

DOI: <https://doi.org/10.34069/AI/2023.71.11.25>

How to Cite:

Levitskaia, A. (2023). The impact of digital technologies on the effectiveness of english language learning by medical students. *Amazonia Investiga*, 12(71), 284-292. <https://doi.org/10.34069/AI/2023.71.11.25>

## The impact of digital technologies on the effectiveness of english language learning by medical students

### Вплив Цифрових Технологій на Ефективність Вивчення Англійської Мови Студентами-Медиками

Received: October 18, 2023

Accepted: November 28, 2023

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#### Abstract

Globalization and increasing demands on specialists determined the need to learn a foreign language in the modern world. Consequently, higher education institutions need to improve the educational programme for the preparation of future specialists for professional activities. The aim of this research was to determine the effectiveness of the use of modern digital technologies during the study of a foreign language by medical students. The research employed the methods of expert evaluation, pre- and post-testing (CEFR), a survey with the inclusion of a technology perception model. Cronbach's alpha was used to check the reliability of the used questionnaires. Cohen's kappa coefficient and Pearson's chi-squared test were used for statistical processing of the results. The study found that students of the experimental group who studied using different digital technologies showed significantly more success in improving foreign language skills after the final test than students of the control group. The novelty of this study is that the study of English by medical students was carried out using digital technologies that were chosen according to the age, profession and foreign language proficiency level of the experimental sample of students. Prospects for further research may be to determine the effectiveness of artificial intelligence during foreign language learning by medical students.

**Keywords:** foreign language training, independent learning, language learning, medical HEI, technologies.

#### Анотація

Необхідність у вивченні іноземної мови у сучасному світі продиктовано глобалізацією та збільшенням вимог до спеціалістів. Через це, заклади вищої освіти потребують вдосконалення освітньої програми під час підготовки майбутніх фахівців до професійної діяльності. Метою поведеного дослідження стало визначення ефективності використання сучасних цифрових технологій під час вивчення іноземної мови студентами медиками. Методами дослідження стали: експертна оцінка, пре- та пост- тестування (CEFR), опитування з включенням моделі сприйняття технологій. Для перевірки надійності використаних анкет було використано альфа Кронбаха. Для статистичної обробки результатів застосовано коефіцієнт Коена та критерій Пірсона. В ході дослідження було виявлено що студенти експериментальної групи які походили навчання з використанням різних цифрових після проведення кінцевого тестування показали значні успіхи у покращенні володіння іноземною мовою ніж студенти контрольної групи. Новизна цього дослідження полягає в тому, що вивчення англійської мови студентами-медиками здійснювалось за допомогою використання цифрових технологій, які були обрані відповідно до віку, фаху та рівня володіння іноземною мовою вибірки студентів експериментальної вибірки. Перспективами майбутніх досліджень може стати визначення ефективності штучного інтелекту під час вивчення іноземної мови студентами медичного напряму підготовки.

**Ключові слова:** вивчення мови, іншомовна підготовка, медичні ЗВО, самостійне навчання, технології.

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## Introduction

Globalization has created an opportunity for specialists from any field to work around the world, and companies have adopted innovative technologies to facilitate work. In this context, Higher Education Institutions (HEIs) must qualitatively prepare specialists to their future work in the company. The need arises for a new educational system, Education 4.0, to improve the training of students (Dhivya et al., 2023). This modern approach to teaching and learning English becomes crucial, especially when faced with common complications and difficulties, as noted by Srivani, Hariharasudan, Nawaz, and Ratajczak (2022), due to the use of traditional educational methods that affect students' learning motivation and effectiveness. In this context, Various studies, such as that of Desta, Workie, Yemer, Denku and Berhanu (2021), have shown that the implementation of digital technologies in the education of medical students has a positive impact on their English proficiency. The present study aimed to analyze the level of English language proficiency of medical students, identify the best digital technologies and implement them, determine and analyze the results obtained after the introduction of these technologies, and conduct a survey to know the attitude of students toward these innovations.

The aim involved the fulfilment of the following research objectives:

1. Analyse the level of English language proficiency of medical students before starting the research;
2. Identify the best digital technologies and implement them in the educational process;
3. Determine and analyse the obtained results of the foreign language proficiency level of medical students after the introduction of digital technologies;
4. Conduct a survey of students to determine their personal attitude to the proposed digital technologies.

## Literature Review

The global pandemic caused a rapid transformation of education, which became the impetus for a dynamic transition to online learning using digital technologies, namely: online platforms, web conferences, electronic diaries, etc. (Cachia et al., 2021; Pratiwi & Waluyo, 2023). This made it possible to continue the educational process with minimal impact on the quality and convenience of teaching for both teachers and students of educational institutions

(Mustapha et al., 2021; Zalite & Zvirbule, 2020). Researchers were quite interested in the impact and effectiveness of digital learning, an overview of which is given below.

Yan and Li (2023) focused on analysing the impact of digital technologies on the cognitive abilities of secondary school students. For the experimental part, the researchers surveyed 20,000 students to determine their logical thinking and problem-solving skills after using technologies such as the Internet and Personal websites were chosen. However, the researchers noted that the study needs further observations of the impact of digital technologies during education, as digital educational technologies are included as a tool for other educational methods.

Jeong (2022) decided to investigate the impact of using digital technologies — mobile applications — to help students improve efficiency and support independent foreign language learning while developing digital literacy and technological competence. To conduct the study, the researcher conducted a pre-test and a post-test using the shortened version of the TOEIC and a questionnaire. However, the study had a limitation due to the analysis of only mobile applications on the involvement of students in learning a foreign language.

Liu, Hua and Zhang (2022) and Hoppin et al., (2023) tested the effectiveness of virtual language learning instructions. Salem (2022) studied the impact of online digital storytelling on the development of students' argumentative writing skills and its impact on improving independent learning skills and overall independence of students in learning a foreign language. Dağdeler and Demiröz (2022) also tested the teachers' attitudes towards using digital technologies during foreign language learning. Therefore, it can be concluded that traditional education, especially related to the study of foreign languages, is gradually moving into the online environment with the involvement of various digital tools. Also, the conducted review part of the study gives reasons to claim that there is a limited number of studies on the use of digital technologies during foreign language learning by students of narrow fields of study, namely future doctors. This fact makes it possible to study in more detail and conduct a corresponding study.

## Methodology

### Design

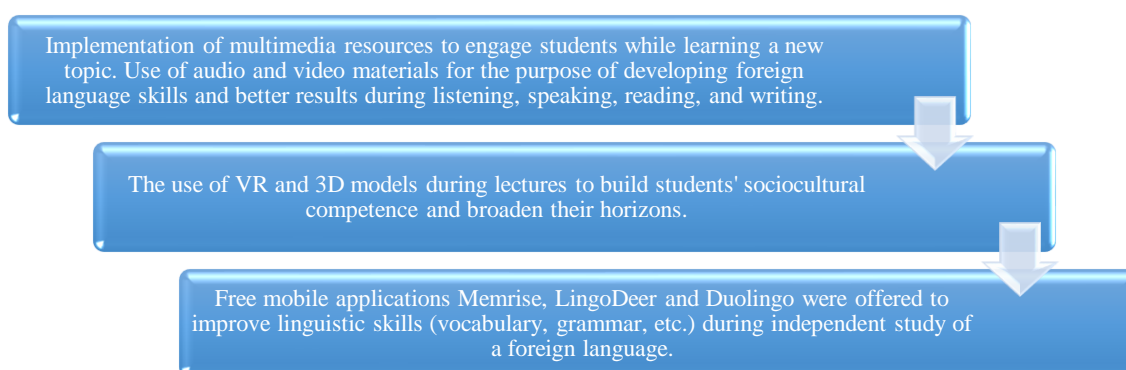
The experimental part of the study was conducted during the 2022/2023 academic year and included the following stages.

**Summative stage.** This stage involved an assessment of the level of English language proficiency of medical students. After that, the students were divided into homogeneous groups for conducting the experiment. This stage also included the selection of digital technologies according to the students' age and their language proficiency level. Digital technologies were chosen by analysing the following variables: the possibility of free use (or the availability of a demo version), appropriateness to the students' age, the possibility of changing or adding

educational material. The digital technologies were selected by analysing international rankings and academic articles. Duration (November-December 2022).

**Research stage.** Conducting the experimental part of the research. Implementation of an additional programme for classroom and independent study of a foreign language by medical students using digital technologies (Figure 1). Conducting final testing and interviews with students and teachers to determine the effectiveness and personal relationship to the implemented digital technologies. Duration (January-June 2023)

**Analytical stage.** Statistical processing of the obtained results. Summing up. Duration (June-July 2023).



**Figure 1.** The scheme of implementation of digital technologies in the educational environment of medical students during foreign language learning.

### Participants

A thorough study was conducted in this research to collect, evaluate, and summarize empirical evidence related to the research items. The study involved 198 medical students of the 2<sup>nd</sup>-3<sup>rd</sup> year of undergraduate studies. Three of them were absent during the testing, so they were excluded from the sample. The gender distribution was (m = 23%, f = 77%). The average age of the students was 21.4 years. Six teachers were also involved in the experiment for expert evaluation. The general experience of teachers was 29 years. The students were divided into homogeneous groups by random selection for conducting the experiment. The experimental group (EG) consisted of 97 students who studied a foreign language using digital technologies. The control group (CG) consisted of 98 participants and studied using a traditional programme. The experimental part of the study was conducted at Odessa Medical University.

### Data collection

The research was conducted using a mixed method and followed a sequential explanatory design (Creswell & Plano Clark, 2011). In the conducted experiment, the quantitative results indicate the use of digital technologies for various educational tasks during foreign language learning. The qualitative results provide descriptive data on participant motivation related to competence, autonomy, and relationship. The students were also interviewed about problems during learning a foreign language with the help of digital technologies. Quantitative data were collected using a questionnaire before and after the experiment. The proposed questionnaire included 10 questions that were divided into sections: a motivational block for learning a foreign language and a second block for determining language skills. After the experiment, the technology acceptance model (TAM) was incorporated into the survey (Davis et al., 2023).

A total of 25 elements divided into dimensions were selected in this model (Figure 2). It was decided to apply TAM to determine students'

personal attitude to the use of digital technologies during education.



Figure 2. Organization of elements included in the perception model.

**Instruments**

Qualitative analysis included the methods of observation, testing and expert evaluation for the diagnostics of foreign language competence criteria. The evaluation was made according to the scale:

- 0 (point) – not developed;
- 1 (point) – minimum level of development;
- 2 (point) – developed, but there are certain gaps;
- 3 (point) – sufficient level of development.

The initial and final testing to determine the impact of digital technologies during English language learning was conducted according to the Common European Framework of Reference (CEFR) methodology (Council of Europe, 2023) using the EF Standard English Test (EF SE) service (EF SET, 2023). The results obtained at the end of the test were distributed and compared to the foreign language proficiency level corresponding to other gradations (Table 1).

**Table 1.** Grading of English language proficiency levels in accordance with the international assessment methodology

CEFR	EF SET	IELTS	Cambridge English Scale	TOEFL iBT	TOEIC (R&L) Total Score	Global Scale of English
< A1	1 - 10	n/a	80 - 99	n/a	n/a	n/a
A1 Beginner	11 - 30	n/a	100 - 119	n/a	120 - 220	22 - 29
A2 Elementary	31 - 40	n/a	120 - 139	n/a	225 - 545	30 - 42
B1 Intermediate	41 - 50	4.0 - 5.0	140 - 159	42 - 71	550 - 780	43 - 58
B2 Upper Intermediate	51 - 60	5.5 - 6.0	160 - 179	72 - 94	785 - 940	59 - 75
C1 Advanced	61 - 70	6.5 - 7.5	180 - 199	95 - 120	945 - 990	76 - 84
C2 Proficient	71 - 100	8.0 - 9.0	200 - 230	n/a	n/a	85 - 90

So, an appropriate methodological framework was formed for carrying out this study with the aim of refuting or confirming the hypothesis that supplementing traditional classes on learning a foreign language by the use of digital technologies will be effective in obtaining the appropriate qualification levels in the knowledge of the English language.

The obtained data were statistically processed using IBM SPSS Statistics 22, Cohen's kappa coefficient and Pearson's chi-squared test were used for statistical analysis of the obtained results.

The reliability of the questionnaire was checked by using Cronbach's alpha. The obtained data of the questionnaire survey results showed a reliability coefficient of 0.76, which exceeds the threshold value of 0.70 for acceptable reliability of the questions.

**Ethical criteria**

Participation of students and teachers was voluntary. The research was based on the principles of impartiality and objectivity in the course of the research. Before the experiment, each participant signed an informed consent for the processing of the obtained results. Personal information of respondents is confidential and not subject to disclosure.

**Results**

Before and after the experiment, medical students were tested to determine the level of motivation and personal assessment of the foreign language proficiency level. Table 2 provides a comparison of the obtained results.

**Table 2.**  
Distribution of responses of EG and CG respondents before and after the experiment (%)

Blocks	Questions	CG	EG	CG	EG	
		before	before	after	after	
Possession of foreign language skills	Motivational	Every educated person should know at least one foreign language	65	65	68	79
		Knowledge of a foreign language is required for further employment	52	50	60	67
		A foreign language is a means of satisfying one's own extracurricular interests	33	29	40	49
		The study of a foreign language is required as a compulsory subject only, in which they want to have a good grade or credit	78	78	75	52
		Do you study English outside the university?	32	34	31	57
	Possession of foreign language skills	In your opinion, does your level of a foreign language proficiency meet the necessary requirements for studying abroad?	13	12	20	19
		Is the knowledge of the English language that you receive at the higher education institution sufficient for your future professional activity?	53	57	60	62
		Do you use foreign language resources to find the necessary specialized information?	15	15	13	42
		Do you use professional information obtained from foreign sources when preparing for lectures?	5	4	9	49
		Does your knowledge of a foreign language help you deepen your knowledge of your major?	2	5	10	76

Source: Developed by the authors

The obtained results of the questionnaire survey before and after the experiment provide quite clear information about the impact of digital technologies during learning a foreign language. A wide scatter of students' answers is observed in questions about the use of a foreign language to deepen professional knowledge ( $R=63\%$ ), as well as the use of foreign sources to prepare for classes ( $R=41\%$ ). In general, the answers of the EG students are 18.5% on average higher than the answers of the CG students who studied using traditional educational methods. However, it is worth noting that there are answers that did not have a sufficient difference between EG and CG. The introduction of digital technologies did not have a significant impact on the assessment of

students' foreign language preparation for professional activities. The results obtained among the CG and the EG students increased uniformly ( $R_{EG}=5\%$ ;  $R_{CG}=7\%$ ). The students also had the same tendency to increase the percentage of positive answers regarding the need for a high level of a foreign language proficiency for studying abroad ( $R_{EG}=7\%$ ;  $R_{CG}=7\%$ ).

After completing the questionnaire survey, the CG and EG students took pre- and post-testing in accordance with the international methodology for assessing the foreign language proficiency level. Table 3 provides the obtained results.

**Table 3.**  
Test results according to the Common European Framework of Reference for Languages (Council of Europe,) before and after the experiment

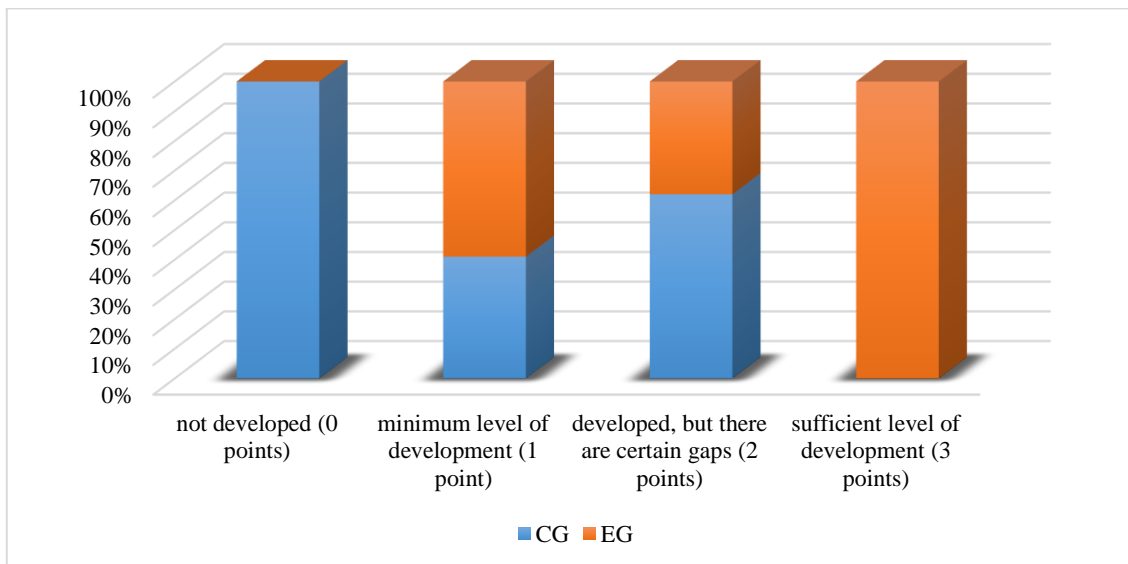
Calculated values	Before			After		
	Arithmetic mean	median	Mean square deviation	Arithmetic mean	median	Mean square deviation
	$\mu$	Me	$\sigma$	$\mu$	Me	$\sigma$
Control group (CG)	40.83	40	9.28	41.73	40	9.57
Experimental group (EG)	43.09	43	8.04	49.16	49	5.70

Source: Developed by the authors



As Table 3 shows, the test results of the CG students remained almost unchanged (R=0.9). According to the international evaluation methodology, the majority of CG students, after completing the 2<sup>nd</sup> semester, were able to pass to the B1 level, which corresponds to the curriculum. However, this indicates that the students were not motivated to study an additional foreign language in order to obtain better results, which is not the case for EG. The

difference before and after the introduction of digital technologies is quite noticeable (R=6.07) and almost corresponds to Level B2. This gives grounds to conclude that students were additionally engaged in studying a foreign language in extracurricular hours. After passing the test, the expert group assessed the level of students' foreign language competence after the experiment (Figure 3).

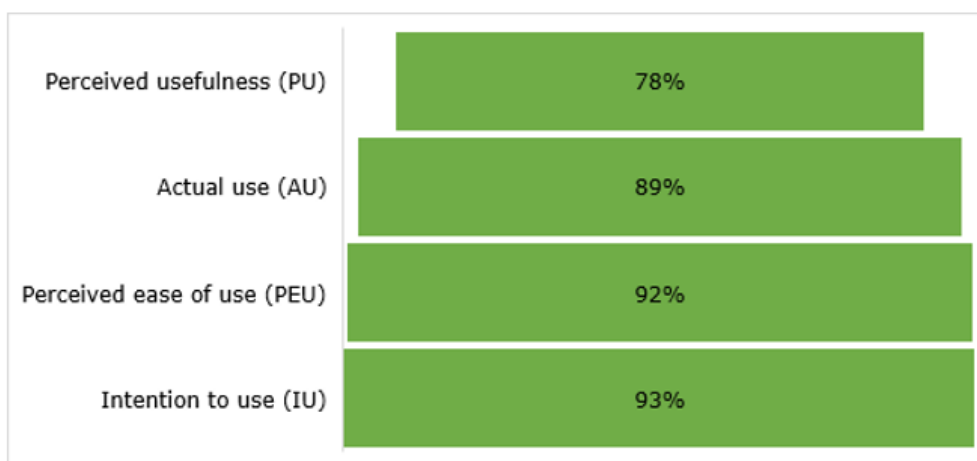


**Figure 3.** Distribution of expert assessment for the control and experimental groups regarding the formation of foreign language competence after the experiment.

Source: Developed by the authors

The obtained results in Figure 3 indicate that the EG students have sufficiently developed foreign language competences compared to EG. All EG students have basic foreign language skills, which is evidenced by the absence of 0 points. In our opinion, the students understood the presented information better thanks to the

interactivity and interest of the implemented digital technologies, due to which the final results became higher than the CG results. The TAM model was applied in order to determine the students' personal perception of the implemented technologies. The results are shown in Figure 4.



**Figure 4.** Assessment of students' perception of implemented digital technologies according to the TAM model after the experiment.

Source: Developed by the authors

The obtained results confirm the previous conclusions that the use of digital technologies during the educational process is perceived by students better than the usual traditional methods. This is the reason why the final results of checking foreign language proficiency level are higher than those of CG students. Figure 4 shows that students plan to continue using digital technologies for independent learning. It is also important that it was easy for students to switch to learning a foreign language with the help of digital technologies.

The statistical analysis using the Pearson's chi-squared test determined that the values of EG obtained during the study are greater than those of CG. Therefore, it can be stated that there is a certain connection between the organization of the programme of classes with the use of digital technologies. When calculating Cohen's kappa coefficient, a value from 0.8 to 1.17 was obtained. This indicates a high effect of the use of the proposed digital technologies. In the CG trained using traditional methods, the Cohen's kappa coefficient was 0.5, indicating a medium effect.

## Discussion

The obtained results indicate that the use of digital technologies is an effective tool both for conducting educational classes and for independent learning of a foreign language. Upon completion of the experimental course, the EG students almost reached the B2 (Upper Intermediate) level in learning a foreign language. The CG students could not show such bright results. In our opinion, this is explained by the fact that the experimental group was involved in independent, additional learning of a foreign language with the help of mobile applications. The obtained results confirm the results of researchers regarding the effectiveness of mobile applications in independent foreign language learning (Rintaningrum, 2023; Konotop et al., 2021; Maszkowska, 2017). Putra et al., (2020) determined that students who had used Hello English for more than three months felt the effect of this application on their communicative competence better than those who had used it for less than three months. Moreover, experienced users also show a higher intention to use Hello English to learn English in the future. The conducted research also confirmed that EG students plan to use digital technologies to learn a foreign language even after the experiment.

It was determined that digital literacy is required for working with new technologies, which is an

important condition for further professional growth (Spurava & Kotilainen, 2023; Spante et al., 2018). A study conducted among medical students using digital technologies during their studies proved that the digital literacy of the EG students significantly improved with the help of additional digital tools. However, Waemusa and Jongwattanapaiboon (2023) showed a difference in mobile phone use between young students' daily life and schooling. It was confirmed that using mobile phones to develop digital literacy in school did not have a positive impact during learning. We believe that the difference in the obtained results can be caused by a different age sample. In our study involved students of the medical HEI. They were also motivated for learning a foreign language to improve professional competencies (Semaan & Yamazaki, 2015; Kryshko et al., 2020).

The conducted research confirms that students must take responsibility for their motivation to continue learning and improving English (Rashid & Howard, 2023). They should take an active part in group classes, conversation clubs and English language assignments. Communicating in English with the teacher and classmates can improve foreign language competence and enhance motivation and self-confidence (Li, 2017). Considering that students were born in the era of digitalization, they should be able to find and use available online opportunities for the development of professional competencies. For example, multimodal online interaction with different people in English (acquaintances, friends, native speakers) can be used.

## Research limitations

The study's main limitations are a convenient sample of students who studied in the 2<sup>nd</sup>-3<sup>rd</sup> year of one HEI. This fact may limit the results obtained and the conclusions drawn. The limited number of used digital technologies does not enable students to state the effectiveness of all digital technologies during foreign language learning. However, it is worth noting that the conducted research was able to provide empirical evidence of the effectiveness of certain digital technologies when learning a foreign language in medical HEIs. The obtained results can be used during the curriculum development for foreign language subjects.

## Recommendations

A random sample shall be chosen for further research, as well as other digital technologies to confirm the obtained results.

## Conclusions

The relevance of the conducted research as well as the obtained results is confirmed by the fact that knowledge of a foreign language and its further improvement is an important skill both in professional life and for personal needs. The results confirmed the advanced hypothesis that the use of digital technologies when learning a foreign language is more interesting, motivating, and effective in learning than traditional methods. The study found that the EG students trained using various digital technologies (mobile applications, 3D visualization, multi-projectors, etc.) after the final test showed significantly progress in improving their foreign language skills than the CG students. It is also worth noting that EG students were more motivated to use digital technologies after the experiment. Most EG students were motivated by the fact that they need a foreign language for professional development and the possibility of using foreign sources to find and use professional information. The novelty of this research is that the study of English by medical students was carried out using digital technologies chosen according to the experimental sample of students' age, profession and foreign language proficiency level. Future research may include determining the effectiveness of artificial intelligence during foreign language learning by medical students.

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