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Research Article

Improving Educational Standards with Advanced Information Systems

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ABSTRACT

Introduction: The study presents the potential of improving the quality of education with the help of modern information technologies.

Objectives: The article aims to analyse the potential of modern information systems to improve the quality of education.

Methods: The study uses complementary general scientific theoretical methods, including analysis, synthesis and abstraction.

Results: The study reveals the potential of innovative technologies and digitalisation in the context of innovative development of the educational space. The main components of innovative teaching technologies are highlighted. It is established that innovative directions for using digital technologies to form digital competence in the methodological and pedagogical work of an educational institution are concentrated in the formats of interactive learning, portal technologies, and immersive environments. It has been proved that diverse digital educational content, as a component of the information educational system, should be actively involved in the learning process to implement strategic directions for developing digital optimisation in the education system. It is substantiated that using information systems in the educational process increases students' motivation, stimulates the development of continuous self-education, diversifies learning and increases its effectiveness.

Conclusions: The relevance of the digital optimisation of the education system is due to the need to increase intellectual potential and improve the quality of education at various levels. Best educational practices have significant potential in implementing information systems tools, guaranteeing adaptability and sustainable development of the educational environment.

Keywords: digitalisation, information system, educational space, integration, information and communication technologies, information society, educational process.

INTRODUCTION

In terms of internationalisation, it is necessary to integrate the requirements of the globalised European educational space in the field of digital competences. European integration will be a priority during Ukraine's post-war reconstruction, which will determine the professional requirements of the new time for specialists.

The issues of digitalisation of education and the introduction of information and communication technology innovations are widely studied by modern scholars. Researchers analyse the possibilities of digital transformation at different levels of the educational environment [1], [2], identify the limits of the impact of digitalisation on the development of education [3], study the specifics of the relationship between digitalisation and the effectiveness of

educational innovations [4], [5]. The possibilities of immersive learning environments are explored by Lee et al. [6]. Interactive learning technologies are discussed in the publications of Sofi-Karim et al. [7].

Research on this issue today represents an increased interest of the scientific community in digitising the educational environment, which indicates the relevance of the issue under study. At the same time, further expanded and in-depth studies of the conceptual aspects and principles of innovative development of the concept of quality education through digital tools are needed.

LITERATURE REVIEW

Several publications by contemporary scholars analyse the structural components of the system of digital optimisation of the educational environment and the introduction of innovative information and communication technologies [8], [9], consider the peculiarities of developing digital competence skills in students [10], and study the specifics of communicative interaction [11].

Among the recent scientific results on the subject, it is necessary to highlight the publications of the authors [7], [12], [13], which promote the potential of digital tools in education as a basis for effective improvement of education at different levels, which will ensure that the skills of students are complementary to the requirements of the current social dynamics. The conceptual framework of the studied issues is expanded in the publications of the authors [14], [15], who focus on the individualisation of the process of digitalisation of learning, the development of a virtual learning environment, project-based and interactive learning, as well as various forms of information and communication interaction in the educational field.

A number of scholars [16], [17] offer practical recommendations for mastering digital skills in the educational environment. These recommendations can be positioned as universal and representative under any conditions and challenges and include a set of interrelated practical tasks.

Most modern scholars offer a systemic vision of the problem of students' formation and development of digital competences in the context of state educational policy priorities and promising professional standards. The authors see the critical vision of the available resource potential and the ability to conceptually approach the means of forming and developing specific digital competences as necessary prerequisites for a systemic concept of digitalisation of education [18].

According to many researchers [16], innovative areas of using digital technologies to form students' digital competence in the system of methodological work in the learning environment are concentrated in interactive learning, portal technologies and immersive environments.

Despite the significant development of the studied issues in the modern scientific field, the issues of specifying the functionality of the components of the system of digitalisation of the educational process remain, for the most part, insufficiently researched, which makes the subject of analysis within this article relevant.

The article aims to analyse modern information systems' potential to improve education quality.

METHODS

The research materials were industry publications, materials from scientific and practical conferences on the digitalisation of the educational environment and the role of information systems in improving the quality of education, and statistical data [19]. At the same time, preference was given to modern developments in the current context.

The study uses complementary general scientific theoretical methods, including analysis, synthesis and abstraction. The integration of analysis and synthesis allowed for an objective and comprehensive study of digitalisation and information and communication technologies in the context of improving the level of education. The system analysis helped to clarify the essence of definitions and conceptual categories. Synthesis combines the individual components and properties identified in the analysis into a single whole. In this process, there was a meaningful combination in the direction from the identical and essential to differentiation and diversity, integrating both general and individual aspects into a single concept. The study used comparative analysis to assess global trends and practices and analyse the evolution of educational processes in Ukraine compared to European standards while considering the contextual national specifics.

The research procedure included two main stages: data collection and analysis. In the first stage, we used primary data sources obtained through the analysis of industry statistics, regulations, and publications. This sample size was deemed reasonable in light of the practical realities that needed to be considered.

The second stage — data analysis — was conducted using mixed methods: quantitative and qualitative statistical analysis methods. The method of abstraction was used as a process of mental distraction from the standard properties of management technologies, concepts, and tools, with the simultaneous selection of the desired essential properties.

RESULTS

The current dynamics of social development are determined by the significant impact of information and communication technologies (ICT). The formation of students' digital competence at different levels should be considered in the context of the pedagogical modelling method, which involves forming a structural and functional model to reveal the vectoriality of each component [20]. The structural model of the modern methodological approach to the formation of digital competence in the process of education includes several components, including diagnostic (identification of the initial level of digital competence and the performance and evaluation component), target (definition of goals and objectives), content (didactic units of content and principles of teaching) and technological (organisational forms, methods and means of teaching) [21].

A transformative learning environment that encourages and motivates allows the student to actively develop and change, promoting effective interaction between all participants in the educational process. At the same time, the main functionality is assigned to the priority of independent activity while developing joint activity interaction, individualisation of learning, and contextual learning. The basic methodological principles are continuity, self-development, systematicity, and activity [22].

Innovative information and communication technologies provide unlimited opportunities for developing modern teaching methods that synergise traditional and distance education elements. The technological basis involves using virtual learning environments and other ICT tools that allow the creation of information content in various formats and different types of communication [23].

Information education, a process of self-organised acquisition of certain competences, has a special functionality. It can be implemented through the integration of innovative teaching methods, such as modular, distance, and blended learning, which promote creativity and motivate individualisation of the educational process.

In particular, the following methods of informal learning can be successfully used:

- mutual learning in the process of jointly solving tasks;

- engaging in global experience by visiting exhibitions and projects online;

- the trial-and-error method, which motivates independent search for answers to problematic issues;

- use of innovative digital online resources, educational platforms, and mobile applications.

It is advisable to summarise that, in general, the concept of forming digital competence within educational institutions through innovative methods and informal learning involves the following activities:

- establishing clear criteria and indicators that determine the qualitative characteristics of successful acquisition of knowledge, skills and abilities in digital competences, as well as the measurability of the result;

- regular evaluation based on monitoring the effectiveness of the learning process based on identified criteria;

- prompt management response to the assessment results, which involves making effective decisions to address identified negative trends [24], [25].

Innovative directions of using digital technologies to form digital competence in the methodological and pedagogical work of an educational institution are concentrated in the formats of interactive learning, portal technologies and immersive environments [26]. An educational portal is defined as a systemic multi-level hub of electronic educational software resources, which are usually subject to a single standardisation of information exchange and operate based on a comprehensive database. It is advisable to actively involve diverse digital educational content as a component of the information educational system in the learning process to implement strategic directions of developing digital optimisation of the education system.

Interactive learning is a promising area for developing the digital environment in the educational sphere to improve the quality of education. Interactive learning involves the creative development of learning exercises and their active use in practical classes, embedding them in their priority web resources [27]. At the same time, users have full access to learning materials via the Internet, in the form of accessible learning materials, without space and time restrictions. As a rule, tracking progress and receiving instant feedback is possible, which contributes to the active and effective acquisition of digital skills [28].

Another advantage is the possibility of personal choice of the period and variations in grouping students. At the same time, digital content is not a digitised textbook; it synthesises diverse interactive opportunities for studying educational material [29]. In active interaction with digital content, students create new resources, communicate, and post the results of their learning activities in their digital environment.

As a result of this process, the teacher can organise the educational process using the blended technology model, synergising online learning and the student's individual work. At the same time, the teacher-educator generally successfully selects resources for personalised learning and organises projects for the effective interaction of digital competence learners [30].

Portal technology now effectively improves the level of media competence, organises the management of information flows, and uses digitalisation tools. The proposed technology allows for the minimisation of the educational process's resource intensity while intensifying its effectiveness [31].

The virtual environment is an innovative way of integrating virtual educational practice-oriented content into the physical sphere, which provides prerequisites for effective learning, including in the context of developing digital competences of educational leaders. The spectrum of immersive technologies covers a number of different applications and tools that allow for integrating, immersing, or interfacing with simulated environments and objects [32].

Several mobile applications using augmented reality and targeted VR devices have already been developed and are available for use. To ensure an effective process of implementing quality education, it is necessary not only to develop and intensively implement several educational technologies using the potential of virtual reality but also to have the technical support necessary to implement immersive tools, optimise the level of digitalisation of the educational institution, and intensify the level of digital literacy of teachers.

The peculiarities of immersive technologies are seen in the effect of personal presence and multisensory, variable possibilities of interactive and social interaction, which, in synergy, significantly affect the dynamics of learning outcomes.

Virtual reality provides a unique experience synthesised with successful learning strategies, including modelling, visualisation, and hands-on learning. The educational environment of virtual reality technologies includes a vivid multimedia and information context that creates a system of unique interactivity. It should be noted that the context can be successfully adapted to individual learning styles [6].

VR technologies form a range of effective practical tools that promote practical generalisation, learning, visualised assimilation, spatial awareness of issues, intensification of cognitive activity, critical thinking and creativity.

Despite several positive aspects of immersive technologies' effects, specific related challenges, shortcomings, and risks exist, such as the high cost of certified virtual tools and the difficulty of accessing the necessary technical support [33]. In the context of the methodological framework, the introduction of immersive technologies in education in Ukraine is accompanied by a lack of standards and criteria to regulate the use of virtual environments in educational institutions of different levels.

At the same time, the priority of user experience in the virtualisation of learning in the future will belong to augmented reality applications that allow for simulating various situations and create a creative space for mastering the necessary skills, developing an individual style of problem-solving [34]. The possibilities of situational virtual modelling of educational content allow for achieving a much higher level of learning effectiveness and contribute to forming and strengthening professional identity. The virtual learning environment, which creates the effect of real presence, contributes to the formation of motivation and involvement of students in the learning process, expanding

the process of cognitive perception, which allows the expansion of the capabilities of traditional educational technologies.

The use of information data is crucial for improving the quality of education through the introduction of information technology. Ukraine is characterised by active progress in this direction (Figure 1).

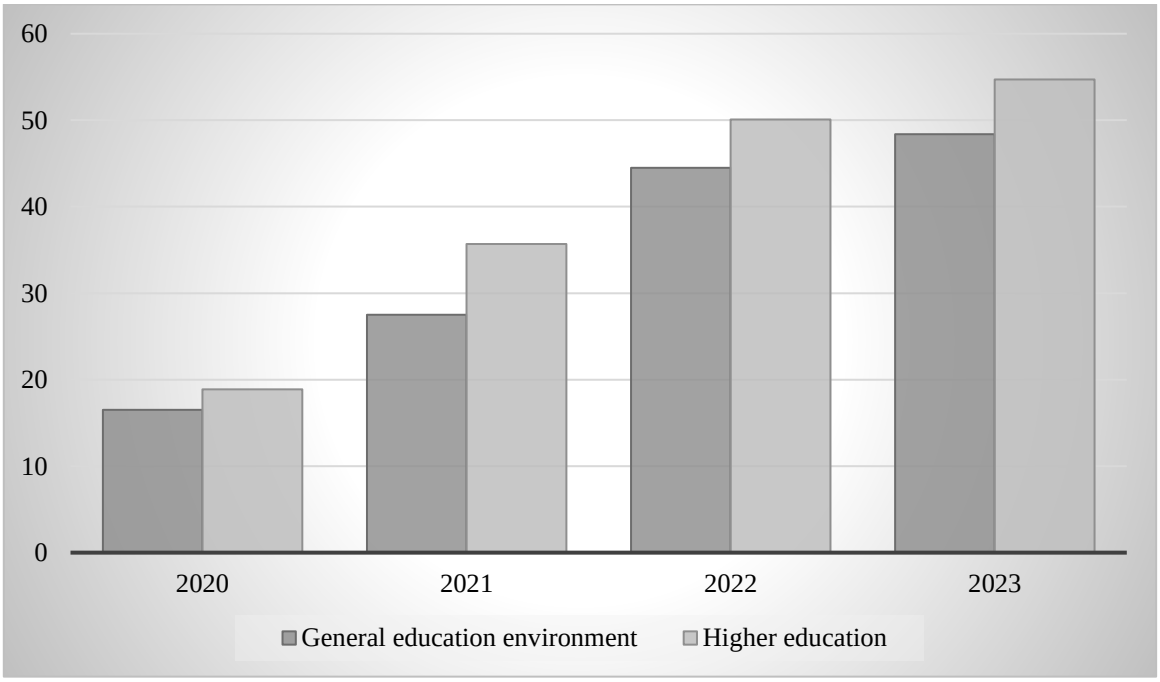

Figure 1. Integration of information systems in the national educational space, %

Source: the author based on materials [19]

The actualisation of the digitisation of the educational environment against the backdrop of the crisis social phenomena of the pandemic and wartime explains the dynamics shown in Figure 1. At the same time, the use of information systems in education allows for the effective use of electronic educational resources, continuous monitoring of teaching quality, and monitoring of the dynamics of the educational services market.

Maintaining and improving the quality of education through digital tools requires adequate technical equipment for the integrated learning process and the selection of optimal software for information systems and portals.

DISCUSSION

Our study aligns with Djamas and Tinedi [16] and points to the need to upgrade the educational system through digitalisation, which will help students acquire digital literacy, the ability to work in a multicultural environment and other necessary competences. In continuation, Burbules et al. [35] and Adıgüzel et al. [36] note that the proposed method of improving learning quality may require updating pedagogical specialists' preparedness level to work in an innovative learning environment.

Yordan and Yordan [2] point out the need to develop digital competence, which determines the success of an individual's adaptation to an integrated social environment. Facing constrained conditions such as a pandemic and military aggression requires the development of comprehensive and innovative approaches to forming digital competence in the educational environment. These approaches involve changing educational programmes and methods, creating conditions for practical work in various environments, and active cooperation with different social and cultural groups.

Other studies show that digitalisation faces problems typical of distance education. According to Hawkridge [37], in some cases, there is a lack of information equipment, inadequate student motivation, and related health problems.

Another important aspect is managing adaptation to changing requirements. In particular, Szymkowiak et al. [4] and Castro and Tumibay [5] point out the importance of resilience and adaptability for developing future digital competences of modern students. Such findings are synergistic with the current study's results, reinforcing them.

Researchers Vassilakopoulou and Hustad [38] identified factors that influence the effective development of digital competence in the educational environment. Furthermore, Haleem et al. [39], Alam [40], and Zhao et al. [41] include positive attitudes towards innovation, mastery of methods and approaches to digitalised education, creation of a barrier-free environment, support and advice, ease of innovative change, resilience and preparation for limited conditions as determinants of digitalisation development. In addition, our research has shown that these factors influence the formation of students' digital competence in the limited conditions of the socio-economic crisis.

This study comprehensively examined the gaps in research on integrating the potential of modern information systems into the educational environment. However, further and in-depth research may be needed to confirm new directions in analytics for the digital competence development of students at different levels, especially in limited settings.

CONCLUSION

The study of the potential for improving the quality of education with the help of modern information technologies actualises the problem of digital optimisation of the education system, which is caused by the need to increase intellectual potential and improve the quality of education at various levels.

The study found that best educational practices have significant potential in implementing information systems tools, guaranteeing adaptability and sustainable development of the educational environment. Innovative directions of using digital technologies for the formation of digital competence in the process of methodological and pedagogical work of an educational institution should include interactive learning, portal technologies and immersive environments, the use of which in the educational process increases the motivation of students, stimulates the development of continuous self-education, diversifies learning and increases its effectiveness. In addition, diverse digital educational content is seen as effective in implementing strategic directions for developing digital optimisation of the education system to improve its quality.

Preserving and improving the quality of education through digital tools requires adequate technical equipment for the integrated educational process and the selection of optimal software for information systems and portals, which forms the direction of further scientific developments in the field of research.

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