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## THE IMPACT OF DIGITAL TECHNOLOGIES ON THE EFFECTIVENESS OF ENGLISH LANGUAGE LEARNING BY MEDICAL STUDENTS

### EL IMPACTO DE LAS TECNOLOGÍAS DIGITALES EN LA EFICACIA DEL APRENDIZAJE DEL IDIOMA INGLÉS POR PARTE DE ESTUDIANTES DE MEDICINA

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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 (HEIs) 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 and to identify the students' personal attitude during the experiment. The research employed the methods of expert evaluation, pre- and post-testing (Common European Framework of Reference for Languages (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 (EG) who studied using different digital technologies showed significant success in improving foreign language skills after the final test than students of the control group (CG). It is also worth noting that EG students were more motivated to use digital technologies after the experiment. 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:

Technologies, foreign language training, medical HEI, independent learning, language learning

#### RESUMEN

La globalización y las crecientes exigencias a los especialistas determinaron la necesidad de aprender una lengua extranjera en el mundo moderno. En consecuencia, las instituciones de educación superior (IES) necesitan mejorar el programa educativo para la preparación de futuros especialistas para actividades profesionales. El objetivo de esta investigación fue determinar la efectividad del uso de tecnologías digitales modernas durante el estudio de una lengua extranjera por parte de estudiantes de medicina e identificar la actitud personal de los estudiantes durante el experimento. La investigación empleó los métodos de evaluación de expertos, pruebas previas y posteriores (Marco Común Europeo de Referencia para las Lenguas (MCER)), una encuesta con la inclusión de un modelo de percepción tecnológica. Se utilizó el alfa de Cronbach para comprobar la fiabilidad de los cuestionarios utilizados. Para el procesamiento estadístico de los resultados se utilizó el coeficiente kappa de Cohen y la prueba chi-cuadrado de Pearson. El estudio encontró que los estudiantes del grupo experimental (EG) que estudiaron utilizando diferentes tecnologías digitales mostraron un éxito significativo en mejorar sus habilidades en lenguas extranjeras después de la prueba final que los estudiantes del grupo de control (CG). También vale la pena señalar que los estudiantes de GE estaban más motivados para utilizar tecnologías digitales después del experimento. La novedad de este estudio es que el estudio del inglés por parte de estudiantes de medicina se realizó mediante tecnologías digitales que fueron elegidas según la edad, profesión y nivel de dominio de lengua extranjera de la muestra experimental de estudiantes. Las perspectivas para futuras investigaciones pueden ser determinar la efectividad de la inteligencia artificial durante el aprendizaje de lenguas extranjeras por parte de estudiantes de medicina.

#### Palabras clave:

Tecnologías, formación en lenguas extranjeras, IES médicas, aprendizaje independiente, aprendizaje de idiomas.

## INTRODUCTION

Globalization has created an opportunity for specialists of any field to work all over the world. Many businesses have started to implement innovative technologies to improve and facilitate work. Therefore, HEIs should qualitatively prepare specialists for their future work in the company. It is necessary to adopt a new educational system in the context of Education 4.0 to improve the training of students (Dhivya et al., 2023). Education 4.0 is a modern technology for teaching and learning English. Most students have complications and difficulties in learning English. Srivani et al. (2022) determined that one of the reasons is teachers' use of traditional educational methods. Because of this, students lose motivation and find learning boring and ineffective.

Improving communicative readiness and self-efficacy in various contexts of English as a foreign language (EFL) learner has attracted the attention of many researchers. Desta et al. (2022) determined that the implementation of digital technologies in the education of medical students has a positive effect on their level of English language proficiency. Karabacak et al. (2023) have determined that digital technologies can help to create an engaging learning environment and improve the educational outcomes of medical students. Mahling et al. (2023) assessed the response and engagement of medical students to the use of digital technology – virtual reality (VR).

In view of the foregoing, it was decided to conduct a more in-depth study of the chosen direction. Therefore, the aim of the study was to determine the influence of digital technologies on the study and understanding of a foreign language by medical students.

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 use of digital technologies is caused by the transformation of education. The transition to online learning was possible using online platforms, web conferencing,

e-diaries and applications (Cachia et. al., 2021; Pratiwi, & Waluyo, 2023). They helped to continue conducting classes and evaluate completed tasks, manage the daily activities of educational institutions, and exchange resources. Nevertheless, the use of digital resources was proactive. The global pandemic caused a sharp transition of all social institutions to the online format and training to support the social system. The use of digital technologies has become the best and only solution in resolving the crisis situation (Mustapha et al., 2021; Zalite, & Zvirbule, 2020). After that, the issue of using digital technologies in all spheres of social life attracted the attention of many researchers.

Yan, & Li (2023) focused on analysing the impact of digital technologies on the cognitive abilities of secondary school students. The Internet and Personal website were chosen for the experiment. 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 to 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. Liu et al. (2022) and Hoppin (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, as well as its impact on improving independent learning skills and overall independence of students in learning a foreign language. Dağdeler, & Demiröz (2022) also tested the teachers' attitudes towards the use of digital technologies during foreign language learning. Therefore, it can be concluded that traditional education, and especially that related to the study of foreign languages, is gradually moving into the online environment with the involvement of various digital tools.

## METHODS AND MATERIALS

### Design

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

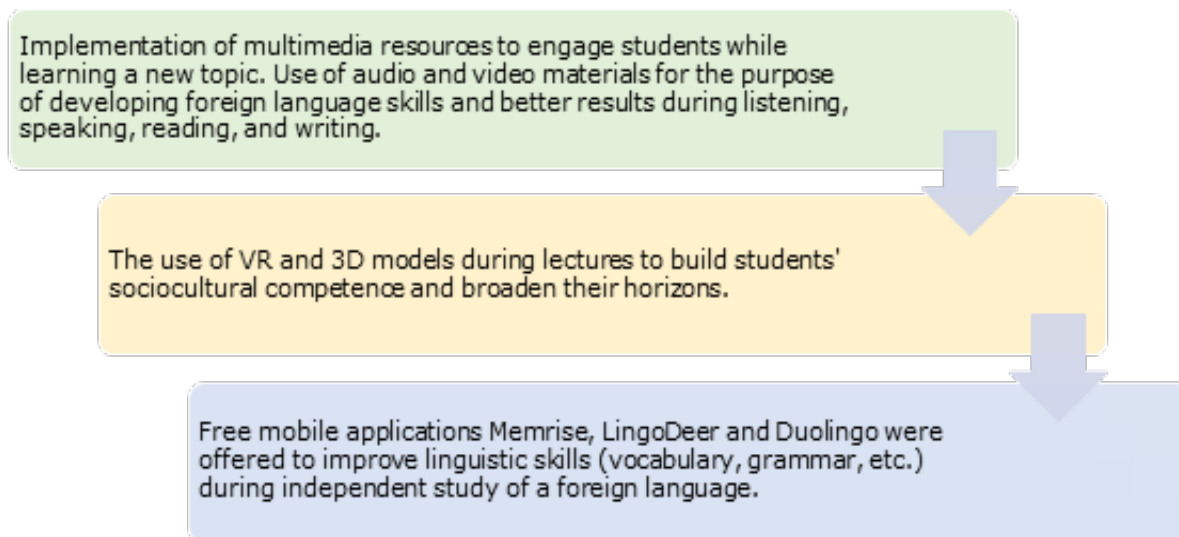
Summative stage. This stage involved an assessment of the level of English language proficiency of medical students. After that, the students were divided into homogeneous groups for conducting the experiment. This stage also included the selection of digital technologies according to the students' age 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).

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



Source: Own elaboration

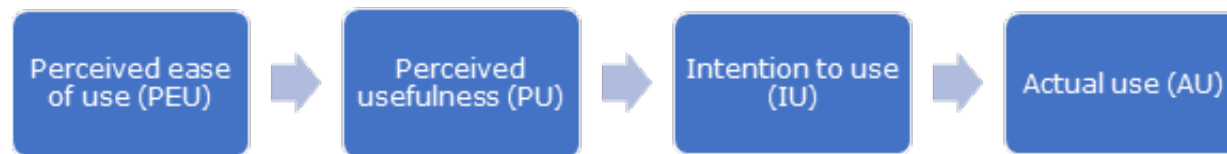
Participants

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 2nd-3rd 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, & 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.

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



Source: Own elaboration

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 (CEFR, 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

Source: Own elaboration

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 AND DISCUSSION

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
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: Own elaboration

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 (= 5%; = 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 (= 7%; = 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.

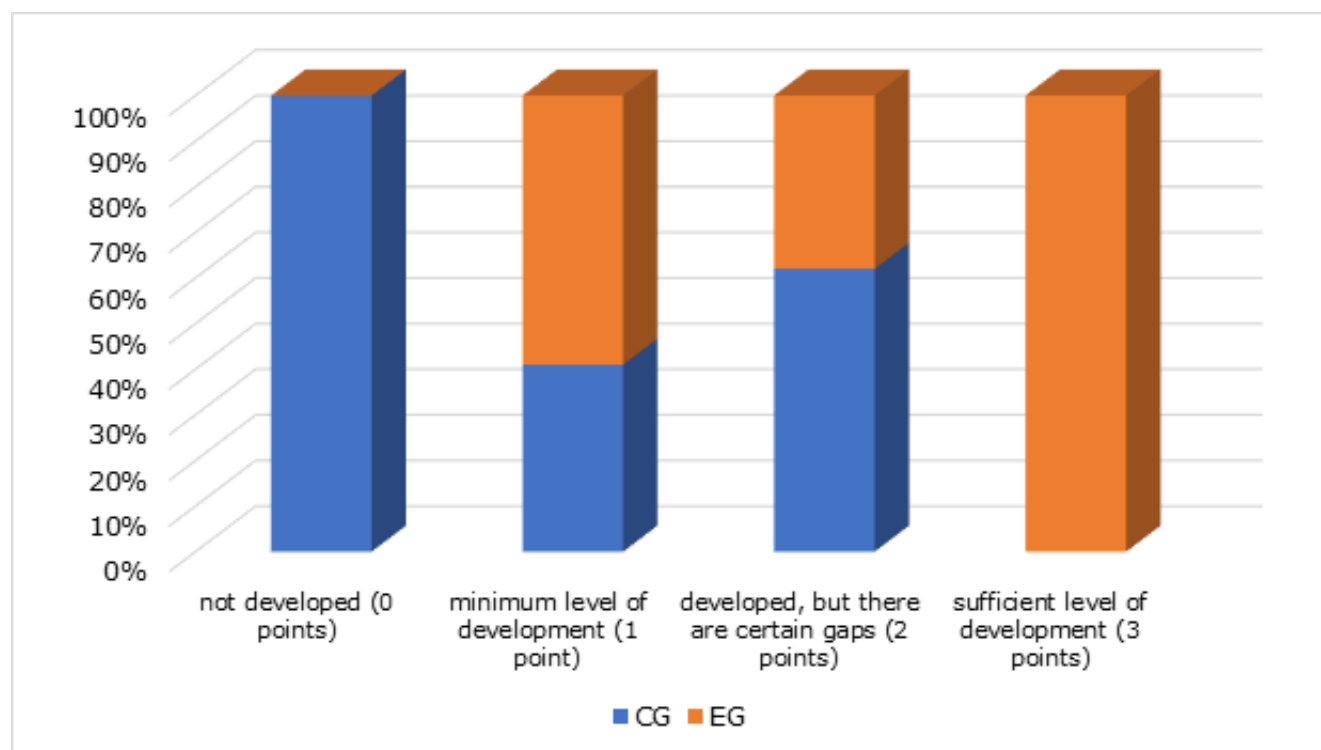
Table 3. Test results according to the Common European Framework of Reference for Languages (CEFR, 2023) before and after the experiment

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: Own elaboration

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 2nd 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).

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



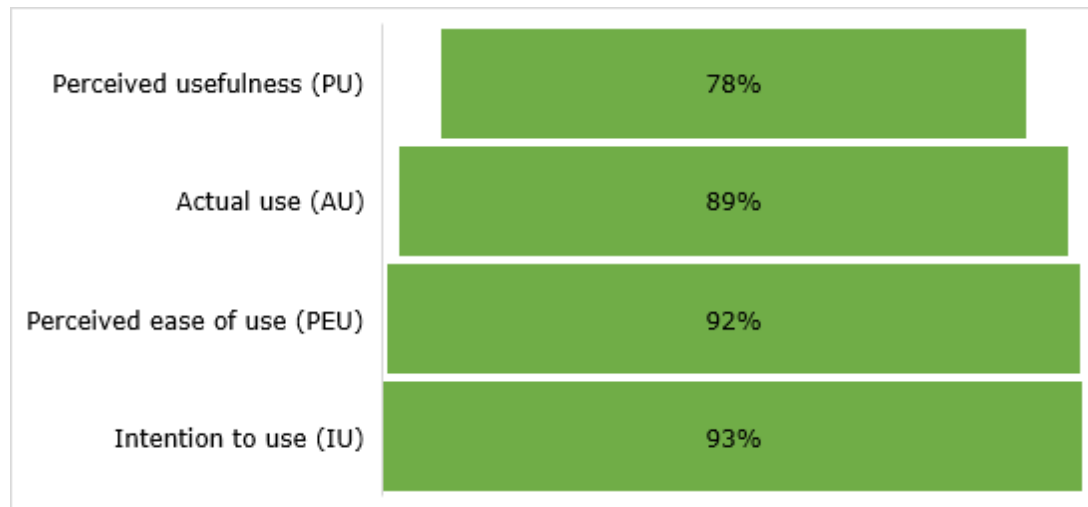
Source: Own elaboration

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.

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



Source: Own elaboration

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. (2022) 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. Waemusa, & Jongwattanapaiboon (2023) showed a difference in

mobile phone use between young students' daily life and schooling. It was confirmed that the use of mobile phones for the development of 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, as well as 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 main limitations of the study 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 stating the effectiveness of all digital technologies during foreign language learning by students. 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 development of the curriculum 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 obtained 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 who were trained using various

digital technologies (mobile applications, 3D visualization, multi-projectors, etc.) after the final test showed significant 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. The majority of EG students were motivated by the fact that they need a foreign language for: professional development, as well as 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 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.

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