

The effectiveness of the augmented reality application in foreign language teaching in higher school

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Abstract. In this study paper we consider the application of the augmented reality for teaching a foreign language and its influence on the education environment throughout the world since educators are trying to find the relevant methods of teaching to better face the time challenges connected with the expansion of the computer technologies. The given paper aims at validating the idea of the effectiveness of the application of the augmented reality techniques in teaching a foreign language at the University. The survey conducted by the authors comprises 64 participants of the Rostov State Transport University of the HR Department; the scrutiny endorses the proposed hypothesis.

1 Introduction

Our society witnesses the expansion of the digital technologies spreading. Due to the nature of this phenomenon and relative ease of use, almost any person can immerse into the world created by the artificial technologies. It is obvious that the digital technologies phenomenon enters all spheres of our life including education, giving rise to changes in methods of teaching, teaching strategies and teaching doctrine in general. We must remind of the fact that digital proficiency nowadays is considered to be the integral part of the prosperous existence of the person in the society. International organization P21 (Partnership for 21st Century skills), which presents the association of the most influential and huge business and science organizations and governmental agencies, includes digital literacy into the list of the skills needed in the 21st century for the individual to be socially adaptive and to function successfully in the environment [1]. New generation colloquially called as zoomers who presents the scope of people born between 1997 and 2010 differs greatly from the previous generations: they are technology-friendly people, deeply involved into the social media life; it means we must bear in mind that the education process must face the challenges of the contemporaneity to be relevant the general trends in society development. New methods of teaching must support lecturers by means of offering them new variety of training methods and technologies such as augmented reality (hereby simply referred to as AR) that is under the study of our paper.

In this section we will scrutinize the scientists who are involved into the study of the augmented reality. Firstly, we must name the author of the term who is Thomas P. Caudell, a former Boeing engineer who applied the aforementioned scientific know-how to help workers with the cabling in the air plane, since that time this term came into a frequent use for

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the describing the technology defined by the D. Roopa et al. [2] as a mixture of the real and computer created universe stuffed with the audio, video, textual and the wide array of other properties for creation a sound educational practice for the user, the authors of the very research paper outline the effectiveness of the abovementioned technology for improving the quality of the educational process. A wide spectrum of scientific papers is dedicated to the study of the augmented reality in medical education.

The following scientists are engaged into the investigations of the medical augmented reality applications: T. Joda et al. [3], Tony Liao et al. [4], Daniel J. Thomas [5] and many others. A special interest for our research paper presents the work of Alexandra Klimova et al. [6] who were examining the existing practices in teaching English using the augmented reality applications. Che Samihah Che Dalim et al. [7] analyses the AR application concerning the teaching English to a non-native children's language learning. Hongyan Bai et al. [8] describes the technology called "English smart classroom" as innovative one in comparison with the traditional class studies. The study paper of Juan Garzón et al. [9] about the interdependence of the pedagogical approach and AR in education also contributes to the methodological base of our research work. Ting-Chia Hsu [10] from National Taiwan Normal University in his research work dedicated to AR asks a question about the importance of the teaching styles in the English practice.

The simplicity of use and relatively inexpensiveness of the AR technologies arise a great interest among the educators and students to such kinds of applications around the world. By the Perkins Coie and the XR Association [11] the percentage of the students asked a question which sphere such kind of technologies as AR is applicable to, gave the answer that was "education"—41% and that was the second place after gaming comprising 61%. Moreover, computer technologies in education create a friendly environment that contributes to the rise of motivation in learning languages [12].

The analysis of the scientific papers on the topic showed that the application of the augmented reality in education and teaching foreign languages in particular is a very urgent problem resulting in changing of the teaching techniques and strategies but still there are some gaps in a foreign language teaching method as a result we posit that the application of the AR tools in teaching a foreign language makes the process of education more effective. In our investigations we apply the following scientific methods: comparative analysis method, descriptive analysis, observation method and mathematic statistic method of scientific research.

2 Methods and materials

We conducted a fortuitous controlled attempt to authenticate the positive impact of the AR application on the teaching foreign languages process. The experiment started on the 2nd of September 2019 and finished in May 2020 comprising one academic year. The measurement and observation took place at the Rostov State Transport University (hereby simply referred to as RSTU), at the Humanities department by the corresponding authors. The selected reference and the control groups are the students of the Human Recourses specialties. The initial sample consisted of 64 participants (that comprised 4 educational groups of students) studying at on department of the RSTU of the Humanities department, females—76% ($n = 48$), males—34% ($n = 21$) of the cohort ($n = 64$), respectively. All the participants were freshmen. All the members of the selected groups could be characterized as having relatively equivalent educational level of English. During the first classes the participants were given explanatory instructions to get familiar with the interface of the two applications those were: Tour Builder & Tour Creator. The experimental and the reference groups received materials containing the indistinguishable subject matter. For analyzing we took the final results on the examining discipline of English Language of the reference and the experimental groups;

for data handling we utilize the mathematical statistic method of data manipulating called U-criterion. The scatterplots illustrate the following correlations between the reference and experimental group; hence, the arguments advance in favor of experimental team indicating $P \leq 0.01$. At considering the results we deduce that the exploiting of the AR applications in teaching a foreign language at the University upgrades the level of the knowledge of the students.

Basing on the results of the statistical analysis we asked students to comment on the list of questions to evaluate the exploiting of the AR technique in the educational process; the participants were offered to esteem the AR classes atmosphere handling the Likert type 5-points scale: 1 point (strongly disagree), 2 points (disagree), 3 points (strongly agree), 5 (not applicable). The learners were given the following statements: 1) I would apply the AR because it's more interesting comparing with the traditional classes; 2) I would apply the AR because it's more convenient; 3) I would apply the AR because the atmosphere during the AR classes is friendlier. Our study highlighted that before the experiment the major part of the students used AR less than 2 hours a week and after the experiment. Judging the diagram (figure 1) we can see that they started to use the AR applications in the educational process more often. The participants outlined that the AR utilizing helped them to better grasp the material and created a friendlier atmosphere during the classes which help to master the language proper and to achieve better results in studying in general.

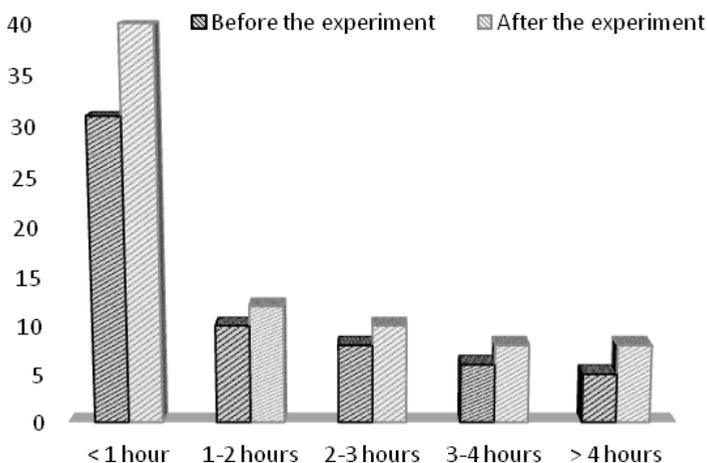


Figure 1. The frequency of the AR application use before and after the experiment

As for the results of the question list the participants in the number of 64 gave 78 answers which indicates different motivation from convenience to a more interesting frame of classes, but the most interesting findings appeared to be the notes about the creating of the safely atmosphere during the classes which contributes to the achieving the better results in studying. The overall goal of this work is to evaluate the validity and the effectiveness of the AR teaching tools in the educational process of teaching a foreign language.

3 Results

Augmented reality is widely used in all branches of science. It finds application in medicine, architecture, aircraft construction as well as train- and car-building, design and many other spheres. Augmented reality (hereby simply referred to as AR) is particularly relevant in the educational process, as it allows attracting students' attention and increasing their motivation

in learning a subject. As for teaching a foreign language, this kind of the pedagogical technology helps learners to immerse themselves completely in the language environment. In this case, all the conditions for full immersion including virtual reality are created and students will have an opportunity to talk with a native speaker, listen to the authentic speech or even visit a famous museum in the country of the language being learnt. It became possible due to augmented reality.

There is a great number of different digital technologies being used during practical classes in English at the university that contribute to the development of students' reading, listening, speaking skills. In this article we try to show the advantages of using AR in a foreign language teaching in the higher educational establishment proving the ideas of Vat-U-Lan who considers that those students who use AR in the English course greatly improve their important skills by comparing with others who learn English in a traditional way.

Among numerous educational tools with AR useful in mastering English are those that improve speaking skills. These are social platforms designed to socialize in English with people. They include "Time XR Social AR&VR" where discussions happen in a virtual world and teachers can use it as an alternative to conversation clubs in English lessons. Another way to improve students' conversational speech is "Altspace VR Community" where they will have an opportunity to communicate with real users all over the world in different speech situations. It is a good practice in English especially in free time because its usage helps to develop listening and speaking skills of learners.

Taking into account different platforms aimed at improving English we should mention educational ones. "Class VR" is created especially for the English language teachers but it also includes an independent educational program with prepared lessons. This program enables to discuss real life situations—shopping, study and so on. It can be supplemented with virtual glasses or helmet that allow students watching interactive videos where they act as participants of the process. They can take part in a virtual tour around a British park or celebrate some holiday, for example, Christmas or Easter. "Class VR" offers augmented and mixed reality programs in which you can use textbooks and workbooks. Teachers form a VR room link where a large group can study under the teacher's control during the certain time. Its peculiar feature is that "Class VR" helps students to communicate using interactive means. This course keeps their interest in learning as well as develops communicative competency as one of the most important goals in learning a foreign language.

One of the most exciting educational platforms for learning English is "Engage". It is produced by the company "Immersive VR Education" that makes it possible to use virtual and augmented reality in the educational process giving high schools all tools for creating the content necessary for virtual classes. The free educational platform "Engage" represents virtual space for conducting practical classes in groups or even individually by teachers, for meeting, discussing or giving presentations in English. In addition to this, students can have experiences of virtual reality using such products, as "Apollo 11 HD", "1943: Berlin Blitz" and "Titanic VR" that allow them to land on the Moon, visit Berlin in 1943 or explore the wrecked steamboat, get acquainted with archival audio and video recordings including the BBC archive and feel the atmosphere of real actions. On the one hand, this educational experience will leave an indelible impression on learners, on the other hand, it will promote to language skills development of students.

Another educational course called "Virtual Speech" combines both traditional means of English teaching and modern technologies of virtual reality. This course consists of a great deal of programs including online lessons: reading, translating, work with texts, listening practice and watching films. In addition, students can practice their speech skills in virtual conferences, discussions, performances. One of the drawbacks is that "Virtual Speech" is not free. The main emphasis is made on Business English and this course is useful for the students

of economic profile of training as students master business vocabulary, various economic topics and the skills of public speaking so essential for their future professional activity.

Augmented reality in practical classes makes learning English exciting and informative. It allows students to develop their abilities in independent research activities that is essential in a higher educational establishment. One of the ways to improve these skills is to use special platforms for creating presentations with 3D models. "Jig Space" gives an access to different presentations and shows arrangement of complicated mechanisms or objects in all details in the form of three-dimensional instructions, for instance, the layers of the Earth or some furniture, engines, etc. Students can create their own presentations with the help of "Jig Space" as well as "Timeline JS" and make the studied subjects real. The later of the mentioned is intended for visualizing chronological events. This service has wide opportunities because creating their presentations students insert texts from various sources, media-content, video- and audio-materials, web-documents, maps, etc. In this way, learners show their creative potential, abilities to self-study, analysing materials and good knowledge of English.

The services "Tour Builder" and "Tour Creator" have practically the same function. They deal with the creation of own tours across a country, a city or simply virtual excursions in any museum. The work with these services is both spectacular and fabulous because they allow students to find themselves in a virtual city or a famous museum that seem to be realistic. Besides, it reveals a person's creativity and contributes to developing speaking skills. Being a creator and a guide of his own tour, a student can apply all his knowledge of English in the process of communication with a group of visitors.

It is also necessary to pay attention to modern applications that English teachers can effectively use in their practice. Application programs create such an atmosphere that is aimed to attract students with visually bright and 3D-moving models. These programs make them interact with the material and be engaged in learning a foreign language. Among a great variety of applications with the usage of augmented reality in the English language teaching, we should mention the following: "Mondly", "Rumii", "Mind Map AR", "Civilisations AR", "ARki" and "Smart Reality".

The educational application "Mondly" is intended for learning all aspects of the English language: grammar, vocabulary, pronunciation, writing, listening and reading oriented for different levels of training. "Mondly" applies augmented reality in the form of virtual images as a teacher or a chat-bot for communication and understanding English. One of the features is that it identifies an individual's speech against the background of various noise and in such a way conditions for real life conversations with a virtual character are recreated. Student can use this application for better theory acquisition, pronunciation improvement, speech practice, memorizing new vocabulary and as a result mastering English in general.

"Rumii" is created as a platform for remote learning of a group and contains diversified tools: 3-D objects, a board, a screen demonstration. "Mind Map AR" facilitates learning a new topic in English, mastering new vocabulary by forming mental maps in augmented reality. This application makes it possible to connect associated notions using images, tags and represent these branches in a three-dimensional space. They are more effective than traditional lectures and make it possible to remember all the material easier and show abilities to creativity and independent work.

The BBC develops the application "Civilisations AR" that is devoted to study of artifacts of ancient civilisations, the period of Renaissance and others. It contains audio guides as well as texts in English. Thus, augmented reality opens up great opportunities in a foreign language teaching. It allows learners to know more about the masterpieces of the world culture and art and simultaneously improve their knowledge of English.

As for "ARki" and "Smart Reality", they will be informative for students specializing in architecture, design, construction because these applications allow to visualize architectural

projects, represent three-dimensional models of buildings. “Smart Reality” can be used by combining interactive models with printed construction plans. Students follow different stages of construction, participate in this process, demonstrate each phase and as a result give a presentation of their projects using professional English vocabulary in their speech. Such work imitates a real professional activity where all the students of the group are involved in the process.

To clearly demonstrate the diversity of digital technologies using augmented reality in a foreign language teaching, we need to present the research data in the form of a table 1.

The results in the table 1 reveal that digital technologies are aimed at forming students’ communicative competence that is considered one of the main purposes in teaching a foreign language. English teachers have a large arsenal of digital tools in their disposal. The choice of digital means depends on the direction of training in each particular group at the technical university.

For achieving the goal of the given research, it was decided to apply augmented reality technologies as well as traditional teaching methods in practical classes of a foreign language in one experimental group and compare the results—the level of formed skills in another group where augmented reality was not used. The pedagogical experiment for revealing high efficiency of augmented reality technology application was carried out in two groups of the Humanitarian Department in Rostov State Transport University. Both groups were estimated by the same indicators: a level of formed skills and communicative competence, an amount of allocated hours, motivation to learning English. The experimental group of students and the control one were practically identical. Students of the experimental group took part in approbation of efficiency theory of using augmented reality technologies in a foreign language teaching.

According to the discipline working program in terms of the curriculum of the training direction for the bachelor’s degree 38.03.03 “HR”, students of the first course should study the topic “The Target Language Country” in the second term. Within the framework of this topic, the English teacher gave a task for the control group using traditional teaching methods: read and translate the text, render it, make up a description of the country, its main sights, discuss this topic in pairs and so on. For another group—experimental—the task included besides working with a text and mastering new vocabulary—a project work with application of such augmented reality technologies as “Tour Builder” and “Tour Creator”. All students of the experimental group were involved in work, their knowledge of English found practical application during creation of a tour around London. They chose different routes, added descriptions, found photos and video materials to them. The purpose of using modern technologies is not only to remember the new professionally oriented vocabulary or grammar forms of verbs, formulate a statement according to the rules, etc., that is to form the necessary skills and abilities in a foreign language, but to create real conditions for application of the received competences and to develop a professional competence.

The augmented reality technologies enable students to immerse in an English-speaking environment, find themselves in a target language country, get acquainted with famous places of interest firsthand. In addition to this, it is necessary to note that these means contribute to developing speech, listening skills in a foreign language, use of new vocabulary, as well as ability to group work, independent activity. The augmented reality technologies increase students’ motivation in learning a foreign language, create positive emotional atmosphere in the lesson, promote communication in English, play an educational role of mutual understanding, support and help to each other.

As a result of application of such assessment methods, as a test, questioning, pedagogical observation, we came to the following conclusions. The students of the experimental group showed good results of formed skills, high motivation and interest in English. In comparison with the control group the achieved results in the experimental group turned out to be

Table 1. Using technologies of augmented reality in teaching a foreign language

The title of the technology	Formed Skills	Advantages	Disadvantages
Time XR Social AR&VR, a social platform	Listening and speaking skills	A teacher discusses different topics with students in a virtual world	Concentrated mainly on speech activity, other types of work are not represented
Altspace VR Community, a social platform	Listening and speaking skills	A teacher discusses different topics with students in a virtual world	Limited in use by speech activity for entertainment
Class VR, an educational platform	Reading, writing, listening, speaking skills	A teacher can plan and organize his own lesson or use the ready one, it is suitable for remote learning	The necessity of additional devices—glasses and a helmet
Engage (Immersive VR Education), an educational platform	Different skills	High school teachers have all tools for creating the content necessary for virtual classes, it is used for work in groups or individually in remote learning	Additional devices—glasses and a helmet, but their usage is optional
Virtual Speech, an educational course	Different skills, especially aimed at business communication	A teacher can combine traditional means of teaching and VR	It is not free
Jig Space, an application	Listening and speaking skills, skills of creative independent work	Students can create their own 3D presentations with the help of “Jig Space” or use different ready presentations of objects	Concentrated on creating presentation
Timeline JS, a service	Skills of creative independent work, including the usage of all abilities and deep knowledge of English	Students create their presentations, find and insert necessary information, video- and audio-materials from various sources	All information is presented in connection with dates, timeline

Table 1. (Continue)

The title of the technology	Formed Skills	Advantages	Disadvantages
Tour Builder, Tour Creator, services	Skills of creative independent work, including the usage of all abilities and deep knowledge of English	Students creating tours, excursions in English	Students must have an account in Google
Mondly, an application	Different skills	Students can communicate with a virtual character on different topics, an application identifies an individual's speech against the background of various noise	It can be used as an additional material for students' self-study, it can't identify voice perfectly
Rumii, an application	Listening and speaking skills	Teachers use a virtual space for remote learning	The necessity of additional devices—glasses and a helmet
Mind Map AR, an application	Lexical skills	It is used for creation mental maps	Focused on work on vocabulary
Civilisations AR, an application	Reading, writing, listening, speaking skills	Students learn of historical artifacts	Limited by historical topics

rather high. Therefore, the efficiency of augmented reality technologies in a foreign language teaching became evident and proved by practice.

4 Discussion

The conducted research has confirmed our hypothesis about the efficiency of using augmented reality technology in a foreign language teaching in high school. Nowadays we can observe the process of digitalization of all spheres of our life. The use of digital technologies in education is an essential part of our reality. Augmented reality is widely used in education of different levels from pre-school to high school and it has a positive impact on students. Its attractiveness finds an explanation in the main features that characterize augmented reality:

- interactivity;
- the effect of presence and immersion in the language environment;
- broadening the understanding of the surrounding processes and phenomena;
- sensory perception of updated data in a familiar environment.

Our study reveals availability of various digital means with augmented reality: social platforms, educational platforms, courses, services, applications—that can be used in practical classes of a foreign language. They are diversified and targeted at forming some definite skills, can be limited by a certain sphere of applying or specialization, but their main advantage is that they are distinguished by interaction with a virtual world in real time [13, 14]. This fact attracts students and promotes the effectiveness of educational process.

We agree with the ideas of Vat-U-Lan [15] concerning more effective assimilation of knowledge by students with using augmented reality technologies. These ideas find their confirmation in the process of the given research. The pedagogical experiment conducted in the course of the study has proved the high efficiency of augmented reality technologies. Students of the experimental group using besides traditional teaching methods digital means with augmented reality showed better results in formed skills, high motivation and interest in learning a foreign language.

We revealed that augmented reality in practical classes increases learners' motivation to study and self-study of a foreign language and greatly improves their knowledge. Therefore, students can apply their skills and abilities in practice with the help of augmented reality technologies. They take an active part in discussions, reading and listening practice and show creativity in their own presentations, creation of tours and other projects applying their knowledge of the English language, formed skills of research activities so essential in their future profession.

5 Conclusion

As a result of the given research, we should conclude that English teachers have a great variety of digital means with using augmented reality. Such modern means play a significant role in improving the educational process in a foreign language teaching. One of the most important functions of their usage is that they are targeted to forming all necessary competencies—speech, linguistic, communicative, sociolinguistic ones. Besides, the other function is connected with developing great motivation of students to learning English. These augmented reality technologies make them take an interest in a foreign language and be carried away with the process of learning grammar rules or some professional vocabulary that is rather complicated and even boring for students in traditional lessons, but quite exciting using augmented reality.

The conducted research has a great practical importance as it contains the detailed analysis of all augmented reality technologies acceptable for a foreign language teaching. They can be applied by educators during the classes. The further research activity is connected with the problem of reflecting augmented reality technologies in official documents with the purpose of their wide usage in high school.

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