

Virtual Reality in preschool language development: Teachers' perceptions of its effectiveness

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Abstract

In a time when technology is continuously redefining teaching and learning methods, virtual reality (VR) is emerging as an innovative tool with the potential to enhance preschool children's language skills by creating engaging and interactive environments. However, the integration of immersive technology introduces new demands on the teaching profession, requiring each educator to adapt and respond accordingly. This article investigates early childhood educators' perceptions regarding the use of virtual reality (VR) as a teaching tool for developing preschoolers' language abilities. In the context of a rapid shift toward digital education, the research highlights both the educational potential of VR and the challenges experienced by teachers in integrating this technology. Based on a quantitative study conducted among 316 preschool teachers, the article analyzes perceptions of VR effectiveness, the factors shaping these perceptions, the level of integration, and the perceived barriers. The study emphasizes the importance of developing digital pedagogical competencies and proposes directions for training and institutional support.

Keywords: *Virtual reality (VR), teacher perceptions; technology integration; language Development; Early Childhood Education.*

1. Introduction

The integration of virtual reality (VR) - based technologies in education—defined as an interactive digital technology that enables the simulation of immersive three-dimensional environments, accessible through specialized equipment—frequently raises questions regarding its necessity and effectiveness within the educational process. This article aims to critically examine the educational potential of VR in early childhood education, with a focus on

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teachers' perceptions and attitudes as key factors in the successful adoption of this technology.

Institutional reluctance, rooted in the preservation of traditional teaching methods, stands in stark contrast to the profile of the digital native—accustomed to virtual environments, flexible in the face of change, and capable of interacting intuitively with emerging technologies. In the long term, this discrepancy risks creating a disconnect between educational expectations and the digital reality in which children grow and develop (Ceobanu, 2016). In this context, the school must not remain a mere transmitter of information—whose relevance is often short-lived—but must evolve into a dynamic space of innovation, critical reflection, and the development of a solid epistemological identity.

The school, as a reflection of society, should not only mirror social transformations but actively anticipate and manage them, assuming responsibility for preparing future generations to navigate the complexity of a constantly evolving reality. This mission demands a profound rethinking of the role of educators in the digital age. Adapting to new requirements involves not only technological training but also a shift in educational mindset—a pedagogical realignment with contemporary social and technological dynamics.

As emphasized by Khukalenko and colleagues (2022), teaching credibility and authenticity rely on the alignment between discourse and practice. The meaningful integration of technology in early childhood education requires that educators themselves actively use these tools, thereby serving as models of adaptive and engaged learning.

2. The revision of the speciality literature.

2.1 VR in Education: Opportunities and Risks

The specialized literature outlines two main directions regarding the integration of virtual reality (VR) in education.

The first perspective highlights VR's educational potential, arguing that its distinctive features—interactivity, multisensory engagement, and immersion—align with the constructivist paradigm of learning (Kaplan-Rakowski & Wojdyski, 2018). These characteristics support the cognitive and emotional involvement of

preschoolers in engaging learning environments designed to stimulate motivation, curiosity, and information retention. From this viewpoint, VR significantly contributes to the optimization of learning processes by facilitating the management of cognitive overload (Robinson & Gilabert, 2007; Chang, Park & Suh, 2024).

Interactive simulations and immersive learning create new educational ecosystems capable of restructuring educational content in ways that are accessible to both perceptual and symbolic systems (Istrate, Velea, Ceobanu, 2025), enhancing sensory perception and expanding both the capacity and duration of human memory. Recent studies emphasize multiple benefits of using VR in education, including memory reinforcement (Krokos et al., 2019), reduction of anxiety (Gruber & Kaplan-Rakowski, 2020), and overall improvement in the learning experience (Kaplan-Rakowski et al., 2023). Against this backdrop, VR has been considered by some researchers as the "educational tool of the 21st century" (Rogers, 2019). The second perspective is more reserved or even critical, pointing out risks such as overstimulation, technology dependence, or weakened social interaction. The high level of immersion and the feeling of presence can negatively impact the ability to concentrate on educational tasks, especially in fields such as the history (Parong & Mayer, 2021), or foreign language learning (Saab et al., 2021).

2.2 Digital Pedagogical Competence

In this ambivalent context, the role of early childhood educators becomes essential. According to the Diffusion of Innovations Theory (Rogers, 2010), perceptions and attitudes toward technology significantly influence its adoption and integration into educational practice. Alfalah (2018) identifies several key factors in the acceptance or rejection of educational technologies: stakeholder perceptions (teachers and students), institutional support, logistical barriers, individual motivation, and prior experiences with technology. Along the same lines, Carrier, Damerow, and Bailey (2017) emphasize that the success of digital learning—including through VR—depends not only on the technology itself, but primarily on the pedagogical foundations that support it. The effectiveness of a digitally mediated educational experience relies on the teacher's ability to provide meaning, coherence, and direction. Like any new

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educational space, immersive environments must be explored, structured, and shaped to become functional and valuable contexts for preschoolers' cognitive development. As Couros (2015) noted that technology will never replace great teachers, but in the hands of great teachers, it's transformational.

The European DigCompEdu framework highlights the importance of developing teachers' digital competences, emphasizing the effective integration of technology in education. At its core is the teacher's ability to adapt teaching strategies to leverage digital tools, assess their impact on learning, and create learner-centered experiences that promote digital literacy and responsible online behavior.

Digital pedagogical competence is defined as the combination of knowledge, skills, and attitudes that enable teachers to effectively use digital technologies in education:

- Knowledge includes understanding how to use and implement digital tools, as well as identifying their educational opportunities and risks.
- Skills involve the critical ability to identify, extract, and analyze information, evaluating its relevance and applicability.
- Attitudes relate to personal traits that shape how educators integrate and use technology in teaching.

Supporting this transformation, the TPACK model (Technological Pedagogical Content Knowledge) offers a framework for understanding the types of knowledge educators need to integrate technology effectively (Mishra & Koehler, 2006; Ilie, 2022). A digitally and pedagogically competent teacher must successfully combine three core domains: technological knowledge, pedagogical knowledge, and content knowledge. The model emphasizes that effective technology use in education requires not only technical skills, but also a deep understanding of pedagogical strategies and subject-specific content.

In the context of virtual reality, this means designing immersive environments that foster exploration, collaboration, and active learning—while continuously adapting teaching methods to the potential of emerging technologies (Nijku et al., 2020). Practically, the teacher becomes a technology specialist from a pedagogical

perspective. An inappropriate choice of applications or content can significantly impact the educational experience of young children.

3. Research methodology

3.1 Instrument

This study employed a quantitative-descriptive research design to explore preschool teachers' perceptions of the effectiveness of virtual reality (VR) technologies in supporting the development of linguistic skills in young children. The research is part of a broader investigation into early childhood educators' digital pedagogical competences. The study was guided by the following research questions:

1. What are preschool teachers' perceptions of the effectiveness of VR technology in developing children's linguistic skills?
2. What is the relationship between the level of VR integration in educational activities and the perceived effectiveness of VR in supporting language development?

3.2 Data Collection

A structured questionnaire titled Perception of VR Integration in Language Development was used for data collection, developed based on a comprehensive review of the relevant literature. Items related to VR integration were adapted from the model proposed by Khukalenko et al. (2022), while those related to language development were constructed using the theoretical framework of Ihmeideh (2009).

The questionnaire is structured into three sections: (1) demographic data, (2) perceptions of VR effectiveness in language development, and (3) the level of VR integration in teaching practice. Perceptions were assessed using 15 items on a 5-point Likert scale. The level of integration was evaluated according to six stages adapted from Wozney et al. (2006) by Khukalenko et al. (2022), which reflect the specific educational application of VR: awareness, learning, understanding, familiarization, adaptation, and creative application.

3.3 Sample

Participants were selected using convenience sampling, targeting preschool teachers from the South-Muntenia region. The

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study included 316 female educators from 20 public kindergartens in the region. Of these, 75% (n = 237) had more than five years of professional experience, while 25% (n = 79) were in their first five years of teaching. Respondents were drawn from both urban and rural areas, ensuring a balanced distribution in terms of educational context.

4. Analysis and interpretation of the research data

4.1 Teachers' perceptions of the effectiveness of vr technology in language development activities

Mean (M) and standard deviation (SD) values were calculated for each of the 15 items measuring perceived effectiveness of using VR in language development activities, rated on a 5-point Likert scale (Table 1).

Table 1. Mean scores of the items on the perceived effectiveness of using VR

Statement	M	SD
1. Using virtual reality in teaching activities contributes to vocabulary development and understanding of linguistic concepts.	4.42	0.98
2. It makes classroom management more difficult.	4.13	1.01
3. It promotes the development of basic language skills (letter recognition, sentence formation, storytelling ability).	4.35	1.00
4. It is effective only if adequate technical resources are available (VR headsets, compatible computers, functional infrastructure and connectivity).	4.58	1.01
5. It succeeds only if teachers receive adequate training in VR use.	4.61	0.89
6. It is more effective than traditional methods in language development because it offers interactivity and immersion.	3.77	1.09
7. It is an effective tool for preschoolers of all age groups (young, middle, and older).	3.61	0.95
8. It is effective if teachers carefully select VR content to ensure it meets children's linguistic needs.	4.21	1.09
9. It allows customization of language activities according to each child's level.	4.25	0.99
10. It increases preschoolers' motivation to participate in language learning activities.	4.63	0.90
11. It requires software training, which can be time-consuming.	4.12	1.08
12. It facilitates practicing pronunciation and developing phonological skills.	4.05	1.05
13. It requires extra time to plan learning activities.	4.43	0.99

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14. It limits direct interaction between children and teachers if not used properly.	4.18	0.88
15. It is effective whether activities are organized individually or in groups.	4.22	0.96

Data analysis highlights that the highest mean scores were associated both with the perceived benefits of VR technology and with the challenges of its implementation in instructional settings. The highest score was recorded for the item stating that VR increases children's motivation to participate in language learning activities ($M = 4.63$, $SD = 0.90$), suggesting that virtual reality is perceived as a strong motivational tool. Immersion, interactivity, presence, and multisensory engagement—key features of VR—are recognized in the literature for their motivational potential (Istemic Starčič et al., 2016; Lindahl & Folkesson, 2012a). Similarly, item 9 (*Enables personalization of language activities according to each child's level*) also received a high score ($M = 4.25$, $SD = 0.99$), reflecting positive teacher perceptions regarding VR's capacity to support differentiated learning. Prior research supports this view, with many educators believing that digital technologies can enhance children's learning (Brown, Englehardt & Mathers, 2016; Mertala, 2019; Izumi-Taylor, Ito & Gibbons, 2010; Lindahl & Folkesson, 2012a, 2012b). VR appears particularly promising in this regard, being part of young children's increasingly multimodal learning environment (Arnott & Yelland, 2020).

In terms of language development, VR is perceived as effective for vocabulary enrichment and concept understanding (item 1, $M = 4.42$), suggesting that educators see VR as supporting the connection between word form and meaning. This finding aligns with research showing that immersive environments enhance learning through repeated exposure to new concepts in engaging contexts (Donahue & Fox, 2012). Likewise, item 3 (*Promotes the development of basic language skills such as letter recognition, sentence formation, and storytelling*) received a high mean score ($M = 4.35$, $SD = 1.00$), indicating the perceived usefulness of VR's multisensory experience in strengthening retention and expressive skills in preschoolers.

However, lower scores were found for items such as pronunciation practice (item 12, $M = 3.10$), likely reflecting the need

for human interaction and corrective feedback, as emphasized in the literature.

Teachers also acknowledged challenges to implementation, such as classroom management and the additional time needed for planning. These concerns are consistent with existing research on resistance to educational change. Respondents noted that VR integration may require more time for organizing learning activities, which may need to be conducted in small groups or individually to avoid classroom management difficulties.

Like other digital tools, VR disrupts the traditional structure of instruction, and this may contribute to reluctance among some teachers. Many feel confident with traditional methods and perceive technology integration as an added burden outside their core responsibilities. Therefore, the time and effort required to learn and implement VR can reduce its appeal.

Perceived effectiveness also varies by age group. For example, item 7 (*VR is effective across all preschool age groups*) received a relatively low score ($M = 2.59$), suggesting that teachers consider VR more suitable for older preschoolers. This aligns with studies indicating that both in-service and pre-service teachers tend to view technology as a “friend” when used with older children (ages 5–6), but a “foe” when considering the developmental needs of younger learners (Dong & Newman, 2016).

4.2 Level of virtual reality technology integration in relation to perceived effectiveness in language development

According to the data presented in Figure 1, the majority of participants (75%) are situated within the first three stages of the VR technology integration process: awareness (26.6%), learning (20%), and understanding (28.4%). Only 15% reported feeling comfortable using VR in educational settings, while a small percentage (10%) are in the advanced phases: adaptation (8%) and creative application (2%).

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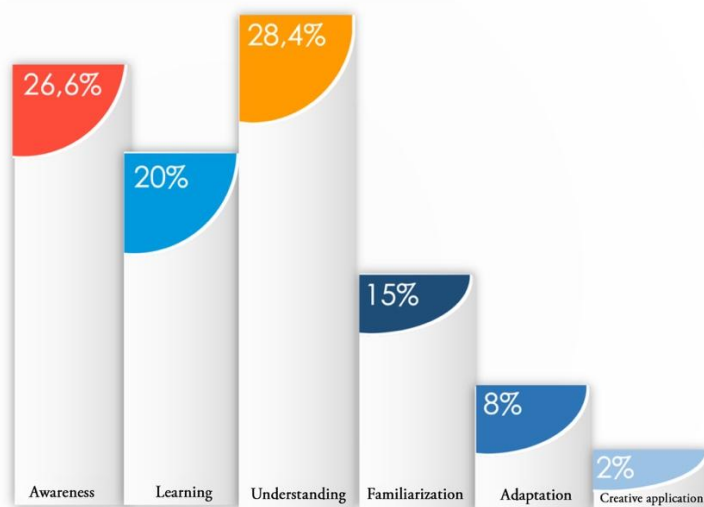


Figure 1 – Self-Assessed Level of Integration

The level of confidence educators have in their own digital skills significantly influences their perception of VR effectiveness in language development activities. Spearman correlation analysis reveals two major trends:

Positive correlation – The deeper educators' understanding of how to implement VR in language development activities, the more likely they are to develop strong, positive beliefs about its effectiveness in enhancing language skills (Table 2). Educators who engage directly with the technology tend to form tangible and positive convictions regarding its educational benefits.

Table 2. Significant positive Spearman correlations between variables

Item	Correlation with the level of integration (Spearman)
Item 1	0.839
Item 3	0.762
Item 6	0.894
Item 9	0.846
Item 12	0.854

Negative correlation – As the level of integration increases, the perception of obstacles and barriers decreases (Table 3). This trend is also supported by previous research (Radianti et al., 2020), which emphasizes that familiarity with emerging technologies reduces resistance and associated concerns. Participation in training programs and the accumulation of experience in real-life contexts support the critical reassessment of perceived barriers and facilitate the integration of VR into educational activities.

Table 3. Significant negative Spearman correlations between variables

Item	Corelație cu nivelul de integrare (Spearman)
Item 2	-0.756
Item 11	-0.573
Item 14	-0.887
Item 15	-0.800

5. Discussion

The overall perspective is positive. In pedagogical contexts, virtual reality (VR) can serve as a valuable tool to support and enhance teaching and learning, particularly in areas such as vocabulary development and understanding linguistic concepts (M=4.42), as well as story retelling, recall, and letter recognition (M=4.35). The literature confirms that digital technologies offer significant learning opportunities for young children by enabling participation in meaningful communication situations (McPake et al., 2013), expanding world knowledge (Davidson, 2009), supporting early literacy (Neumann, 2016), and developing phonological awareness (Falloon, 2020). Interactive and multisensory learning environments created through VR can support a pedagogy centered on play, communication, and exploration (Dwyer et al., 2022).

However, a significant proportion of educators do not yet feel prepared to use VR effectively. Teachers' beliefs are often shaped by previous personal experiences (Nespor, 1987; Ertmer, 2005), suggesting that a lack of practical exposure can lead to skepticism or reluctance regarding the educational potential of immersive

technologies. This highlights the need for ongoing professional development, framed by the TPACK model (Technological Pedagogical Content Knowledge) (An & Reigeluth, 2011; Ferrari, 2013). Training programs should help teachers connect technology, pedagogy, and content through authentic integration experiences.

Findings indicate that early childhood educators play a critical role in either facilitating or limiting the use of VR in learning environments. The research confirms a clear alignment between teachers' self-perceived level of VR integration and their beliefs about its effectiveness in language development. VR use must be tailored to the age, developmental level, and specific needs of the children (Vidal-Hall et al., 2020).

6. Conclusions

The rapid evolution of digital technologies has not only reshaped childhood experiences but also prompted educators to reassess their pedagogical approaches. Digital pedagogical competence is now an essential component of the teaching profession, requiring the ability to select and apply digital tools appropriately based on children's age and developmental stage (Murcia et al., 2018).

To ensure the meaningful integration of VR, it is essential to identify both the opportunities that enrich educational practice and the challenges or ethical concerns that must be addressed. VR integration should be grounded in strong pedagogical principles that align innovation with traditional educational values (Istrate et al., 2025). While VR clearly has the potential to engage preschoolers and create meaningful learning experiences, its adoption remains slow due to varying levels of teacher readiness, attitudes toward technology, and access to resources.

A first step involves creating specialized training programs that go beyond basic technical familiarization and provide educators with concrete opportunities to creatively integrate VR into innovative teaching scenarios. Such training should emphasize not only the technical dimension, but also pedagogical strategies and content adaptation to children's learning styles.

In parallel, a supportive infrastructure is essential—access to VR equipment, technical support, and relevant educational resources should be ensured. This will allow educators to see VR not as an added pressure, but as a genuine opportunity to enrich the learning process.

Ultimately, successful implementation depends on three key factors: the pedagogical foundation supporting the technology, educators' attitudes—shaped by past experiences—and the availability of appropriate technical resources. Only through a coherent and sustained approach can we fully realize the potential of VR to support language development in early childhood education and meet the needs of 21st-century learners.

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