedagogical contexts. Teachers often find themselves lacking the necessary support or training to effectively administer VR learning environments and to develop engaging pedagogical activities [30]. This situation underscores the need to provide educators with the appropriate resources and skills to seamlessly incorporate VR into their educational programs. Furthermore, meticulous planning and ongoing support are essential to ensure that VR experiences lead to positive learning outcomes and avoid potential disadvantages [46].

Concurrently, AI-driven language learning tools encounter difficulties in capturing the cultural and contextual nuances of language, such as idiomatic expressions, regional accents, and dialectal variations. This limitation can result in misunderstandings or communication errors, particularly in the acquisition of languages with complex structures. AI requires a better understanding of diverse cultures since it cannot inherently do so itself [47]. Additionally, it is possible that these AI tools may not detect or correct errors as precisely as a teacher, leading learners to develop incorrect habits. Any integration of these technologies needs to be aligned with societal values and prioritize well-being: educators, learners, parents, developers, and policymakers, according to reports from UNESCO and the OECD (European Commission and European Parliament).

It is, therefore, imperative to adopt a holistic approach that integrates various ethical dimensions, such as data ethics, learning analytics ethics, and respect for human rights, to ensure an ethical and responsible implementation of AI and VR in a language classroom. This approach should aim for the mutual benefit of all stakeholders while adhering rigorously to fundamental ethical principles. By harnessing the capabilities of analytics, educators and educational institutions are obligated to ensure that the use of data and analytical techniques adheres to established ethical standards, thereby guaranteeing responsible and respectful practice that preserves the confidentiality and integrity of individuals [48].

6 Conclusion

In conclusion, the present study has identified several advantages associated with the use of Virtual Reality (VR) and Artificial Intelligence (AI) in educational contexts. These benefits include increased motivation and interest from learners, the opportunity to address educational situations that were previously inaccessible due to limitations of traditional methods, and notably improved learning outcomes. However, the integration of these technologies also presents challenges, such as the absence of a universally accepted pedagogical approach, inadequate training of educators to effectively integrate VR and AI, high costs associated with acquiring and maintaining technology, concerns regarding ergonomics for students, and even potential health risks arising from prolonged use of VR.

Indeed, future research could employ other varied techniques, such as workshops and more in-depth interviews, to encourage a deeper exploration of these technologies in the service of language teaching and learning. Despite these limitations, VR and AI have the potential to have a significant impact on education, particularly in the field of language learning. The ability of these technologies to enhance student engagement, understanding, and practical application of information across diverse educational contexts is a potent asset. Moreover, VR and AI can facilitate complex procedures that would otherwise be time-consuming or unfeasible. For instance, the development of intricate code can be streamlined, and virtual simulations can be created with just a few prompts, leveraging the power of AI.

By acknowledging the advantages and challenges associated with VR and AI in education, we can work towards a future where these technologies are effectively integrated into the learning process, ultimately enhancing educational experiences for all students.

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