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Integration of information technologies into innovative teaching methods: Improving the quality of professional education in the digital age

Integración de las tecnologías de la información en métodos de enseñanza innovadores: Mejorar la calidad de la educación profesional en la era digital

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ABSTRACT

Introduction: modern possibilities of using digital technologies in vocational education are actively used to improve the training of specialists and adapt them to the requirements of the labour market. The purpose of the article is to analyse the integration of information technology into innovative teaching methods and to study the improvement of the quality of vocational education in the digital age.
Method: the type of research is quantitative. The authors used such scientific methods: comparison and content analysis. The materials were processed from 02-09-2023 to 21-12-2023. A survey of teachers of vocational education institutions (140 people) was also conducted, based on which the main opinions on the state and prospects of digitalisation in this area are presented.
Results: it was showed how often and effectively digital technologies are used and what innovative tools teachers use. It is also demonstrated that the difficulties in reforming the material base of education are recognised as extremely significant in Ukrainian reality. The importance of continuous professional development is emphasised, as digital technologies are developing rapidly.
Conclusions: it was summarised the results of the study, emphasising that the digitalisation of vocational education aims to ensure the proper development of education in line with the current challenges of the labour market.

Keywords: Professional Education; Digitalisation; Innovations; Methods; Integration.

RESUMEN

Introducción: las modernas posibilidades de uso de las tecnologías digitales en la formación profesional se utilizan activamente para mejorar la formación de los especialistas y adaptarlos a las exigencias del mercado laboral. El objetivo del artículo es analizar la integración de las tecnologías de la información en métodos de enseñanza innovadores y estudiar la mejora de la calidad de la formación profesional en la era digital.

Método: el tipo de investigación es cuantitativa. Los autores utilizaron métodos científicos: comparación y análisis de contenido. Los materiales fueron procesados del 02-09-2023 al 21-12-2023. También se realizó una encuesta a profesores de instituciones de formación profesional (140 personas), a partir de la cual se presentan las principales opiniones sobre el estado y las perspectivas de la digitalización en este ámbito.
Resultados: los resultados muestran con qué frecuencia y eficacia se utilizan las tecnologías digitales y qué herramientas innovadoras emplean los profesores. También se demuestra que las dificultades para reformar la base material de la educación se reconocen como extremadamente importantes en la realidad ucraniana. Se subraya la importancia del desarrollo profesional continuo, ya que las tecnologías digitales evolucionan rápidamente. Se señala positivamente la orientación de la formación profesional moderna hacia el estudiante y la política estatal activa en este ámbito.
Conclusiones: las conclusiones resumen los resultados del estudio, haciendo hincapié en que la digitalización de la formación profesional tiene como objetivo garantizar el correcto desarrollo de la educación en consonancia con los retos actuales del mercado laboral.

Palabras clave: Educación Profesional; Digitalización; Innovaciones; Métodos; Integración.

INTRODUCTION

The use of modern digital technologies in the field of vocational education demonstrates positive dynamics, as evidenced by many experts.[4] This integration leads to an increase in the level of theoretical knowledge and practical skills, which, in a digital society and accelerated information exchange, is an important link in the training of future workers.

Innovative teaching methods, as an element of general digitalisation, have made it possible to implement the concept of distance education. In the context of the global COVID-19 pandemic, the use of digital methods has proven to be effective, and even after the consequences of the devastating pandemic have been overcome, digital technologies have become an important part of traditional teaching methods. In fact, new opportunities for their use have been opened up, which, together with the new conditions and circumstances of the organisation of production, service sector and economic activity in general, has significantly transformed vocational education.[2]

The basic concepts that are in the mainstream of transformations of vocational education systems in the modern world are: internationalisation and multiculturalism (we are talking about the possibility of using international experience in the educational systems of educational institutions), globalisation, which is associated with the current market of educational digital opportunities, the formation of universal values, approaches that are focused on the acquisition and further evolution of the most important personal competencies.[4,5] Among such competences, researchers usually distinguish analytical thinking, creative thinking skills, non-standard techniques in performing tasks, digital competence (rapid response to changes in modern digital technologies, their application and active participation in development), stress resistance, professional endurance, logic and consistency in solving problems.[6] An important and common element for all EU countries is the emphasis on the practical orientation of vocational education, which is achieved through the deep integration of digital technologies into the educational process, and the adaptation of curricula to the requirements of modern productive activity.[7] First of all, we are talking about the active use of online platforms in the training of students, the use of dual learning, and the integration of vocational training courses into the general education system.

Researchers note current trends in digital technologies.[8,9] First of all, we are talking about the use of e-learning, video learning, blockchain technologies, Big Data, artificial intelligence, gamification, online platforms, immersive technologies, virtual and augmented reality, STEAM, 3D printing, etc. Taking into account the spread of general digital trends and various technologies that can be used in the organisation of educational activities, digitalisation has become an integral element of vocational education.

It is noted that educational work with the use of digital technologies increases the interest of students in learning, stimulates them to seek knowledge, master digital tools, and deepen their professional knowledge. Given that the education system, according to many researchers, aims to provide society and each individual with a transition to the digital age, focus on new work tools, there is a search for an innovative educational process that provides professional training in the digital space.[10] Another important aspect is the ability to train not only young students, but also middle-aged and older people for new types and types of work. Important innovative methodological technologies in vocational education, which are actively used and implemented, have a positive trend in their use. In particular, open space pedagogy opens up a promising way to further shape the personal path of students and organise their deeper communication with the world. Such environments provide the necessary content: they are open platforms for communication with other students and teachers

around the world.[11] This technology opens up spaces for free communication, creative development and growth in order to maximise the use of all available ways of obtaining an effective education.

The open space system provides more efficient ways to achieve deeper education with less effort. This saving of effort has a positive impact on the well-being of teachers and students. Open space is much more than just a place for creative professional education. This system offers students the opportunity to discover their talents, combine them with deep social skills and experience, and analyse the unknown from a perspective that leads to a more open understanding of themselves and their potential against the backdrop of the development of the digital society and corresponding changes in educational processes.[12,13] Another global format of digital interaction is Makerspaces. It is the organisation of creative workshop spaces for research, lectures, brainstorming, experiments, practical work, implementation of ideas and improvement of new learning skills.

The proposed combination of traditional and digital skills and familiarity with engineering creates learning environments that offer original solutions, search for innovative combinations, compare theoretical knowledge with practical work, etc. In addition, makerspaces focus on honing practical skills, teaching students primarily STEAM subjects, which is really relevant for vocational education institutions. The proposed spaces, which combine various solutions, promote creative production and work with technical and digital equipment. They contribute to important achievements in improving the innovation of teaching practices, and become tools for encouraging students to find creative solutions to existing problems, primarily using the possibilities of design, creation, and construction.[14]

The relevance of such educational professional spaces is emphasised by European experts.[15,16] Using the concepts of learning factories 4.0, they consider these educational methodologies to be innovative for vocational education, industry schools, etc. The proposed term "Learning Factory 4.0" combines a number of practices and features of using digital tools to achieve positive learning outcomes.

Hence, the use of innovative technologies in vocational education is an extremely relevant part of modern learning, especially in the context of digital technologies. The information capabilities of technology make it possible not only to increase the efficiency of education, but also to improve it and develop new approaches to vocational training that meet the needs of the modern labour market.

The use of computer technology is one of the most common innovative technologies in the field of vocational education. Learners can use computers to work with online resources, complete assignments and projects, and to better communicate with teachers and other learners.[17] In addition, special online platforms have been created to help students improve their learning of specific subjects, perform complex calculations, or other tasks.One of the branches of this process is the use of additional online courses.[18] Video and audio information, virtual and augmented reality can also be actively used.[19,20] Researchers also draw attention to the possible gamification of the learning space of vocational education.[21,22,23] First of all, we are talking about the integration of interactive games that allow you to relax, have fun, but also learn new things. This attracts students' interest, gives them an impetus to study new materials and obtain additional information on their own, based on their interest.[24] Such technologies make it possible to create certain immersive environments where students can apply various skills and work on problems that they will face in real life. Hence, taking these features into account has become an integral part of the existing practices of organising learning activities, which will also require a new look, as recent studies show a steady trend towards a certain rethinking of the use of educational technologies in the digital age.

In particular, an important issue is to identify and analyse the capabilities of artificial intelligence technologies that have modernised the learning process. In vocational education, this opens up opportunities for further combining digital teaching with the evolution of learning technologies.

Another pressing issue is defining the role of teachers in modern education.[3] This means that the teacher is turning from the main source of information into an assistant who has to moderate or manage the educational process, while students acquire the skills of independent information search. This leads to the identification of opportunities to use digital technologies in lifelong learning.

The latter aspect is extremely important. Because the development of technology towards integration with digital elements will undoubtedly continue. For this reason, the ability to acquire new skills and abilities for vocational learners will require special emphasis, as this quality will allow them to receive the necessary training independently - simultaneously with the transformation of working conditions and the integration of new capacities for production needs.

Therefore, the purpose of the article is to study the integration of information technology into innovative teaching methods.

METHOD

Design

Determining the peculiarities of the application and integration of information technologies and teaching methods in the training of vocational education students in the context of rapid digitalisation was carried

out through the gradual implementation of several research stages: theoretical, empirical and generalising. Therefore, the type of research is quantitative.

The first stage involves identifying and characterising the theoretical problems of applying innovative methods and digital technologies in vocational education. The empirical stage consists in conducting an experiment to identify the main problems and prospects for the application of innovative digital solutions in vocational education.

First of all, a questionnaire was used to determine the attitude of modern teachers to the use of digital tools in vocational education, outline the main difficulties and the ability of vocational teachers to effectively use innovative teaching methods and digital elements in the future. The third stage is the stage of summarising and generalising, comparing the results of the survey with the data and theoretical conclusions of other researchers. On this basis, the following perspectives and possibilities of applying innovative methods in the field of vocational education were investigated.

Participants

In order to solve the tasks and achieve the main goal of the study, a pilot survey was conducted among teachers of vocational education institutions in Ukraine. A total of 140 people took part in the survey. These were teachers who have worked in vocational education for at least 5 years and have their own teaching experience. Age and gender were not taken into account as criteria - the questions were the same for all participants of the experiment. In general, people aged 31 to 65 were interviewed, which made it possible to assess different experiences of using innovative methods and technologies in teaching. In order to take part in the survey, all participants gave their personal consent to participate, which allowed their answers to be used for analysis and conclusions. Participation in the survey was voluntary, anonymous and free of charge.

Instruments

A number of scientific methods were used to determine the results of the study. Content analysis, synthesis and comparison were used to collect and study scientific literature, which made it possible to identify the main trends in the development of vocational education through the prism of digitalisation. The empirical methods include a survey of teachers of vocational institutions of Ukraine, which was carried out using modern tools of digital interaction. First of all, we are talking about the use of the Google-forms platform to provide answers to the questions. A chatbot on Telegram, a popular messenger among teachers, was also used. Hence, the survey was made online. To summarise the results of the study, we used the capabilities of Excel.

Data collection

The materials were collected and processed from 02-09-2023 to 21-12-2023. This is the first semester of study in vocational education institutions. In order to determine the effectiveness of the use of digital tools and innovative teaching methods, the main problems and prospects for the development of vocational education, a survey questionnaire consisting of 7 closed questions was developed. The survey aimed to determine the extent to which modern teachers use digital tools in their regular teaching. In addition to determining the degree of effectiveness of the use of information technology, it also covers the specifics of the educational process, the definition of the general role in the provision of educational services, and opinions on the prospects and further evolution of innovative vocational education. The study calculated the total number of answers and their correspondence in percentage.

Data analysis

The obtained information is processed using a comparative analysis of the problems and opportunities for the future application of innovative technologies in the system of vocational education through the prism of digitalisation. Using the method of abstraction, attention was drawn to the issues of the next evolution of innovations in vocational education, and the main recommendations for achieving more effective use of digital information technologies for educational purposes were formulated. The use of the modelling method made it possible to characterise the main leading ways for the development of innovative ways of organising the educational process in the field of vocational education in the future.

Ethical criteria

The survey was conducted in full compliance with the principles of professional ethics, respect for the opinions of others, anonymity and impartiality of all participants. The absence of discriminatory practices based on gender or age allowed us to avoid misunderstandings and ethical biases to the maximum extent possible. The experiment began with the voluntary consent of the participants, and the results were processed without outside interference and the use of artificial intelligence.

RESULTS

The survey found that teachers actively use digital technologies in their classes. In particular, it was found that only 3 % of respondents do not use modern digital technologies, but continue to use exclusively traditional teaching methods, as they did before. At the same time, 40 % of respondents always use digital technologies, while 45 % of respondents use them in combination with traditional methods of work (see Table 1).

Table 1. Rate the frequency of use of digital technologies in learning		
Variable	Frequency number	Frequency %
I always use	56 people	40
Combine with traditional teaching methods	63 people	45
I focus primarily on traditional education	17 people	13
I do not use	4 persons	3

At the same time, teachers noted that they primarily use online learning platforms - 60 % (this refers to establishing communication with students - Zoom, Microsoft Teams, etc.) Only 10 % of teachers use additional online resources (educational platforms for extracurricular learning), online workshops, and video lectures by other teachers. Online opportunities to search for educational literature are recommended by 25 % of respondents. Another 5 % of respondents said that if they used digital technologies for distance learning, they did so in accordance with the order to switch to distance learning (in fact, it is a case of being forced to use digital learning due to the pandemic and quarantine restrictions and military operations in Ukraine, which were launched by the Kremlin regime in February 2022) (table 2).

Table 2. What digital tools do you use in your teaching?		
Variable	Frequency number	Frequency %
Communication platforms (Zoom, Microsoft Teams, etc.)	84 people	60
Internet opportunities for searching for educational and scientific literature	63 people	25
Additional educational platforms	14 people	10
Use of digital tools in accordance with the order of the administration	7 people	5

The survey found that teachers feel that there has been real progress in teaching and the level of knowledge of students - 62 % of respondents chose this option. 30 % of respondents see no difference in the use of digital technologies compared to traditional teaching. 8 % of the surveyed teachers noted a regression in the use of digital technologies in vocational education (table 3).

Table 3. How would you assess the results of using digital technologies?		
Variable	Frequency number	Frequency %
Promote progress in learning	87 people	62
Do not affect the level of education of applicants	42 people	30
Noticeable regression in learning	11 people	8

A topical issue was to identify the problems associated with the use of digital technologies in vocational education. Based on the results of the survey, it was found that the biggest problem identified by respondents was the outdated technical and material base, which did not allow them to fully realise the potential of digital technologies (50 % of respondents). The outdated regulatory framework was identified as a problem by 26 % of respondents, while 20 % of respondents pointed to a lack of motivation. Difficulties in establishing communication with students due to the use of innovative methods were mentioned by 4 % of respondents (table 4).

Table 4. What problems do you face when using digital tools in teaching?		
Variable	Frequency number	Frequency %
Insufficient level of material and technical resources	70 people	50
Outdated regulatory documents and orders	36 people	26
Lack of motivation	28 people	20
Difficulty in connecting with students	6 people	4

Among the ways to improve the implementation of digital innovations in vocational education, the largest number of respondents identified the need for continuous professional development of teachers (55 %). 25 % of respondents mentioned the importance of increasing the salaries of teachers, while 12 % mentioned the need for re-certification as a way to "weed out" those who do not have teaching talent. 8 % of respondents mentioned the importance of introducing new innovative methods (table 5).

Table 5. What would you say are the ways to improve the implementation of digital tools?		
Variable	Frequency number	Frequency %
The need for continuous professional development	77 people	55
Increasing remuneration as a way to increase motivation	35 people	25
The importance of re-certification and renewal of teaching staff	17 people	12
Increased use of innovative teaching methods and digital technologies	11 people	8

When asked about changes in the paradigms of education for students, the majority of respondents identified the need for further introduction of European experience related not only to the technological aspect, but also to the student-centred approach (60 %). 30 % of respondents indicated the relevance of developing Ukrainian experience related to the specifics of local production and services. 5 % of respondents noted the need to introduce a more authoritarian teaching model, while another 5 % were undecided (table 6).

Table 6. What learning paradigms would you say are effective for digital learning?		
Variable	Frequency number	Frequency %
Focusing on European experience	84 people	60
Focus on local expertise	42 people	30
Restoring the authoritarian teaching model of education	7 people	5
Undecided on the answer	7 people	5

Table 7. How do you assess the reforms in vocational education?		
Variable	Frequency number	Frequency %
I positively evaluate the attention to vocational education from the state authorities	77 people	55
I am sceptical about the initiatives of the authorities	14 people	10
I believe that cooperation with private entities is a more effective tool	6 people	9
Vocational education does not receive adequate attention	7 people	5

Given the significant role of state authorities in shaping the strategy of educational policy in the field of vocational education, it was proposed to evaluate it. 55 % of respondents noted as positive the fact that

government initiatives in Ukraine in recent years have been aimed at improving the level of vocational education and its reform. At the same time, 29 % are rather sceptical about new initiatives, including the further introduction of vocational education elements in general education institutions. 10 % of respondents emphasise the importance of establishing cooperation with the private sector for the further development of vocational education. Another 6 % of respondents believe that vocational education still receives little attention (table 7). The findings indicate a broad interest in vocational education.

DISCUSSION

The study confirms that digital technologies play an important role in the development of vocational education, further improvement of innovative technologies and their application. The results show that teachers are actively using digital tools to improve vocational education, recognise the difficulties along the way, but also offer opportunities for improvement and future development of digital innovations.

First of all, we are talking about the constant integration of digital technologies into the educational process - in most cases, classes cannot be held without them. These results confirm the theses of other researchers on digital evolution in education and the importance of understanding the digitalisation of pedagogy as further creative development.[25,26] At the same time, the findings indicate that in Ukrainian realities, the most popular platforms are those for distance learning, which does not quite correspond to the general trends in the development of vocational education: in European countries, additional online resources that allow for self-study are primarily popular.[27]

Similar to the results reported in the scientific literature, the data obtained indicate that, at least, the use of digital technologies leads to better learning outcomes than traditional methods that have been used for a long time.[28] However, there is a sharp difference between the problems identified by Ukrainian teachers and foreign experience: while in the Ukrainian context, problems with the material and technical base are obvious, in European countries, motivational problems are identified.[29] The findings confirm the conclusions of other researchers that modern vocational education requires continuous professional development of teachers.[30]

At the same time, Ukrainian teachers point to the importance of European experience, which is quite natural.[31,32] Importantly, the results pointed to the importance of further development of vocational education as an element of state policy. This conclusion was also supported by other researchers.[29] Therefore, the survey made it possible to identify problematic and promising aspects in the functioning of vocational education in the Ukrainian reality.

Undoubtedly, the proposed study has its limitations. First of all, the sample of 140 volunteers may not cover the whole variety of opinions on the state of digitalisation of vocational education. In addition, the sample does not take into account differences in teaching experience, so it is difficult to establish how much more experienced professionals use digital technologies than traditional teaching. At the same time, the figures are quite relevant and demonstrate the main trends in understanding the role of digital innovations in vocational education.

CONCLUSIONS

Therefore, the digitalisation of vocational education aims to ensure the proper development of education in line with the current challenges of the labour market. Current experience in the application of innovative methods indicates the need for further application of student-centred learning, which echoes the needs for reforming the vocational education environment and further introduction of digital technologies. The survey found that, in general, the trends in the use of digital technologies in Ukraine are in line with global standards. This was determined through the analysis of scientific literature. In particular, modern teachers often use digital technologies in their teaching. However, in Ukraine, it is primarily about communication technologies, while in other contexts, the importance of additional technologies for learning is emphasised.

However, even such digital technologies generally improve the learning process and increase its effectiveness, which can also be explained by the interest of students in mastering new technologies. An important aspect of the application of the latest innovative methods and technologies in education is the identification of problems that exist in this area. In particular, the issue of lack of funding and adequate material and technical base, which is relevant for modern Ukraine, was emphasised. Obviously, this problem will require a comprehensive solution in the future. Among the current challenges is the need for continuous professional development of teachers and the search for additional motivation for self-improvement through increased knowledge and skills, digital competence, etc. This is partly facilitated by the positive attitude towards the attention currently paid to vocational education as an important element of educational policy.

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CONFLICT OF INTEREST

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