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The role of smart technologies in maintaining student motivation during distance learning

El papel de las tecnologías inteligentes en el mantenimiento de la motivación de los estudiantes durante el aprendizaje a distancia

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Abstract

Smart technologies are a common element of education, which have a positive impact on the organization of education, its efficiency, and the possibility of self-control. The aim of the study is to determine the role of smart technologies in the distance learning to maintain student motivation. The aim was achieved through the use of the methods of observation and analysis, calculations of the coefficient of oscillation, the coefficient of variation, and Spearman's rank coefficient. Learning mechanisms provided for acquiring language knowledge, develop the consecutive interpreting skills, and master formal and informal communication styles. It was established that such learning mechanisms after the study enhanced students' motivation of 82% for distance learning. Before the study, a high level of motivation was observed among only 21% of students. The results of the Stapel Scale showed that smart technologies (1.0) had the greatest impact on students' motivation, which is related to the continuity of learning. The learning process had also the greatest impact on students' dynamic adaptation (2.25). The conducted research is important for the development of students' professional foreign language skills and enhancement of their

motivation through the use of smart technologies during distance learning.

Keywords: meaningful learning, online platforms, person-oriented learning, students' purposefulness, rational thinking.

Resumen

El objetivo del estudio es determinar el papel de las tecnologías inteligentes en la educación a distancia para mantener la motivación de los estudiantes. El objetivo se logró mediante el uso de métodos de observación y análisis, cálculos del coeficiente de oscilación, el coeficiente de variación y el coeficiente de rango de Spearman. Se proporcionan mecanismos de aprendizaje para adquirir conocimientos lingüísticos, desarrollar las habilidades de interpretación consecutiva y dominar los estilos de comunicación formal e informal. Se estableció que dichos mecanismos de aprendizaje después del estudio aumentaron la motivación de los estudiantes en un 82% para el aprendizaje a distancia. Antes del estudio, sólo se observaba un alto nivel de motivación entre el 21% de los estudiantes. Los resultados de la Escala Stapel mostraron que las tecnologías inteligentes (1.0) tuvieron el mayor impacto en la motivación de los estudiantes, lo que se relaciona con la continuidad del aprendizaje. El proceso de aprendizaje también tuvo el mayor impacto en la adaptación dinámica de los estudiantes. La investigación realizada es importante para el desarrollo de las habilidades profesionales en lenguas extranjeras de los estudiantes y la mejora de su motivación mediante el uso de tecnologías inteligentes durante el aprendizaje a distancia.

Palabras clave: aprendizaje orientado a la persona, aprendizaje significativo, determinación del estudiante, pensamiento racional, plataformas en línea.

Introduction

The transition from traditional to interactive learning is determined not only by the technological progress, but also by social changes (the COVID-19 pandemic, the instability of the political situation, military conflicts, etc.). The effectiveness of smart-technologies implies the high-quality perception of educational information in the classroom and beyond, which is positive for distance learning. Smart technologies during distance learning help to provide personalized learning, comprehend the provided information, ensure its visual perception, and activate thinking (Raza & Khan, 2022). Therefore, the features of Smart technologies is a relevant issue that contributes to ensuring a higher quality learning process.

The use of smart technologies during distance learning is common, as they provide a self-directed, adaptive, technological learning process. This is positive for providing the necessary resources to learn the material, which affects student motivation (Cavus et al., 2022). Distance learning is based on the principles of openness, which involves the use of interactive technologies to provide a learning environment. Distance learning differs from the traditional approach to the presentation of material, lack of a single classroom space, direct interaction with the teacher and other students. The process of distance learning should be associated with flexibility, the use of available technologies, social equality, which ensures the same conditions for the perception of educational material (Konovalenko et al., 2023). In the context of distance education the teacher provides not only the preparation of material for study, but also coordinates the educational process. The teacher must constantly improve the educational material, apply creative skills to maintain student motivation (Ihnatova et al., 2022). A high quality of distance learning must be ensured, which contributes to specialized control over compliance with the educational standards. A properly organized learning process should be aimed at ensuring the conscious perception of information by students, maintaining their motivation, and meeting the deadlines.

Smart technologies contribute to continuous learning and ensure the simultaneous involvement of the

entire group in the lesson. Visual perception of information with the help of modern technologies allows processing more information, which affects the activation of students' creative potential, their thinking (Krasulia et al., 2022). It is also possible to deviate from one format of information presentation with the help of modern technologies, which provides an author's approach to designing training. This approach to learning enables choosing one's own pace of learning, which affects the overall quality (Metruk, 2022). Focusing on students' independent work allows for a meaningful perception of information, which contributes to the search for creative approaches to learning. However, the disadvantages of distance learning can be related to the complexity of control and organization of group work, problems with access to information, lack of student motivation (Petchamé et al., 2023a). Therefore, it is necessary to provide a clear and balanced organization of the educational process, which enables minimizing possible problems.

The study of the theoretical aspects of the presented topic revealed that the advantages of smart technologies in distance learning are a common issue. But the analysis of the advantages of smart technologies is not related to specific types of interactive works that can be used in a separately organized training programme. The aim of the work is to determine the importance of smart technologies for maintaining students' motivation during distance learning.

The aim involved the fulfilment of the following research objectives:

- Develop distance learning mechanisms using smart technologies for future foreign language teachers;
- Determine the level of students' motivation for distance learning;
- Identify of the factor that had the greatest impact on enhancing students' learning motivation;
- Determine the skills that students have developed during their studies focusing on the role of smart technologies.

Literature Review

Smart technologies contribute to the provision of smart education, which is reflected in professional training. Their effectiveness is related to mobile access, the possibility of presenting new information. Achieving high results is also possible through process automation, real-time data collection, and self-organization ability. Self-analysis of one's knowledge allows to achieve higher results and take into account the gaps in the acquired knowledge on a separate topic (Dmitrenko et al., 2023). Smart technologies facilitate joint learning, which is of particular importance during the COVID-19 pandemic and provides interpersonal communication. Smart technologies contribute to a better understanding of educational topics during online learning, affect students' academic performance and satisfaction. This is related to the possibility of providing support to the students, which facilitates the learning of the educational materials and academic quality of education (Abuhassna et al., 2023). Digital pedagogical methods are one of the important tools for distance learning. It was established that students' motivation to use digital technologies is related to the development of personal skills, understanding the value of learning, and providing remote communication. Online learning can also be more effective than traditional learning because it focuses on dealing with critical moments in understanding a particular topic. Interaction with other students and teachers is important in online learning (Giovannella, 2022).

Higher education is being transformed under the influence of modern technologies, which contribute to distance learning. Modern technologies enable an extended study of information for education due to the use of secondary sources. Modern technologies also contribute to personalized learning and the development of independence. On the other hand, the teacher acts as a mentor, who focuses on individual learning models. The use of modern technologies by educational institutions contributes to the professionalization of the educational process and its high-quality organization (Sułkowski, 2021). Smart technologies make it possible to ensure the digital transformation of the educational process, which is connected with the information perception. Their positive impact on students is related to the provi sion of

personalized learning, which helps to reveal the potential of each student. Smart technologies also influence the monitoring of the learning progress of each student, which forms their independence (Lorenzo & Gallon, 2018). Mobile technologies facilitate access to library and information resources, as they automate the information search. They also help to find current and new information that satisfies students' needs. Systematization of information is important, which contributes to better learning (Ashiq et al., 2023).

Information and communication technologies have a positive effect on improving the students' intellectual abilities, which contributes to their qualitative processing. This approach also affects the qualitative learning of the material and the development of practical skills. Effectiveness is associated with meaningful inclusion in the subject and study of quality content that is directly related to the learning process. But the effectiveness of learning should be based on the absence of a gap between theoretical knowledge and practical skills (Kokaj et al., 2023). Multimedia technologies help to control the quality of the educational process. However, access to diverse materials can lead to obtaining incorrect information, which can result in low effectiveness. The teacher should monitor the quality of the provided information, focusing on the flexibility, technological ability, and self-organization principles. The effectiveness of learning depends on the gradual complication of the materials, completed tasks, which leads to an increased rating indicators (Li et al., 2023). A virtual learning format can be provided through the use of Bipolar Laddering. The application is aimed at improving the organization of learning and promoting interaction between students. The application also promotes compliance with the technical aspects of learning, which is associated with attending classes (Petchamé et al., 2023b).

The analysis of the academic papers determined the advantages of smart technologies in the educational process. However, there is no definition of specific mechanisms of their use in the educational process for the organization of distance learning.

Methods

Research design

The first stage of the study involved the development of distance learning mechanisms to determine the role of smart technologies in enhancing students' motivation. The development of mechanisms was aimed at training future foreign language teachers. The learning mechanisms were aimed at enhancing students' motivation in learning and the possibility of using various smart technologies. The learning mechanisms were aimed at ensuring the specifics of the distance learning process. The training covered the period of for 6 months in 2023.

The second stage of the study provided for determining the level of students' motivation for the presented format of distance learning. The results were compared before and after the study, which involved determining the level of students' motivation or lack of motivation. Their neutral attitude to such a learning process was also determined. The element of education which was most important for ensuring positive students' motivation was also identified at this stage.

The third stage of the research programme aimed at identifying the skills developed in students during the research. The identification of skills was associated with a positive influence on the development of foreign language competence.

Sampling

The research involved 137 students who were studyin g to be future foreign language teachers. Students studied at KROK University of Economics and Law, Skovoroda Kharkiv National Pedagogical University,

National University of Life and Environmental Sciences of Ukraine, Alfred Nobel University. The students were selected in terms of the same foreign language competence and being engaged in distance or blended (classroom and distance) learning within one year. The study involved only third-year students in order to compare learning motivation before and after the study. Students of the same year of study were involved in the study in order to prepare the same tasks in the educational process. This approach was aimed at ensuring equal conditions for all respondents.

Methods

It was planned to make an initial analysis of university curricula in order to develop learning mechanisms. The need for curricula analysis was related to the identification of smart technologies that can be applied in education and for selecting ways to develop mechanisms. The choice of smart technologies was aimed at the possibility of providing distance learning, which contributed to the study of a foreign language programme. Focusing on these requirements for smart technologies, 20 applications were excluded because their functions did not contribute to conducting online classes. The choice of smart technologies also involved taking into account the relevance of tasks and video lectures to the training programme.

Determining students' motivation involved the use of the Stapel Scale for obtaining a specific answer to a particular question. The Stapel Scale was also used to determine the indicators that, according to the students, had the greatest positive impact on the learning process. According to the Stapel Scale, students were required to assign points from 0 to 1 to each indicator. This approach excluded students' doubts and contributed to obtaining an accurate answer. The use of e-mail facilitated data collection and confirmed the answers of each respondent. The level of student learning motivation was presented as a percentage. The selection of the most influential indicators in education for the formation of positive students' motivation involved an additional calculation of the oscillation coefficient in order to exclude falsified results (Cavus et al., 2022).

$$\rho = \frac{R_x}{x}, \qquad (1)$$

x – conditional value of a separate indicator of influence, which was obtained on the basis of data from students;
R_x – an indicator of the variation of a conditional random variable (the value that reflects the maximum set estimate).

Determining the level of acquired skills of students involved the use of a general theoretical analysis method. This approach made it possible to determine progress in students' education, their perception and processing of educational information. The coefficient of variance developed by the authors of the article was calculated to obtain the final result:

$$c_{var} = \frac{y_p + y_{pr}}{p_a}, \qquad (2)$$

y_p – a score for the most pronounced skill developed in students;
y_{pr} – prevalence of the most pronounced skills over the least pronounced skills;
p_a – a score for the possibility of applying the acquired abilities for fulfilling non-standard tasks.

Data analysis

The statistical analysis of the data was aimed at ensuring the qualitative organization of the research, which contributed to the confirmation of the obtained results and a more detailed analysis. A statistical calculation of the Spearman coefficient was carried out in order to confirm the qualitative analysis of the

established data (Oyetade et al., 2020). Statistical calculation determined the distance of some indicators relative to others. The calculation of the Spearman coefficient was carried out to compare the level of students' motivation before and after the study in order to determine the influence of indicators that contributed to an effective educational process. A statistical calculation was also carried out to determine the level of particular skills developed by students during training.

$$r_s = 1 - \frac{6\sum_i d^2}{N(N^2-1)}, \qquad (3)$$

N – the number of indicators for calculation;
d^2 – the square of the differences between the indicators, which depends on the serial number and is related to tabular data.

Ethical criteria

The study was conducted in accordance with the ethical criteria of the Committee on Publication Ethics (Committee on Publication Ethics, 2021). This approach made it possible to exclude the conflict of interests of the authors and contributed to ensuring the same conditions of study and data collection for all students.

Results

Determining the role of smart technologies in maintaining student motivation during distance learning provided for the primary development of learning mechanisms. This excluded the abstract definition of the advantages or disadvantages of smart technologies and was based on particular examples. The first stage of the research consisted in the development of distance learning mechanisms for future foreign language teachers (Figure 1).

Figure 1. Mechanisms for distance learning of future foreign language teachers using smart technologies.

The distance learning process involved the general transfer of information through the Webex online platform. The platform became the basis for conducting lectures and practical classes. It was also used for recording the lectures for the possibility of reproducing the educational material outside of classes. During training, the Webex platform provided for the exchange of educational materials, which was used as an interactive whiteboard. Distance learning using the Webex platform provided the possibility of group work, voting or raising hands as in a regular classroom. The learning process also involved the use of notes for further discussion of a particular issue. The learning process was intended for the *acquisition of language skills*. This stage of learning consisted of studying grammar and vocabulary. Learning provided for studying information with a teacher, as well as independently. The learning process was ensured through the use of engVId and LingQ applications. In addition to the teacher's materials, the learning process involved the use of additional lectures from digital applications. The engVId application facilitates the use of video lessons, focusing on a certain topic of classes. These video lessons are aimed at increasing the initial level of knowledge. Additional educational materials were received using the LingQ platform, which enabled focusing on text (audio) materials for studying a particular topic. Digital applications helped in the study of parts of speech, different tenses (from the Simple, Continuous, Perfect and Perfect Continuous groups). The learning process also provided for the construction of sentences, focusing on the sequential combination of words.

The development of consecutive translation skills is important for learning a foreign language, as it is aimed at understanding the read or heard text. The learning process was based on group work, which involved familiarization with the text for further translation. The Webex online platform facilitated group learning, which allowed teachers to monitor the quality of the text translated by students. The vocabulary was enriched through the use of Loyal books smart technology, which helps to enrich the vocabulary based on electronic (audio) books. Oral and written translation of the text from Ukrainian to English and vice versa was provided during the training.

The development of formal and informal communication styles was also an integral part of training, which involved the acquisition of professional skills. The learning process was aimed at academic study of the English language, as well as informal approaches to communication. Communication was built using the Webex online platform. The training also involved the selection of the most informative topics, their diversity, aimed at the development of practical competence and emotional satisfaction. The BeeSpeaker application was used for overcoming the language barrier due to the formation of correct pronunciation based on the capabilities of the programme.

The developed learning mechanisms were aimed at building professional speaking skills and enhancing students' motivation. The level of students' motivation before and after training was determined using the Stapel Scale (Figure 2).

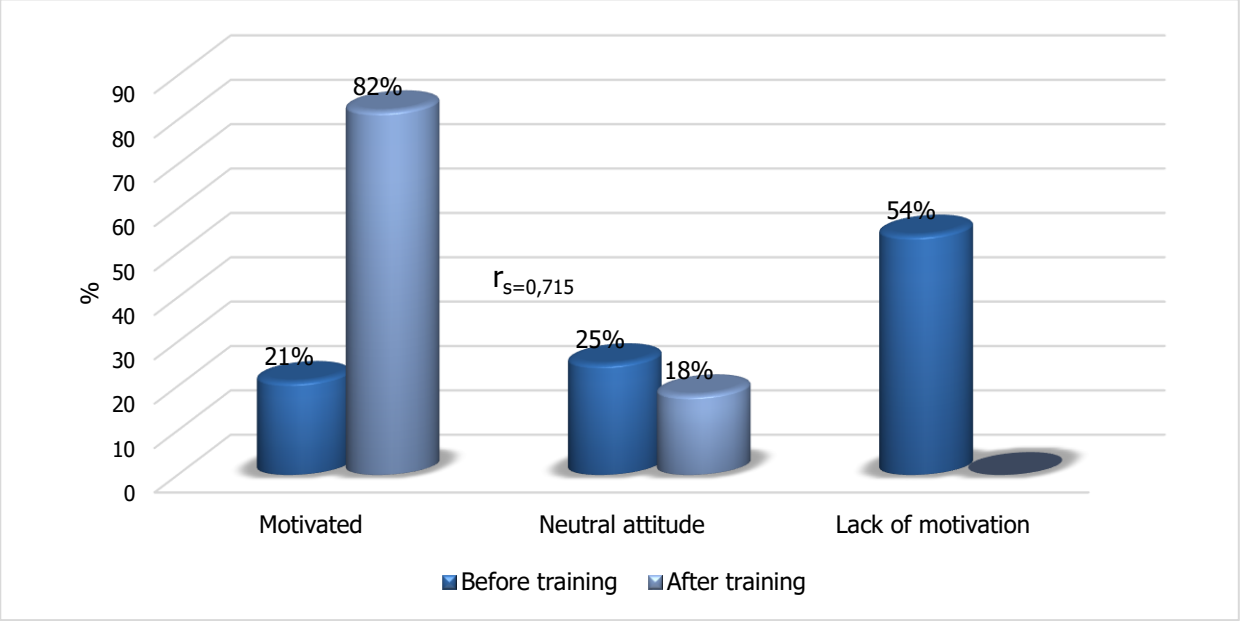

Figure 2. The level of students' motivation for distance learning

It was established that the use of smart technologies contributed to increasing the level of student motivation. The results before and after training differ significantly, which is explained by the use of different applications that are aimed at forming a separate professional skill. The high students' motivation was associated with the constant improvement of knowledge, which involved the performance of various tasks. The learning process also contributed to the development of professional and situational communication skills, which influenced the level of foreign language competence. Students' motivation was also related to a clearly organized learning process, which allowed for a meaningful approach to the study of the topic. This contributed to increasing the efficiency of independent work, which affected the development of students' thinking. An important role was also played by remote access to materials, which contributed to their additional study during the preparation of homework. For students who later wanted to continue their postgraduate studies, the use of smart technologies was of little importance for the development of research activities. This made it possible to build creative skills and develop logical thinking.

The students' neutral attitude towards the presented educational approach was associated with the lack of normal communication as in the classroom. However, these students confirmed that the learning process was clearly balanced, which made it possible to achieve the desired level of knowledge.

A significant part of the students was not motivated in learning before the study. The reason is that the use of a single online platform, e-mail, and messengers did not contribute to the acquisition of professional knowledge. This approach also influenced the need for self-study.

The objectives of the research were also to determine which factor had the greatest influence on the formation of positive students' motivation towards the educational process (Table 1).

Table 1.
Determining the factor that had the greatest impact on students' learning motivation

Impact factor	Digital superiority of impact factors	Comparison using the Spearman coefficient				
		Smart technologies	Personalized learning	Diversity of the educational process	Work in groups	Other
Smart technologies	1.0	-	0.953	0.716	0.683	0.937
Personalized learning	0.81	0.953	-	0.904	0.921	0.950
Diversity of the educational process	0.83	0.716	0.904	-	0.862	0.844
Work in groups	0.75	0.683	0.921	0.862	-	0.871
Other	0.62	0.937	0.950	0.844	0.871	-

It was established that the use of smart technologies had the greatest impact on the formation of positive students' motivation. The positive value of smart technologies is related to the provision of continuous learning. This helps to study and consolidate the material not only during classes, but also during the preparation of homework. The students were also able to perform various exercises with the help of Smart technologies to improve their professional level.

The diversity of the educational process also had an impact on student motivation, as it contributed to immersion in the informational and educational environment. Diversity in education contributed to the generalization of knowledge, focusing on modern educational concepts. Personalized learning was associated with the performance of various tasks according to the level of students' knowledge, which contributed to their improvement. Personalized learning is aimed at acquiring cognitive skills, which contributes to the acquisition of more professional knowledge.

Working in groups also contributed to motivation, which made it possible to focus on the level of knowledge of different students. It also made it possible to expand professional knowledge, focusing on other experiences. Other answers were related to the use of video conferences, certain smart technologies, etc., which contributed to learning the educational material. This ensured orientation towards the set goal, realization of educational skills.

At the third stage of the research, the skills that were acquired by students during their studies as a result of using smart technologies were determined (Figure 3).

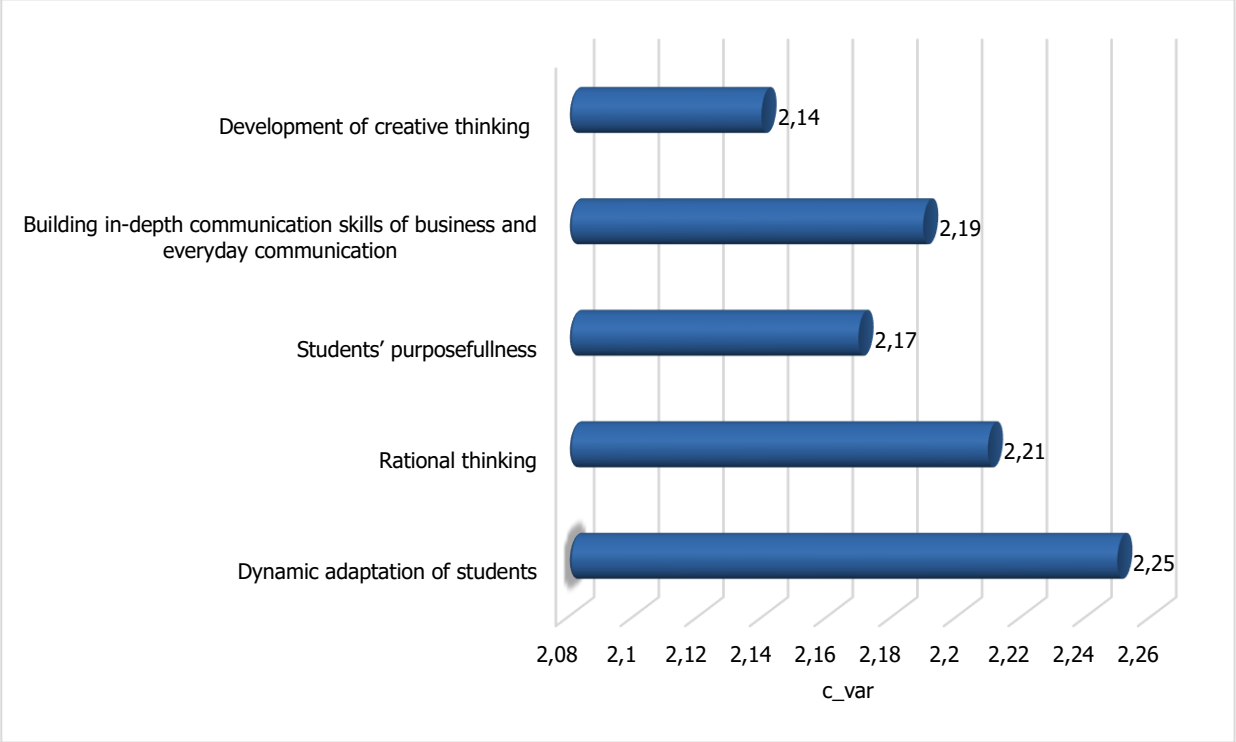

Figure 3. Skills that were acquired by students in the process of learning with the use of smart technologies

It was established that smart technologies also had a positive value for the development of various learning skills, which contributed to the study of the subject. Dynamic adaptation of students was associated with flexibility in the perception of new tasks or smart technologies. This made it possible to perform the assigned tasks with high quality in order to consolidate the necessary knowledge. It also had an impact on the students' involvement in the development of professional knowledge.

Rational thinking was associated with improved foreign language skills, facilitating the performance of tasks of higher complexity. This was reflected in the logical perception of information, which contributed to the clarity of tasks.

Student purposefulness was associated with increased productivity, which contributed to additional study of educational materials. The search for materials was facilitated by smart technologies used in education.

The formation of in-depth communication skills of business and everyday communication was connected with the provision of quality education. This allowed students to communicate on various topics using professional vocabulary.

The development of creative thinking is associated with non-standard perception and display of information, which influenced the achievement of high results and professional knowledge.

Discussion

The obtained results are related to the determination of the positive value of smart technologies for the development of student motivation in distance learning. This was achieved as a result of remote classes using the Webex online platform, which was also used as an interactive whiteboard. The acquisition of

language skills was related to the development of writing skills, the accuracy of sentence construction, and involved the use of the engVId and LingQ applications. The smart application Loyal books was used to develop the sequential translation skills, which contributed to the understanding of the read or heard text. The BeeSpeaker application was used to develop formal and informal communication styles, which helped to overcome the language barrier.

The analysis of recent publications showed the difference in the obtained data. It is necessary to ensure the students' motivation to perceive information during the educational process. Modern technologies contribute to the expansion of educational opportunities for formal or alternative education. With the help of modern technology, it is possible to provide a deeper understanding of the theoretical material and its practical application. The use of modern technologies should be associated with personalized access for students to facilitate interaction between them (Lorenzo et al., 2021).

The use of smart technologies during distance learning should be aimed at developing identity and increasing internal cohesion. Smart technology materials should also be publicly available, which contributes to adequate perception of information. Providing group access to learning promotes higher results (Urbanetti et al., 2023). The disadvantage of distance education is the lack of direct interaction between the participants of the educational process. Therefore, the functions of the used smart technologies should be aimed at motivating students and developing professional knowledge. At the same time, the learning process must be adapted to approved educational standards. Innovative approaches to learning should contribute to the development of students' creative potential (Abuhassna & Alnawajha, 2023). A comparison of the results of the published work showed that smart technologies are aimed at developing students' motivation during distance learning. In our article, specific mechanisms were developed to enhance student motivation, which involved the use of the Webex online platform, engVId, LingQ, Loyal books, and BeeSpeaker applications.

The distance learning process should be based on the correct evaluation of students, which affects their motivation. Formal evaluation should be excluded, and attention should be paid to the creation of favourable pedagogical conditions. The results of the study show that the positive students' motivation has an impact on obtaining a high grade. This can be achieved through the intelligent integration of smart technologies to ensure student self-assessment (Dmitrenko et al., 2021). Mobile learning should be aimed at improving the quality of the educational process. This can be achieved through the analysis of the correctness of the chosen approach to learning and mobile applications, which are designed for studying separate topics. The development of interactivity contributes to the expansion of students' horizons, affects the time limit. It can also stimulate students' interest to improve the quality of learning (Li, 2023). E-learning is a common method of modern education. The use of technologies Effort Expectancy, Social Influence and Facilitating Conditions ensures the reliability of education. The technologies have a positive value in the selection of quality information for learning, promote social interaction. These approaches influence students' overall literacy and motivate them to learn (Oyetade et al., 2023). In contrast to the presented studies, the ways of students' evaluation-based motivation in distance learning are not studied in our article. Of course, students' understanding of their level of knowledge is important, but a well-designed approach to learning has a greater impact. However, it was established that the learning motivation was influenced by smart technologies, personalized learning, the diversity of the educational process, and work in groups.

Modern technologies make it possible to complete regular educational programmes, use multimedia videos, and instrumental software. The level of acquired skills is evaluated through a rating scale and factor analysis by comparing individual results. The evaluation process should be based on the students' personal skills, which is related to predictive, comparative and evaluative components (Long & Lin, 2022). Digital technologies have caused changes in the education system, which is associated with overcoming traditional education systems and adapting new approaches. Digital technologies contribute to the development of

creative skills, which affects the learning process. Focusing students' attention on the learning process should be related to the search for motivation. This may be related to the use of various applications to improve student performance (Nejković & Andrejević, 2022).

The review of academic articles gave grounds to determine the positive value of smart technologies in the educational process, which has an impact on students' motivation. Specific mechanisms were developed in our study to provide distance learning using smart technologies. The level of students' motivation in this learning process was also determined during the study, as well as the impact factors.

Limitations

The limitations of the study are related to the year of study of the students involved in the survey (3rd year). There is no comparison of the impact of distance learning on different students (e.g. third- and fourth-year students), which will be implemented in the future. However, the limitations of the article are not significant, as the authors, based on the developed learning mechanisms, determined the impact of Smart technologies on enhancing students' motivation to achieve their professional skills.

Recommendations

The spread of smart technologies in the modern education system facilitates their use not only during classroom sessions, but also during distance learning. Smart technologies ensure the continuity of the educational process, facilitate access to materials. Their effectiveness also implies the possibility of using various tasks that will contribute to raising the students' level. Therefore, the use of smart technologies during distance learning can contribute to comprehensive education. It is, however, necessary to ensure high-quality organization of the learning process, to study the mechanisms of using modern technologies that will correspond to the main training system. This approach will have a positive effect on students, which will motivate them to study the subject in depth and contribute to achieving high results.

Conclusions

The aim of the study set by the authors was achieved after completing the research. It was achieved as a result of the development of distance learning mechanisms, which made it possible to further check the level of students' motivation on specific examples. The relevance of the obtained results was primarily achieved through the development of educational mechanisms for future English teachers. The training was provided through the use of the Webex online platform, engVId, LingQ, BeeSpeaker, smart Loyal Books application.

The obtained positive results were related to determining the level of student motivation. It was established that the quality of the research is related to obtaining a high level of student motivation, which was provided by the aim of the research. It was found that 21% of students felt motivated before the study, while 82% after the study. The results after the study are related to easier perception of information due to the use of smart technologies. According to the students, achieving their high level of motivation became possible primarily due to the use of smart technologies (1.0) and the diversity of the educational process (0.83).

These indicators were important for the development of language knowledge, which enabled reaching a higher level. It was established among the students that the learning process had a positive value for the development of dynamic adaptation of students, rational and creative thinking, as well as for students' purposefulness, development of in-depth communication skills of business and everyday communication.

The academic novelty of the article is related to the enhancement of students' motivation through the development of specific learning mechanisms using the most effective smart technologies. The practical significance of the article is the possibility of developing students' motivation during distance learning due to the use of the most correct smart technologies. Research prospects may be related to the comparison of smart technologies in distance learning to determine their impact on student performance.

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