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The use of Augmented Reality and Virtual Reality Technologies in Teaching Foreign Languages

Abstract. *The article is devoted to analyzing the educational potential of augmented reality (AR) and virtual reality (VR) technologies in teaching foreign languages, specifically in the professional training of future teachers. The possibility and benefits of introducing AR technologies in the system of teachers' professional training are based on the experience of the discipline «Modern Technologies of Teaching a Foreign Language to Preschool Children», which is taught during the first (bachelor's) level of education to students of the 012 Preschool Education Specialty at the Faculty of Pedagogical Education in Borys Grinchenko Kyiv University. The literature analysis and the description of the empirical experience of the interaction and implementation of AR and VR technologies in the course content are the major research methods used in this article. The article performs an analysis of the advantages and disadvantages of AR and VR technologies in foreign language teaching. The didactic potential of both aforementioned technologies is identified, including the improved learning environment, increased motivation, interaction, and content retention, the richness of multimedia modes, better visualization, and suitability for special learning needs. The article emphasizes the influence on multiple language skills and vocabulary development (vocabulary acquisition, phonics, pronunciation, comprehension, writing, reading, speaking, improved communication, and general learning skills). The data received proves the suitability and benefits of implementing current AR technologies in the professional training of future teachers and language teaching in general, as opposed to VR technologies that are limited*

due to their drawbacks that outweigh their current advantages, but still allow them to be considered a very powerful tool in the near future. Still, their partial accessibility by learners gives them the right to be used in terms of the realization of individual approaches. As a result of this article, a list of AR and VR technologies that could be used in foreign language teaching is revealed. The perspective of future research could focus on the analysis of specific technologies from AR or VR groups.

Keywords: *AR technologies, digital skills, foreign languages teaching, modern technologies of teaching, VR technologies.*

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Introduction. With the advancement of technology and the implementation of various innovative learning tools, the question of the widespread introduction of Augmented Reality (AR) and Virtual Reality (VR) technologies in education, specifically in teaching foreign languages, remains a matter of time. In terms of rapid digitalization and the high requirements for the digital skills of modern teachers, the question of investigating the educational potential and further implementation of AR and VR technologies in professional training, as well as foreign language teaching, becomes an urgent issue. The scientific research on the educational potential of the use of AR in education has been ongoing for twenty-five years since the appearance of the first education tool for teaching three-dimensional anatomy (Garzón, 2021), while that of VR, though gaining attention in the 1980s, dates back to the modern era that started in 2012 with the introduction of the Oculus Rift project (Smutny et al., 2019). AR, together with VR technologies, offers a unique learning experience that meets the needs of 21st-century learners in a superior way and gives modern teachers a wide range of teaching opportunities for engagement, immersion, and experiences that were previously difficult or even impossible.

This study aims to analyze and summarize the educational potential of using AR and VR technologies in foreign language teaching, as well as in the process of training future

teachers. It also provides an overview of the affordable software that can be used for both teaching and professional training.

Methodology. To achieve the aforementioned aim of the study, the observation and descriptive investigation methods, as well as the generalization of scientific publications were used. To prove the education potential of AR and VR technologies implementation in future teachers' professional training the description of the empirical experience was also applied.

Analysis of the recent research and publications. The new forms and technologies of learning, in terms of future teacher training, are widely analyzed in relation to digitalization and distance learning. Lyudmyla Khoruzha, Volodymyr Proshkin, Olga Kotenko, and Eugenia Smyrnova-Trybulska emphasize the necessity of shaping the digital competence of modern teachers (2019). Natalia Kosharna and Lada Petryk reveal the specifics of teaching foreign languages to students in the 013 «Primary education» and 012 «Preschool education» specialties in terms of the «HyFlex learning» model (2022), and together with Larysa Udovychenko, Nataliia Kuzminets, and Olena Stadnik, in terms of the use of blended learning technology (2021). Scientists Liudmyla Nezhyva and Svitlana Palamar overviewed the future primary school teachers' training in terms of the requirements for implementing AR in literacy and literary reading lessons (Nezhyva & Palamar, 2021). In terms of the analysis of the application of AR and VR technologies in the architecture, engineering, and construction industries, the scientists Tan, Xu, Li, and Chen concluded that their application to education and training can improve the teaching strategies used today in a more diversified educational environment (2022).

The process of the introduction of AR and VR technologies in education, in general, has become possible due to the rapid increase in the number of affordable hardware and software, making it a focus of recent research and feasible for the education domain. This is the reason the process of their introduction is sometimes compared to reinventing education (Elmqaddem, 2019). While there are still some doubts concerning the efficiency of the aforementioned technologies, the study of Elmqaddem proves that their

implementation is more suitable for the modern learner, who prefers interaction, entertainment, involvement, and manipulation of objects (Elmqaddem, 2019, p. 235). Thus, the researcher admits that the potential of AR and VR technologies is currently not being fully utilized.

Even though AR and VR technologies are considered comparatively new to the education sphere, particularly in foreign language learning, there is significant research that should be mentioned as a contributing factor to further analysis and investigation of the topic. While Juan Garzón gives a general overview of AR in education since the development of the first application designed for educational settings (2021), Smutny et al. present a review of VR applications in education and training (2019). Al Farsi, G. et al. reviewed the existing VR applications in higher educational institutions in their paper (2021). Scientists Karacan and Kemal offered a classification of AR applications (image-based AR, creation-based, and markerless AR) and overviewed the AR technology as a learning tool in foreign language education (2021, p. 70), while researcher Lan developed a classification of VR applications for language learning (2020).

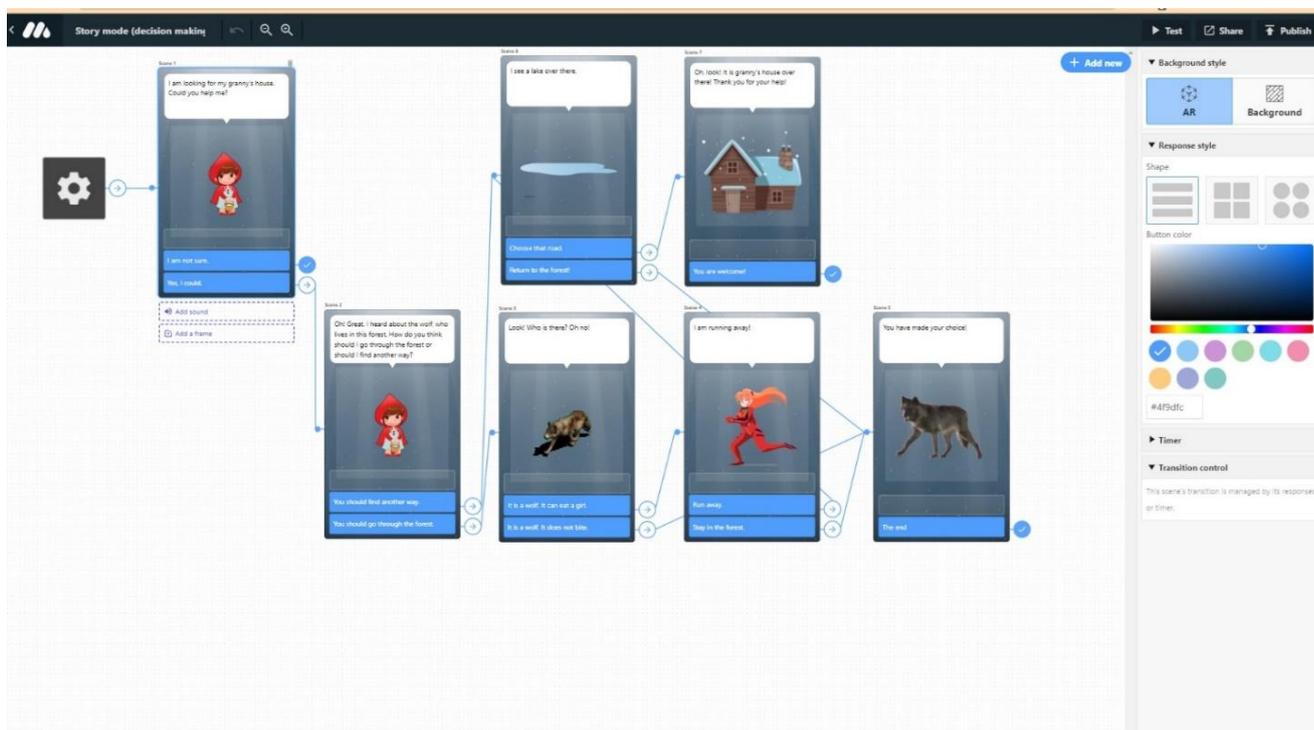
Though there are studies devoted to the use of AR and VR technologies in language learning, they do not involve the aspect of their introduction to future teachers' professional training, which makes the investigation of this question topical.

Research results. The widespread adoption of AR can be traced back to the popular game app Pokemon Go, which was released in 2016. Since then, the effectiveness of AR and VR technologies in scientific fields has been demonstrated, while their implementation in education has only begun more recently. One of the reasons for the delay was the high cost of hardware and content. However, with the advancement of technology and increased affordability, the integration of AR and VR in education has gradually increased. Considered one of the most influential technologies, AR is now becoming a trend in foreign language learning as well (Alakärppä et al., 2017). AR and VR apps can be easily found on App Store or Google Play and can be used in both classroom and individual settings.

Based on the defined categories of AR applications, Octaland 4D+, Animal 4D+, Space 4D+, Dinosaur 4D+, Ocean 4D+, Humanoid 4+, Cars 4D+, and History of Aircraft 4D+ developed by Octagon Studio represent the subgroup of Image-based AR (Karacan & Kemal, 2021, p. 70). This particular group of AR includes applications that have limited functionality and require the user to purchase sets of flashcards to be used in the classroom. Depending on the chosen set, as in the case of Octaland 4D+, the application gets acquainted with occupation cards, or as in the case of Humanoid 4+, it allows for studying the human body and its parts. In addition to traditional interaction with the set of cards, an application such as Animal 4D+ contains a spelling game that is specifically suitable for language learning needs. The aforementioned Octaland 4D+ also offers a coloring book that could be useful for describing a character's activity in terms of learning a topic devoted to human appearance.

The second and third subgroups of AR applications are represented by the Metaverse application, which either offers ready-to-use materials or allows the creation of personalized products. Currently, Metaverse is considered one of the best free applications for creating AR experiences. Although it is limited in visual content (picture-based), it is user-friendly and allows users to add their own pictures outside of the website. The application has a wide variety of opportunities for teaching multiple language skills and vocabulary, including speaking, storytelling, and comprehension activities. Figure 1 below shows the interface of the application and an example of a story created in it. In comparison with other software such as Unite AR, which requires payment and has a free trial period of 14 days, Metaverse offers significantly more benefits. Among the numerous options, the application can add its own characters, choose from a variety of scenes, add video and polls, attach music to the chosen scenes, and create custom collections that are called “walls.” The created content can be shared publicly or kept private via link or QR-code. From a methodological point of view, it can be used as a narration tool, for vocabulary and grammar comprehension, storytelling, trivia games, quizzes, and more.

Figure 1. The Metaverse website interface and a sample of experience creation



The other AR applications that are used in foreign language learning can be found via the App Store (Mondly AR, Catchy Words AR) or Google Play (Mondly AR, ARLOOPA, Animal AR 3D Safari). Most of them offer some free content, while others require payment. The specifics of AR applications lie in the fact that they appear, develop, and disappear quickly. Therefore, the best way to find a resource that fits particular educational needs and tasks is to check the App Store and Google Play constantly or be ready to create personal content in applications such as Metaverse.

The number of available and affordable VR applications aimed at learning foreign languages is comparatively lower than that of AR. The scientist Lan offered to classify VR into 5 groups of applications: entertainment, social networking, visual experiences, creation, and operation (2020). Each category is characterized by certain specifics. Some

examples of them are discussed further in the article.

One of the digital platforms, Steam, offers 4,562 VR video games, 296 of which belong to the education category (as of February 12, 2023), which are further divided into over 40 subcategories. The particular language learning game that immediately appears in the list of VR games is Mondly: Learn Languages in VR (fee-based). The game is similar to the Mondly AR application and allows one to build fluency in 30 languages. Due to speech recognition and chatbot technology, the game offers a uniquely immersive experience.

Among the applications specifically aimed at language learning is the Language Lab. Its special feature is the way language acquisition occurs, which is very similar to the process of small children learning their native language through immediate interaction with the language itself. The short lessons are based on the TPR approach offered by Dr. James J Asher and focused on A1-B1 levels. That means that a learner does certain things with objects in a repetitive manner, which is addressed as learning by doing. The 2022 video game is fee-based, which means it includes content that requires further payment. The Language Lab offers several game options: lessons, open worlds, games, and community or social space. The example of the lesson mode is presented in Figure 2, while the game mode is depicted in Figure 3. The social space offers a unique opportunity to chat with native speakers or those who learn foreign languages via the Discord instant messaging social platform. Currently, the game is also characterized by early access, which grants the users the opportunity to leave feedback on the lessons. The distributors of the game, except for the traditional and co-op language lessons, are working on community language exchanges, as well as on the ability of speech recognition.

Figure 2. The Language Lab (lesson mode)



Figure 3. The Language Lab (game mode)



The applications such as *Mayflower Reflections* and *Solar System VR* offer cinematic narration and represent the discovery VR category. The research on this type of experience emerges to a significant degree only since 2017 (Gödde et al., 2018). One of the specific features of this new type of narration is the freedom to choose the viewing direction that is achieved due to 360-degree immersion. Despite the role of the passive observer such a type of VR experience makes emphasis on narration itself. Thus, the focus of *Mayflower Reflections* is the story of the 1620 Mayflower Voyage, an inspiring tale, and completely free.

Figure 4. *Mayflower Reflections* (game mode)



Cinematic narration and discovery VR have made it possible to travel through space. As a result, *Solar System VR* offers an educational journey to explore planets and moons. Unlike *Mayflower Reflections*, it requires payment, but the price is lower than that of most VR video games. Additionally, compared to the aforementioned VR, *Solar System VR* is more immersive and provides a greater variety of scenes, such as landing on the surface of a moon. The use of this type of VR in foreign language learning includes storytelling, improving listening skills, and introducing the integrative approach to teaching, such as combining English and geography subjects. The game mode is represented in Figure 5.

Figure 5. Solar System VR (game mode)



Such applications as Great Paintings VR and The Omni Gallery represent another category of VR, which is visual experience. They allow users to visit museums and customize their interior, creating a unique museum visiting experience that is accompanied by music and a unique atmosphere. Great Paintings VR is a free VR game that contains more than 1000 famous paintings from the great museums of the world. Each painting can be studied individually or via an art gallery that is organized according to the particular art movement or painter. The settings of the 2021 game, despite the lack of traditional gaming components, give the viewer the ability to customize the entire exhibit, from changing the color and pattern of wallpapers, doors, frames of the paintings, and floor to the choice of music that will accompany one's visual experience. Each painting, as is common in real museums, has a short description that can be heard by choosing a specific menu option. The described features and game modes of Great Paintings VR are represented in Figure 6. Such video games could be useful for learning art topics in English lessons and, like those in the discovery VR category, allow for the realization of using the integrative approach to teaching and combining English and art classes. They are also ideal tools for quizzes and

trivia games in English lessons.

Figure 6. Great Paintings VR (game mode)



Figure 7. The OmniGallery (game mode)



The OmniGallery is another free virtual museum. In the 2021 VR video game, it is described as a multiverse of art exhibits, with several major exhibits including the Classic Hill and the Diorama-Rama, which offer different works of art. The first exhibit provides access to the best of «Pre-Modern» art, with 3D scans and sculptures, while the second exhibit features 3D figures and scans, where enthusiasts of English culture can find and admire Stonehenge. The game mode is shown in Figure 7. Other video games like Google Earth VR and BRINK Traveler offer opportunities for virtual travel around the world, allowing for the integration of geography and foreign language learning, as well as quizzes and projects without leaving the classroom. The game mode of Google Earth VR is represented in Figure 8.

Figure 8. Google Earth VR (game mode)



While Google Earth VR gives free access to almost any place in the world BRINK Traveler requires payment. The game that came out in 2021 features 20 beautiful spots within 13 locations. It offers a virtual guide that explains everything considering the surroundings. Also, it allows users to collect points of interest and shoot photos. The specific feature that is offered by the developers of the software is the ability to download the particular location that you wish to visit instead of downloading all the content of BRINK Traveler. Also, as with the other VR video games, it promises regular content updates. The game mode of the BRINK Traveler is introduced in Figure 9.

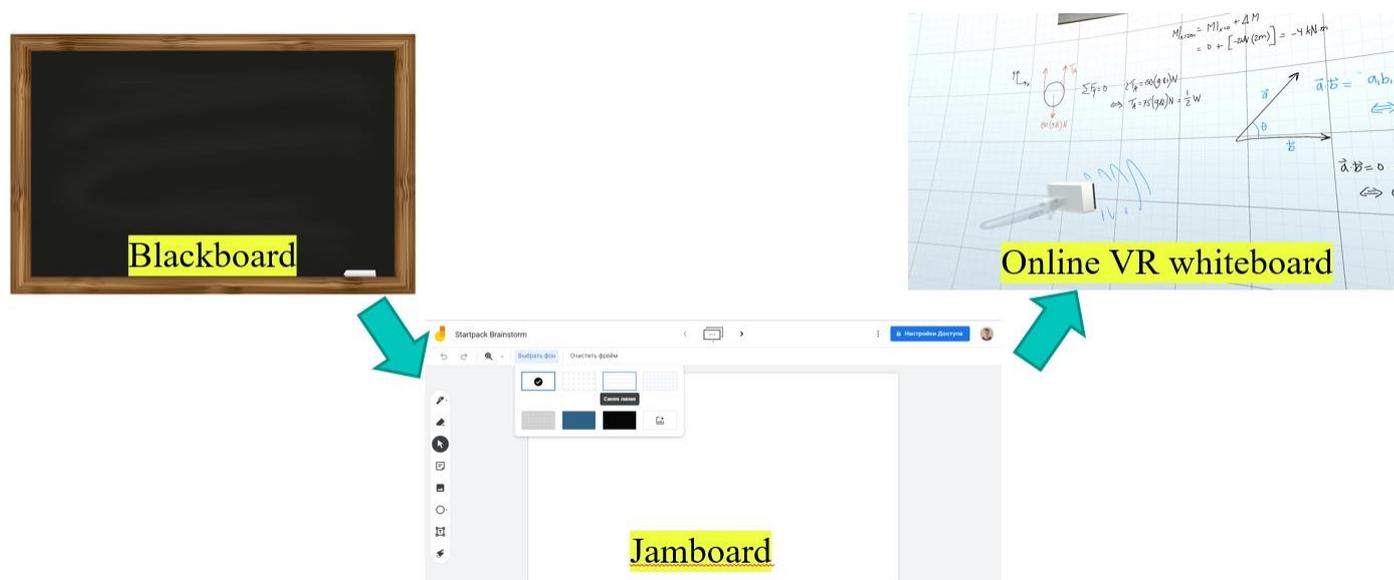
Figure 9. BRINK Traveler (game mode)



Except for VR video games from the categories mentioned above, there are other useful educational tools foreign language teachers could implement in their professional activities. One of them is Dry Erase: Infinite VR Whiteboard. This is an environmentally-friendly option that can substitute traditional paper, chalk, and board, and keep all the memos, lesson plans, and explanations of different grammar rules and materials for the

future. It also allows for editing and adding new information, and the ability to share with an unlimited audience, which is why it's called an infinite whiteboard in VR. Dry Erase: Infinite VR Whiteboard requires payment and offers unlimited writing space, a wide choice of colors (over 750 markers with various thickness combinations), and the ability to import images and export created assignments, presentations, and others. There are also unique advantages of Dry Erase to compare with similar online tools such as Jamboard. The ability to record sessions and broadcast them on YouTube makes Dry Erase: Infinite VR Whiteboard the perfect VR tool for both foreign language learning and the professional training of future teachers. The analysis of the aforementioned VR tool represents the evolution of the traditional blackboard, which is depicted in Figure 10.

Figure 10. Dry Erase: Infinite VR Whiteboard (Evolution of traditional tool seen in VR)



The use of the aforementioned AR and VR technologies in foreign language learning has already been emphasized. They offer a number of advantages such as improving the learning environment, increasing motivation and interaction, contributing to content retention, offering a rich variety of multimedia modes, assisting with better visualization,

and demonstrating suitability for special learning needs, making them a great universal tool in education. However, challenges occur in the process of their introduction, such as the lack of technical knowledge and experience, limited content and language input of free software, material costs, and others. Despite these issues, AR technologies remain more widespread and affordable compared to VR. The material cost of VR technologies makes their use more limited compared to AR. While most AR technologies require the use of students' smartphones, the use of VR requires expensive VR devices, specific hardware and software. Moreover, the cases of physical discomfort should also be taken into consideration. The drawbacks of VR limit its use to individuals who already have these technologies at home, making personalized learning possible in such situations. While the question of the challenges of introducing AR and VR technologies in foreign language learning is still being studied, the influence of these technologies on multiple language skills, vocabulary development and acquisition, phonics, pronunciation, comprehension, writing, reading, speaking, and others make further research in language learning inevitable.

The process of introducing future teachers to the use of AR and VR technologies in their professional activities has already started. Thus, the students of the 012 Preschool Education Specialty of the Faculty of Pedagogical Education at Borys Grinchenko University have been acquainted with these technologies since the 2022 working curriculum in the «Modern Technologies of Teaching a Foreign Language to Preschool Children» discipline, which is taught during their first (bachelor's) education level. The 10th module (out of 12) of the discipline is devoted to the overview and practice of predominantly AR applications in teaching English to preschool students. The students shoot methodological videos on the advantages and disadvantages of certain software and give recommendations on their choice based on the lesson's goal, learning needs, and their application in the learning process.

Discussion. This paper provided an overview of affordable AR and VR technologies that can be used in foreign language learning, and introduced their use in the professional training of future teachers. The paper emphasized the advantages and educational potential

of these technologies, and highlighted their suitability for the field as well as the needs of modern learners. While the theoretical implications of AR and VR in education were discussed in depth, the paper also acknowledged the need for further empirical research to support their potential benefits. This limitation points to the prospects for further research and development in the field.

Conclusions. Currently, numerous affordable AR and VR technologies could be implemented in foreign language learning and the professional training of future teachers. The completed general overview of the educational potential of the observed technologies allows us to conclude that Metaverse is a multifunctional AR tool that can be used for storytelling and narration, vocabulary and grammar practice, trivia games, and many other options. The affordable VR technologies offer a variety of experiences and usage. For example, the Language Lab, which is based on the TPR approach, involves traditional lessons, investigation of open worlds, games mode, and communication in specifically designed social space. Mayflower Reflections and Solar System VR represent cinematic narration and the discovery VR category, while Great Paintings VR and The Omni Gallery reveal visual experiences. The OmniGallery, Google Earth VR, and BRINK Traveler allow for improved listening skills and the realization of the integrative approach to teaching a foreign language. Despite the challenges they face while offering an immersive entertainment experience, AR and VR technologies improve multiple language skills and influence general learning skills. However, as with any other technology, the use of AR and VR technologies in the classroom should be based on the learning goals and needs, taking into consideration the strengths and weaknesses, as well as the educational potential of each technology.

Prospects for further research development. The current article provides an overview of available AR and VR technologies for future teachers' training and foreign language learning. Therefore, further research could investigate the level of readiness among future teachers to use AR and VR technologies in their professional activities.

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Застосування технологій доповненої та віртуальної реальності у викладанні іноземних мов

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Анотація. Стаття присвячена дослідженню освітнього потенціалу технологій доповненої реальності (AR) та віртуальної реальності (VR) у викладанні іноземних мов, зокрема, у професійній підготовці майбутніх учителів. Дослідження базується на досвіді викладання курсу «Сучасні технології навчання дітей дошкільного віку іноземної мови» на першому рівні освіти для студентів спеціальності «Дошкільна освіта». Основні методи дослідження, які використовуються в статті, включають аналіз літератури та опис емпіричного досвіду взаємодії та впровадження технологій AR і VR у зміст означеного курсу. В статті розглянуто переваги та недоліки технологій AR та VR у навчанні іноземних мов. Дослідження виявило дидактичний потенціал обох технологій, зокрема покращене навчальне середовище, підвищення мотивації, взаємодії та утримання матеріалу, багатство мультимедійних режимів, краща візуалізація, придатність для особливих навчальних потреб. Стаття наголошує на впливі AR-технологій на мовні навички та розвиток словникового запасу, зокрема на засвоєння словникового запасу, звукоутворення, вимову, розуміння, письмо, читання, говоріння, покращення комунікативних і загальних навчальних навичок. Отримані дані доводять доцільність та переваги впровадження сучасних AR-технологій у професійну підготовку майбутніх учителів та викладання іноземних мов загалом, на відміну від VR-технологій, які мають свої обмеження, що переважають їх поточні переваги.

Тим не менш, VR-технології можна вважати дуже потужним інструментом у найближчому майбутньому. Разом з тим, часткова доступність AR та VR-технологій для тих, хто навчається, дозволяє використовувати їх у процесі реалізації індивідуального підходу. У результаті цієї статті пропонується перелік технологій AR та VR, які можна використовувати у викладанні іноземних мов. Перспективою майбутніх досліджень є аналіз конкретних технологій з групи AR або VR технологій.

Ключові слова: *технології доповненої реальності; цифрові навички, викладання іноземних мов, сучасні технології навчання, технології віртуальної реальності.*

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