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The role of technology in the development of higher education in Ukraine in the context of global challenges

El papel de la tecnología en el desarrollo de la enseñanza superior en Ucrania en el contexto de los retos mundiales

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Abstract

The article examines the role of technology in the evolution of higher education in Ukraine, with a particular focus on the challenges posed by global change. The author analyses the impact of digitalisation on the learning process, the organisation of educational activities and the interaction between students and teachers. The article discusses both the positive aspects of the introduction of digital tools, such as increased student engagement, curriculum flexibility and effective management of educational resources, and potential problems, such as technical difficulties, the need to improve the digital literacy of teachers and students, and the possible decline in the quality of education due to the use of low-quality teaching materials. The article is based on an empirical study of the introduction of digital technologies in higher

education institutions, as well as on the results obtained in EU countries in 2022. The practical and theoretical implications of the study are discussed separately. This includes the development of recommendations for the integration of digital technologies into the educational process, as well as the development of educational theory in the context of digitalisation.

Keywords: technological innovation, digital transformation, educational innovation, higher education, smart technologies.

Resumen

El artículo examina el papel de la tecnología en la evolución de la enseñanza superior en Ucrania, con especial atención a los retos que plantea el cambio global. El autor analiza el impacto de la digitalización en el proceso de aprendizaje, la organización de las actividades educativas y la interacción entre estudiantes y profesores. El artículo analiza tanto los aspectos positivos de la introducción de herramientas digitales, como el mayor compromiso de los estudiantes, la flexibilidad de los planes de estudio y la gestión eficaz de los recursos educativos, como los posibles problemas, como las dificultades técnicas, la necesidad de mejorar la alfabetización digital de profesores y estudiantes, y el posible deterioro de la calidad de la enseñanza debido al uso de materiales didácticos de baja calidad. El artículo se basa en un estudio empírico sobre la introducción de las tecnologías digitales en las instituciones de enseñanza superior, así como en los resultados obtenidos en los países de la UE en 2022. Las implicaciones prácticas y teóricas del estudio se discuten por separado. Esto incluye la elaboración de recomendaciones para la integración de las tecnologías digitales en el proceso educativo, así como el desarrollo de la teoría educativa en el contexto de la digitalización.

Palabras clave: innovación tecnológica, transformación digital, innovación educativa, enseñanza superior, tecnologías inteligentes.

Introduction

Before analysing the processes of transformation of the higher education institution under the influence of technological development, it is important to define what should be understood by the institution of education in general and higher education in particular. The institution of education is the most important social institution that regulates the processes of socialisation of individuals. When we talk about a social institution, it means that roles (mutually typified actions inherent in each role) are distributed among the subjects of relations, which indicate specific actions to actors in certain situations.

Relationships between role holders are regulated by a system of norms and rules that are situated in a cultural and historical context, and the roles themselves serve as models of behaviour. Norms, rules and roles are always linked to a particular situation and cultural context. This means that institutions are not created forever; they change depending on place, time and cultural context. Institutions capture social experience in the memory of society, so that individuals can give meaning to their actions, their biographies, and the actions of others (Byrko et al., 2022).

Education as an institution has its own ideology, rooted in the culture of a particular society. This ideology gives it meaning and determines the direction of educational activities, i.e., determines how and what to teach in order for an individual to be successful, useful to society and socialised. Ideology served as the basis of the conceptual model of education. Previously, higher education was assessed not so much from a pragmatic point of view, as the acquisition of a profitable job, but from the point of view of possessing the highest good, i.e. realising the possibilities of comprehensive and harmonious personal development. Today, the ideology is changing: the pragmatic and social stratification aspects of higher education are becoming more important (Shevchenko, & Dubiaha, 2022).

Institutional analysis includes the study of the current state of the higher education system, its norms, values, rules of interaction between key stakeholders and their roles. Technologisation of higher education means the transformation of educational and management processes, as well as everyday social practices, through the introduction of technologies for creating, processing, exchanging and transmitting large amounts of information on electronic media. This process involves the integration of education with information resources. When analysing the digitalisation of higher education, we will focus on how digital tools and technologies change the educational situation, the roles of the main participants in the educational process, the conceptual model of education and the management of educational institutions (Iastremska et al., 2023).

The research focuses on how modern technologies influence the development of higher education in Ukraine, especially in the context of global challenges. The article analyses the changes that have taken place in higher education in Ukraine as a result of the introduction of digital technologies, including the transition to online learning, the use of digital platforms for lectures and seminars, and the introduction of electronic learning management systems.

The purpose of this article is to study and analyse the role of modern technologies in the development of higher education in Ukraine in the context of global challenges.

Theoretical Framework or Literature Review

Theoretical foundations of the study of the introduction of new technologies in the higher education system

The changes in the education system that are taking place under the influence of technology are widely discussed in the scientific literature (Kayumovich, 2024; Palkova & Agapova, 2021). Many articles focus on the benefits of digital technologies used in higher education (Boiko et al., 2024; Skoromnyi et al., 2021). These advantages include: students' access to information resources without restrictions; creation of individualised educational trajectories; transparency of educational organisations; optimisation of interaction between teachers and students, as well as between all participants in the educational process; formation of flexible structures for managing the educational process, etc.

Along with the positive aspects, the literature contains sceptical assessments of the technologisation and digitalisation of higher education (Barvinok & Pudło, 2023; Berbets et al., 2021). The challenges faced by the higher education system are discussed: increased competition in the market of educational services due to the emergence of new providers, increased mobility of students, changes in their demands for content, forms and technologies of education, on the one hand, and the inability of universities to master new requirements and fully use the capabilities of digital technologies, on the other (Oharenko et al., 2022; Okanda, 2024).

Attention is also drawn to the increase in fraud and plagiarism due to the expansion of access to information resources of educational organisations (Boiko et al., 2024; Tkachuk et al., 2023). Researchers are seriously concerned about the formalisation of professional training and the decrease in the diversity of graduates' knowledge and competences due to the algorithmisation and standardisation of online education, especially in the case of robotic programs and the lack of direct contact with the teacher and students (Zaitsev, 2023; Opryshko et al., 2024).

At the same time, the main problem with studies analysing the social effects of the technologicalisation of higher education is that they usually assess the technologicalisation of one of the elements. This refers to a change in either the learning paradigm, or the management of educational organisations, or the organisation of the learning process, or communications between the main participants in the educational process. There are virtually no studies that focus on the transformation of this institution under the influence of digitalisation and the associated social risks as a probability of a positive or negative outcome for society and the educational institution itself.

Methodology

Design

The effectiveness of this study is assessed using qualitative and quantitative indicators. During the observations, these indicators are measured, compared and analysed, and then the data are interpreted. The study went through several stages, as shown in Table 1.

Table 1.
Stages of the study

No.	Stage	The period of the event	Content of the research stage
1	Stating.	February 2023	Defining the purpose and objectives of the study. Formation of control and experimental groups of students. Selection of research tools and methods. Conducting primary testing. Checking methods for internal consistency and relevance to the chosen research topic
2	Shaping	September 2023 - March 2024.	Implementation of pedagogical conditions for the use of the latest technologies for students of the experimental group. The pedagogical conditions include: the use of synchronous and asynchronous distance education tools, the use of chatbots, messengers, and other means of digitalising the educational process. At this stage, the academic performance of students and their attitude to the conditions of the educational environment of the university were monitored.
3	Final	April 2024	Processing of research results. Summing up the results.

Participants

The study was conducted at the Department of Foreign Languages of the Faculty of Biology and Technology of Sumy National Agrarian University and the Practice of English Language and Methods of Teaching it at the Faculty of Ukrainian and Foreign Philology and Department of Pedagogics and Psychology of Ivan Franko Drohobych State Pedagogical University. The respondents were selected by drawing lots among the students of these departments. Students of the 2nd-4th year of study took part in the research and experimental work. The control group consisted of 68 people, including 35 men and 33 women. The experimental group consisted of 67 people, including 18 men and 49 women.

The age composition of the study groups was the same; both groups studied according to the same educational standard of higher education. In the process of theoretical and practical training, both groups were taught by the same teachers. Students of the experimental group participated in pedagogical conditions of using the latest technologies in education, while students of the control group studied according to the standard methodology. The study also involved an expert group of 9 teachers.

Data collection

1. The Educational Environment Trust Scale (EETS) was developed by researchers at the University of Illinois. The EETS consists of 18 statements designed to assess students' trust in teachers, peers, and the overall educational environment.
2. Using the method of expert assessments, an independent and objective study of the role of smart technologies in stimulating students' motivation to learn a foreign language was conducted. The expert group also analysed the academic performance of students in two groups - with and without the use of smart technologies. The results of the analysis became the basis for identifying the correlation between motivation to learn and the use of smart technologies in the learning process.
3. The European Framework for the Digital Competence of Educators (European Comission, n/d) is a global framework created by the European Commission to define and assess the digital competences required by educators. This tool aims to support teachers in developing their digital skills to effectively use technology in the teaching and learning process. DigCompEdu provides self-assessment tools to

help teachers assess their level of digital skills.

Data análisis

1. The following formula is used to determine the standard deviation (SD) for each group:

$$S = \sqrt{\frac{\sum(X_i - \overline{X})^2}{N-1}}; (1)$$

where X_i is the value of each level, $\underline{X}$ - is the average value, N is the number of observations.

2. The *criterion* χ^2 *is calculated by the formula:*

$$\chi^2 = N \cdot [\sum_{j=1}^{m} \left(\sum_{i=1}^{n} \frac{x_{ij}^2}{Q_i \cdot R_j} \right) - 1], (2)$$

where N is the total number of students who participated in the formative stage of the pedagogical experiment;
m is the number of possible values of the first feature; n is the number of possible values of the second feature;
x_{ij} - the number of combinations of the i-th value of the first feature with the j-th value of the second feature;
Qi is the total number of observations of the i-th value of the first feature;
Ri is the total number of observations of the j-th value of the second feature.

Typically, critical values are given for different levels of significance. The probability of error associated with rejecting or not rejecting the null hypothesis is called the significance level. This means that the probability of considering differences to be significant when they are actually random is determined by the significance level. In pedagogical research, a significance level (denoted by α) of 0.05 is usually used, which indicates that the possibility of error should not exceed 5%. This is the level of significance used in this study.

Results and Discussion

Study the impact of technology on the learning environment

The attitude of CG and EG students to the learning environment of the university was studied using the EETS test. The results are presented in the form of a diagram at Fig. 1.

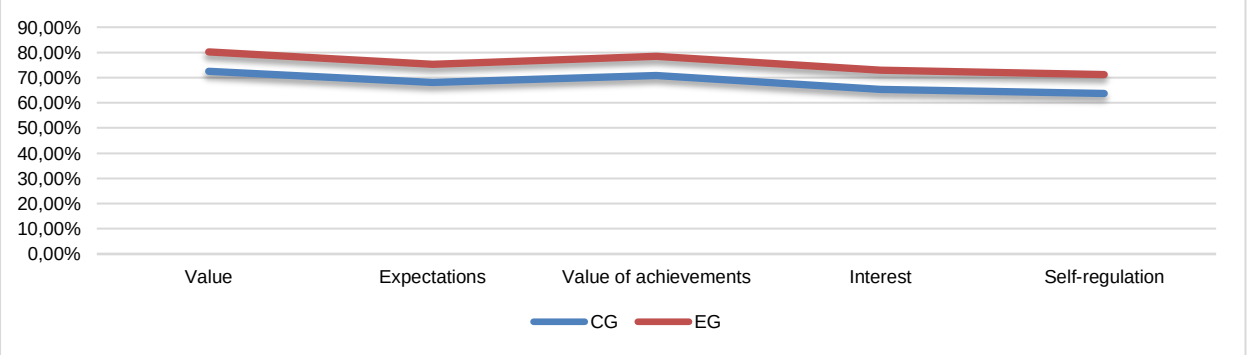

Figure 1. Results of the EETS test for CG and EG.

In the EG, there is a slightly higher level of learning value compared to the CG. This indicates that students who participated in the experiment value learning more, possibly due to new methods or approaches used

during the experiment. The EG also has higher expectations of academic success, indicating greater confidence in their abilities and a more positive perception of the learning process. EG participants attach more importance to their academic achievements, which may indicate that they are more motivated to succeed.

The CG, on the other hand, shows less interest in learning compared to the EG, possibly due to less interesting or outdated methods used in the standard curriculum. EG participants have better skills in self-regulation of learning activities, which indicates that they are more self-disciplined and organised.

These results indicate that the introduction of new methods or approaches may help to improve perceptions of the educational environment. However, more research is needed to confirm these findings and to understand the specific factors that influence perceptions of the educational environment. It is also important to take into account other possible factors that may influence the issue under study. Table 2 shows the dynamics of academic performance of students in both groups.

Table 2.
Dynamics of academic performance of EG and CG students

Group	Success rate	Before the experiment (%)	After the experiment (%)	p-value
EG	High	20.0 (12.5)	40.0 (15.2)	<0.001
EG	Medium	50.0 (16.8)	45.0 (14.7)	0.231
EG	Low	30.0 (15.3)	15.0 (10.8)	<0.001
CG	High	25.0 (13.4)	25.0 (12.9)	0.874
CG	Medium	45.0 (18.1)	45.0 (17.6)	0.954
CG	Low	30.0 (14.2)	30.0 (14.5)	0.921

Table 2 illustrates the dynamics of academic performance of EG and CG students before and after the introduction of pedagogical conditions for the use of innovative technologies. The main trends show significant differences in academic performance between the groups.

In the EG, there was a significant increase in the proportion of students with a high level of academic performance after the experiment. The indicator increased from 20% to 40%, which is statistically significant ($p < 0.001$). At the same time, there is a significant decrease in the proportion of students with low academic performance, from 30% to 15%, which is also statistically significant ($p < 0.001$). These changes indicate the positive impact of the use of the latest technologies on students' academic achievements. The level of average academic performance in the EG has undergone a slight change, decreasing from 50% to 45%, which is not statistically significant ($p = 0.231$). This indicates that the increase in academic performance was mainly due to the transition of students from low to high levels.

In the CG, academic performance remained virtually unchanged after the experiment. The proportion of students with high academic performance remained at 25%, with no statistically significant changes ($p = 0.874$). Similarly, the proportions of students with average (45%) and low (30%) performance levels remained stable, also without statistically significant changes ($p = 0.954$ and $p = 0.921$, respectively).

The analysis of the results shows that the introduction of the latest technologies in EGs has led to a significant improvement in academic performance, in particular, an increase in the proportion of students with high academic performance and a decrease in the proportion of students with low academic performance. In the CGs where traditional teaching methods were used, no such changes occurred.

Discussion

Not all universities see technologisation and digitalisation as a priority for modernising the educational process. However, they cannot ignore technological progress that promises certain benefits to all

stakeholders. An, Wang, Li, Gan, & Li (2021) believe that the introduction of digital technologies and tools expands the possibilities of using interactive teaching methods and has a positive impact on student engagement in the learning process. As the current study shows, effective technologies include the use of Learning Management Systems (LMS), which facilitate access to learning materials and make the learning process more flexible. This is also confirmed by the results of studies by Bećirović, Brdarević-Čeljo & Delić (2021) and Chen, Zou & Xie (2020). Digital technologies based on artificial intelligence, such as chatbots, are also proving to be very useful in organising the educational process. Deja, Rak, & Bell (2021) describe examples of chatbots in university libraries.

The study showed that students are comfortable using various technological tools. For example, in the Summit Learning project, a chatbot acts as a tutor, engages in a dialogue with each student, and identifies areas where the student is lagging behind (Ervianti et al., 2023). The chatbot then uses this data to create an individualised learning program that focuses on the subjects that cause the most difficulty and tracks student progress from the first to the last lesson.

It is worth noting that the introduction of web-based tools creates new requirements for teachers and students who need to master Web 2.0 tools and develop digital competencies. This is evidenced by the work of Haleem, Javaid, Qadri & Suman (2022). However, the experience of using digital tools in universities in different countries shows that not everyone is ready for such changes. In particular, Humairoh (2023) points out that not everyone takes advantage of, for example, learning management systems (LMS), considering them not a very useful addition to traditional teaching practices.

In addition, the use of these tools in the educational process changes the roles of teachers and students, transforming their relationship and redefining the essence of classroom work. Classroom work is transformed into a discussion platform where students' solutions are discussed, mistakes and omissions are identified, and important aspects of the discipline are conceptualised.

As the results of the current study show, the introduction of digital tools and technologies is changing the educational situation by involving new actors in the process. These actors include software developers, owners of educational platforms, and intermediaries who adapt tools and technologies to the educational process in higher education, as well as help teachers and students to master new technologies. New actors are actively involved in decision-making on the content and organisation of the educational process, partially replacing academic staff. These changes are particularly noticeable in the transition to online education (Klimova et al., 2023).

Online learning based on digital technologies makes the educational process more dynamic, interesting and flexible. Electronic learning materials, such as textbooks, presentations, and video tutorials, can be reused, allowing teachers to save time on classroom preparation and pay more attention to communicating with students. The use of Socrative, Kahoot, Edmodo and Nearpod in the educational process allows teachers to share interactive materials, engage students in discussions and assess assignments in real time.

However, to work effectively with these systems, technical support is required both in the preparation of electronic teaching and learning materials and in the use of Internet resources. This creates a need for specialists or even separate structural units in higher education institutions to provide such support, which complicates the management of the educational organisation.

When considering the intensive development of online education, global social risks should also be taken into account. Competition between online platforms providing online learning services and between universities seeking to expand their influence through online courses leads to duplication of disciplines and learning materials. This can offset the benefits of a networked education model (Ma, 2021). In addition, low-quality learning materials appear in the online space, which sometimes do not meet the minimum requirements of higher education, which carries the risk of lowering the quality of graduates.

Scientific novelty and main limitations of the study

The practical significance of the study lies in the development of recommendations for the integration of digital technologies into the higher education process. The results can be used to develop effective curricula that incorporate new digital tools and technologies, thereby increasing the readiness of teachers to use modern technologies. This will improve the organisation of the learning process through the use of learning management systems (LMS) and other interactive platforms. This will increase students' interest and motivation in learning through the use of interactive methods. In addition, the results of the study will help to create conditions for individualisation of learning, which will allow for more effective adaptation of educational programmes to the specific needs of each student.

The theoretical significance of the study is to deepen the understanding of the impact of technology on the educational process in higher education. The study contributes to the development of educational theory, in particular in terms of the use of digital tools to improve the educational process and increase its efficiency. In addition, the study expands knowledge about the changing roles of teachers and students in the context of digitalisation of education, as well as analyses new forms of interaction and teaching methods. The theoretical conclusions of the study can be used as a basis for further research in the field of pedagogy and educational technologies, as well as for improving educational standards and policies.

The methodological limitations of this study are related to the use of specific methods of data collection and analysis, which may affect the overall validity and reliability of the results. It should be noted that the limited use of only certain quantitative and qualitative methods may lead to an incomplete reflection of the full range of the impact of digital technologies on the educational process. In addition, the subjectivity of teachers' and students' assessments can affect the accuracy of measurements. Instrumental limitations may be related to the use of a limited number of digital tools and technologies in the study. The tools selected for the study may not be equally accessible or familiar to all study participants. This may affect the perception and use of technology. Some tools may have technical limitations that make it difficult to integrate them into the learning process or reduce the effectiveness of their use.

The limitations of the sample are related to the fact that the study was conducted on the basis of specific universities and faculties, which to some extent distorts the generalisation of the results to all other HEIs. The sample consisted of students selected by lot from specific faculties, which may not fully reflect the diversity of the student population. In addition, the number of participants was limited, which may affect the statistical significance of the results. Also, the age and level of training of the students in the sample may also affect the results, as different groups of students may perceive and use digital technologies differently.

Conclusion

The research is driven by the need to meet the growing demand for professionals with innovative skills, including the ability to interact effectively in today's uncertain environment and adapt to various changes. The study examined the interaction between the levels of technologicalisation and students' attitudes towards the educational environment. The findings led to several key conclusions. Digitalisation of the educational process opens up new opportunities to improve learning and optimise its effectiveness. Although not all higher education institutions currently allocate sufficient resources to this area, technological progress is having a profound impact on the education sector, bringing significant benefits to all stakeholders. The introduction of digital technologies, such as learning management systems (LMS) and chatbots, has demonstrated significant benefits.

The use of an LMS facilitates access to learning materials and increases the flexibility of the learning process. Chatbots using artificial intelligence are useful tools for organising the learning process, especially in university libraries. Not only do they make it easier for students to access information and literature, but they also reduce the workload of library staff by automating routine tasks. In addition, chatbots act as virtual consultants, helping to tailor the learning process to the individual needs of students. Summit Learning's

project demonstrates the potential of chatbots as tutors that identify gaps in students' knowledge and develop individualised learning programmes, which can improve academic results. Thus, digital technologies are an important tool for modernising the educational process, improving the quality of education, student engagement and the efficiency of teachers and educational institutions in general.

It is imperative that universities proactively integrate these technologies, adapting them to their specific needs and circumstances, to maximise the benefits of their use. The findings have a wide range of practical applications. In the pedagogical sphere, courses and curricula can be developed that focus on the integrated development of digital and communication skills.

The use of interactive technologies in teaching can have a positive impact on students' digital competence. Future research could be aimed at better understanding and optimising the impact of educational technologisation on the development of students' skills. One of the prospects is to further study the role of interactive and intelligent systems in shaping effective communication between students and teachers.

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