NEWEST PRACTICES OF DESIGN TRAINING OF SCIENTIFIC AND PEDAGOGICAL WORKERS: DIGITAL TECHNOLOGIES IN THE CONTEXT OF DISTANCE LEARNING INTEGRATION

NOVAS PRÁTICAS DA FORMAÇÃO EM DESIGN DE TRABALHADORES CIENTÍFICOS E PEDAGÓGICOS: TECNOLOGIAS DIGITAIS NO CONTEXTO DA INTEGRAÇÃO DO ENSINO A DISTÂNCIA

PRÁCTICAS MÁS NOVEDOSAS DE FORMACIÓN DE DISEÑO DE TRABAJADORES CIENTÍFICOS Y PEDAGÓGICOS: LAS TECNOLOGÍAS DIGITALES EN EL CONTEXTO DE LA INTEGRACIÓN DE LA ENSEÑANZA A DISTANCIA

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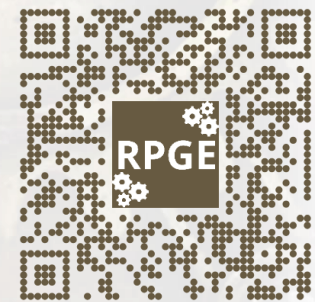
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ABSTRACT: The purpose of the article is to analyze modern practices of design training of scientific and pedagogical workers based on the use of digital technologies and the integration of distance learning. A number of scientific theoretical methods were used to implement this task: analysis, synthesis, structural-functional, prognostic, and axiological methods. In the results, the main attention is paid to the role of design thinking in the system of training future teachers and scientists, digital technologies in the context of the latest practices of design training of future teachers and scientists. It has been demonstrated that mastering modern design thinking and its improvement are important prerequisites for shaping the professional work. The conclusions draw attention to the possibilities of the project method, the effectiveness of establishing cooperation with employers as important mechanisms for introducing design thinking in the modern world.

KEYWORDS: Distance education. Design thinking. Educational environments. Integration. Digitalization.

RESUMO: *O objetivo do artigo é analisar as práticas modernas de formação em design de trabalhadores científicos e pedagógicos com base no uso de tecnologias digitais e na integração da educação a distância. Vários métodos teórico-científicos foram utilizados para implementar essa tarefa: análise, síntese, métodos estruturais-funcionais, prognósticos e axiológicos. Nos resultados, a principal atenção é dada ao papel do design thinking no sistema de formação de futuros professores e cientistas, tecnologias digitais no contexto das mais recentes práticas dessas formações. Tem sido demonstrado que o domínio do design thinking moderno e seu aprimoramento são pré-requisitos importantes para moldar o trabalho profissional. As conclusões chamam a atenção para as possibilidades do método de projeto e para a eficácia de estabelecer cooperação com empregadores como mecanismos importantes para introduzir o design thinking no mundo moderno.*

PALAVRAS-CHAVE: *Educação a distância. Design thinking. Ambientes educacionais. Integração. Digitalização.*

RESUMEN: *El propósito del artículo es analizar las prácticas más modernas de formación en diseño de trabajadores científicos y pedagógicos basadas en el uso de tecnologías digitales y la integración del aprendizaje a distancia. Para llevar a cabo esta tarea se utilizaron varios métodos teóricos científicos: análisis, síntesis, métodos estructural-funcional, pronóstico y axiológico. En los resultados, la principal atención se presta al papel del pensamiento de diseño en el sistema de formación de futuros profesores y científicos, las tecnologías digitales en el contexto de las últimas prácticas de formación de diseño de los futuros profesores y científicos. Se ha demostrado que el dominio del pensamiento de diseño moderno y su perfeccionamiento son requisitos importantes para configurar el trabajo profesional. Las conclusiones llaman la atención sobre las posibilidades del método de proyectos, la eficacia de establecer una cooperación con los empleadores como mecanismos importantes para introducir el pensamiento de diseño en el mundo del futuro.*

PALABRAS CLAVE: *Educación a distancia. Pensamiento de diseño. Entornos educativos. Integración. Digitalización.*

Introduction

The modern development of information technology makes it possible to improve knowledge about the organization of the educational process that meets the current requirements of society and allows for self-development and improvement of professional skills. The integration of digital technologies into many areas of social life has also led to the evolution of pedagogical methods for organizing learning and teaching. The introduction of the latest innovative technologies has improved the quality and delivery of education. This was partly facilitated by the COVID-19 pandemic, as the introduction of global quarantine restrictions led to an active interest in distance education. The effectiveness of this transition (albeit forced) is demonstrated by the gradual increase in results among higher education students, and the average level of knowledge at the appropriate level. As a result, distance education is perceived as one of the newest innovative methods that deserves to be used separately. At the same time, this state of affairs in the dynamic times of changing technologies has led to the search for further improvement of this type of education. Thanks to the emergence of new digital solutions and the use of new teaching methods, new visions of design-based learning have also emerged.

The purpose of the article is to analyze the current practices of design training for academic staff based on the use of digital technologies and the integration of distance learning into the educational process. Accordingly, the main objectives of this study are: 1. to characterize the importance of design thinking in the system of training future teachers and scientists; 2. to analyze key digital technologies in the context of the latest practice of design training of scientific and pedagogical workers; 3. to describe the main innovative methods of forming design (creative) thinking in students.

Theoretical Framework

Many contemporary scholars are interested in the theoretical understanding of the design training of future specialists. In particular, the peculiarities of using design thinking in pedagogy were characterized by Luka (2020). In this work, it is determined that design thinking is an approach that originated in art but is now actively used in various fields. It is focused on comprehensive human development, helps to solve complex problems, and can be used in teaching or learning to develop relevant skills of the 21st century: creativity, leadership,

initiative, social skills (LUKA, 2020). Taheri's (2022) study proves that the demand for teaching and learning design thinking is growing: the number of educational institutions offering design thinking development is growing every day (TAHERI, 2022). In modern educational programs, the component of design thinking is a key component in the training of modern specialists (WONG; WONG, 2019). At the same time, Talbot (2022) characterized the key aspects of the formation of design thinking through the development of improvisation skills. This study argues that the skills needed for successful creative thinking and effective social interaction can be taught, "and that improvisation is an ideal vehicle for doing so" (TALBOT, 2022, p. 25).

Razali *et al.* (2022) characterized the main approaches to the development of design thinking in education. The study by Razali *et al.* (2022) proved that this approach is an effective tool for improving the teaching process, especially when it comes to the formation of relevant skills of the XXI century. The main innovative ways of developing design thinking in the training of future specialists can be traced in the works of (MEINEL; KROHN, 2021; MARNER; ÖRTEGREN, 2014). Koch (2022) also identified the theoretical basis of modern pedagogical paradigms that focus on the formation of the individual, his or her development, and the ability to teach and learn. On the other hand, the methodological basis of the article is the work of contemporary authors who study the peculiarities of using innovative digital technologies in education, some aspects of the implementation and use of the distance education model. The key features of the use of digital technologies in the system of training future teachers are highlighted in Martinez-Nuñez, Borras-Gene, and Fidalgo-Blanco (2016). These researchers focused on analyzing the role of virtual learning platforms in education. A comparative analysis of the traditional model of education with the distance (digital) model was conducted by Jena, Gupta, and Mishra (2021). Marathe (2018) also addressed a similar issue - his conclusions are relevant due to the use of an appropriate empirical base. Pinheiro and Santos (2022) described the problem of using distance education, predicting its future development. Williams *et al.* (2023) in their empirical study characterized the attitudes of modern students towards distance education. Wojciech *et al.* (2021) described the main challenges to the further development of digital learning. At the same time, Ali (2022) investigated the problem of the effectiveness of using immersive digital technologies in learning.

Methodology

However, there are almost no comprehensive studies that would characterize the peculiarity of the development of design thinking in the context of distance learning and, accordingly, through the prism of the use of digital technologies (MARATHE, 2018). Modern researchers have only partially touched upon this issue, focusing on the theoretical aspects of the formation of design thinking in future teachers and scientists.

This study is based on the application of system analysis, which allowed us to divide the main subject of research into smaller elements. According to the synthesis, these elements were combined, and their own conclusions were formed. The study also used the structural-functional method, which explained the impact of certain technologies and tools of distance education on the training of a proper specialist for scientific and pedagogical work. At the same time, individual manifestations and dependencies were studied within a single whole. The prognostic method was used to provide recommendations that may be useful for teachers. The axiological method of research allowed us to move from general statements to our own conclusions (ALI, 2022).

Results

The role of design thinking in the system of training future teachers and scientists

Modern education and science require specialists who are able to think outside the box, solve complex issues creatively, and respond proactively and flexibly to the challenges of the professional sphere.

Accordingly, design (creative) thinking skills are one of the most important skills of professional work. They are perceived as higher-order thinking skills, formed on complex and post-formal types of thinking, associated with the formation of completely new, unique, and valuable ideas during professional activities (LUKA, 2020). The term higher-order thinking skills refers to those skills that are important for the development of professional and strategic thinking. They include creative, critical, and metacognitive thinking.

The development of design thinking is important for the organization of effective professional work of educators and researchers. People with design thinking are creative in their approach to fulfilling their responsibilities (MARANTZ COHEN; MULE, 2019). In particular, modern researchers prove that teachers who use modern creative approaches in the organization of learning contribute to the development of motivation in students (LUKA, 2020). At the same

time, a creative approach to solving complex problems is also necessary for modern scientists, who must have creative thinking and respond flexibly to the challenges of the professional sphere (See Table 1).

Table 1 – Signs of design thinking

Striving for intellectual novelty	Creating your own unique (original) solution. Looking at a typical situation from a new perspective.
Rejection of stereotypical thinking	Rejection of typical solutions. Striving to generate new concepts and ideas.
Flexibility of thinking	Ability to quickly move from one category to another.
Originality of thinking	Formation of new ideas, ability to create new experiences
Smoothness of thinking	Ability to smoothly formulate ways to solve complex issues, proposals, or alternative answers.
Development of metaphorical thinking	Ability to effectively use comparisons or analogies to form new atypical connections

Source: Prepared by the authors

The design training of future research and teaching staff synthesizes the educational process and creative environment, which contribute to the development of emotional and psychological security of applicants, the realization of their intellectual work and creative qualities (MAWTUS *et al*., 2019). However, in this system, it is important to have optimal organizational conditions for the implementation of training. It is about combining intellectual and research interests with autonomy, the optimal ratio of time for rest and study, creating an atmosphere of free expression of personal initiative, and encouraging students to form atypical, original solutions.

Digital technologies in the context of the latest practice of design training of scientific and pedagogical workers

Globalization challenges have influenced the transformation of education: innovative and digital technologies are becoming an effective method of individualizing learning and improving student motivation. Most modern educational institutions use educational digital technologies, which is why the activities of teachers and researchers require appropriate skills (MITRA, 2022). In particular, the teacher, while still remaining a reliable source of knowledge, now has to direct students' attention to the use of other resources and media, developing a critical attitude towards sources of information coming from the environment.

In view of the digitalization of education and science, the latest practice of design training for academic staff is unthinkable without the use of digital innovative technologies (DHAWAN, 2020). Modern digital technologies are an effective tool for the development of an educational institution and the educational process, while the range of innovative digital platforms, resources, and tools makes it possible to implement the educational process remotely, taking into account the individual capabilities of each participant in the educational process. Current digital tools and information and communication technologies facilitate the rapid exchange of information, the latest scientific developments, certain knowledge, and experience, and enable the effective development of distance education (NADRLJANSKI; STEVO; MILICA, 2019). At the same time, they influence the formation of digital electronic libraries and archives, which are important for future teachers and researchers. At the same time, digital technologies contribute to increasing academic mobility, expanding the scope of joint research (between students from different countries), and integrating the international scientific and educational environment (PENG, 2020). In the design training of future teachers and scientists, digital resources and information and communication technologies also affect the adaptation of students to modern innovative socio-cultural conditions, allow them to preserve their original features and competitive characteristics while forming a unified innovative e-learning environment (FIELDS; DE JAGER, 2022).

Modern researchers prove that the organization of distance learning creates many unlimited learning opportunities, which generally improves everyone's education (OSTANINA *et al*., 2023). Regardless of their place of residence, students can improve their digital skills (digital culture of communication, skills of mastering digital resources), critical and creative thinking.

In order to effectively implement the educational process, the author identifies software tools that are important in the formation of a distance learning model. LMS platforms, in particular, LMS-Moodle, are the most useful for creating a digital learning space. Universal tools for organizing online lectures and video consultations include Zoom, Google Meet, Hangouts, Microsoft Teams, Skype, BigBlueButton (HIDAYATI; LINA, 2022; HA, 2020). Special messengers are used for educational communication: WhatsApp, Viber, Messenger. At the same time, in order to prepare various interactive tasks, they use Learning Apps, Google Classroom, Miro, Triventy, Mentimer, etc. A popular resource for creating educational quizzes is Quizizz. In distance digital learning, special attention is paid to the creation of infographics and presentations. Sun (2022) proves that the use of multimedia technologies in teaching not only improves students' motivation and interest but also contributes to their creative development: in the future, they will also use such methods of demonstration with more advanced tools. The Piktochart resource allows you to create colorful infographics. Canva, Venngage, Creately are also important resources for creating high-quality educational infographics. It is important to use the game method in the process of developing creativity in miners. Accordingly, there are several important methods of developing design thinking with the help of digital resources for future teachers and scientists (See Figure 1).

Figure 1 – Methods of developing design thinking
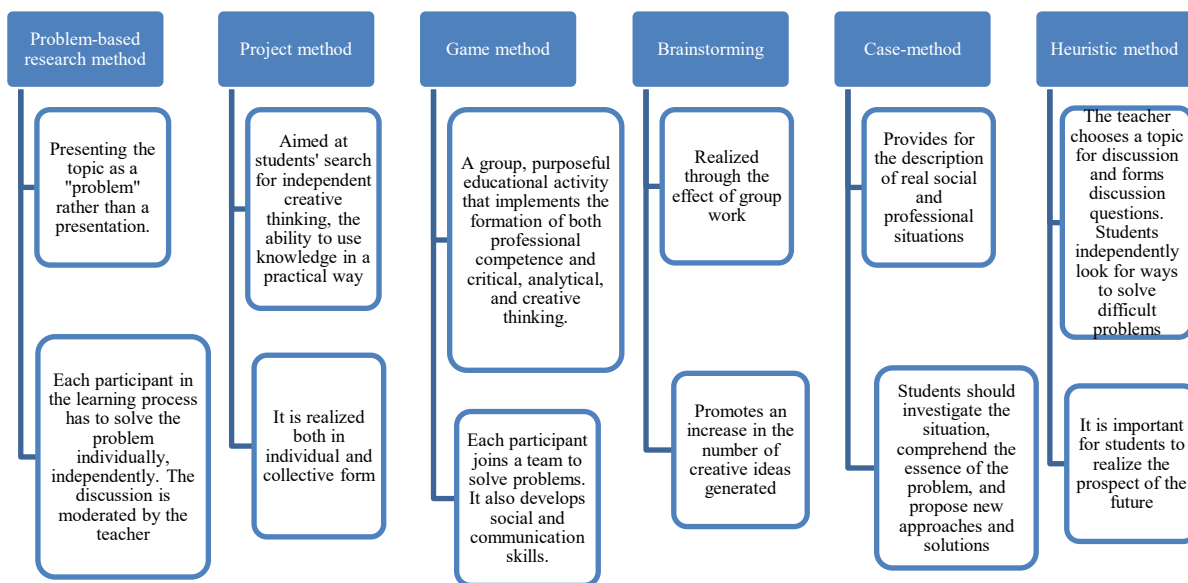
Source: Prepared by the authors

In order to develop the design thinking skills of future teachers and researchers, the most productive methods are problem-research, game, project methods, brainstorming, and case-method. At the same time, the formation of design thinking with the help of modern digital technologies is associated with the improvement of such intellectual operations as analysis, generalization, abstraction, and synthesis. Nevertheless, some psychological factors are also important in design training: an atmosphere of trust and cooperation, a personality-oriented approach to students.

Discussion

Some researchers believe that the design training of future teachers and scientists requires personal contact between teachers and students during the educational process (SADIKU; OMOTOSO; MUSA, 2019; WRIGLEY; STRAKER, 2015). Nevertheless, other scholars argue that the digital transformation of education does not deprive students of such contacts, but rather avoids many costs, including material ones (MARANTZ COHEN; MULE, 2019; MITRA, 2022; PEREZ VELAZQUEZ, 2019; ALI, 2022).

According to Zhang and Aslan (2021), when implementing digital education, teachers have more time to prepare. A student who searches for information on his/her own can better absorb theoretical materials, visit digital media libraries, get acquainted with important works of scientists in the digital space, and receive advice or support from a teacher remotely.

The main factors of the positive impact of digitalization on education are improving students' learning outcomes, activating creative project activities, and independent scientific and research work (ABD-RABO; HASHAIKEH, 2021). The use of distance education can become more effective when combined with the development of creativity as an important element of modern pedagogical technologies (DHAWAN, 2020).

Modern educators note that many students have a hidden potential for creativity, and given the necessary conditions for development and support, they can unleash this potential or demonstrate creativity skills in a particular field (LUKA, 2020). However, the systematic development of creativity is possible only on a psychological basis characterized by a wide range of needs and interests of the individual, his or her focus on self-realization, communication, cognition, and openness to the new (WONG; WONG, 2019). In addition, flexible critical thinking skills and a high level of human performance play an important role. The main task of modern teachers is to support and encourage students' creative attitude to learning, intrinsic motivation, and activity. Therefore, it is especially important to form a

creative basis in students' behavior and relationships, and then improve it using design thinking methods (KONIECZNY, 2021). The results of this study demonstrate that project, problem-research, and game methods are effective for the development of design thinking.

However, modern scholars focus on the effectiveness of the project method as a method of developing design thinking (MITCHELL; HUDSON; BARONE, 2020). This method is widely used in both higher and secondary schools. It was introduced in the United States in the 1920s and immediately gained popularity among educators because it optimally combines theoretical knowledge with its practical application to solve complex problems. Today, it is used as a renovation - a specific methodology that has not lost its relevance as a result of being supplemented by modern technologies. Thanks to the proposed project methodology, which is underestimated in the scientific literature, it is possible to deepen the knowledge and skills of students, prepare them for scientific and pedagogical activities.

Another way of using distance learning in educational training is also relevant. In particular, in order to improve the affordable situation in the education market, it is necessary to improve the quality of training of future specialists. One of the important ways proposed is to establish close cooperation between employers and higher education institutions. The essence of this practice is that stakeholders participate in the training of future specialists by making proposals and changes to the curriculum (FWLER *et al.*, 2020). This method is quite effective, given the European experience of managing educational processes. Another relevant area for improving the design thinking of students is the better implementation of practical skills, which is especially possible during internships and pedagogical and scientific tasks. Organizations and institutes can familiarize future specialists with the peculiarities of the local education sector, point out the main areas that will require the use of modern work approaches, including design thinking. Practical work using creativity in real conditions can demonstrate opportunities to improve the available situation in the labor market, creating appropriate conditions for importing experience and knowledge for others.

Conclusions

Therefore, the use of the latest practices of training academic staff with the addition of digital technologies integrated into distance learning is a relevant subject for research and further development. In particular, it has been established that modern design thinking and its development are important for organizing effective professional work among teachers and scientists. Students who have design thinking creatively perform their duties, which leads to an improvement in their level of motivation, and in the future, it will also allow them to improve the motivation of others in the direct performance of their duties. Among the special characteristics of the active use of design thinking are: the desire for intellectual novelty, rejection of stereotypical thinking, the flexibility of thinking, the desire for originality and fluidity, and the development of the ability to think metaphorically. The use of software tools is also important for greater learning effectiveness, primarily digital learning spaces and digital environments. At the same time, the methods proposed by researchers need to be adjusted. To achieve better progress in the use of the design approach to the training of academic staff, it is necessary to turn to the active involvement of distance learning and digital technologies, to add the project method, to establish cooperation with employers (educational institutions and academic institutions), and to emphasize practical activities (research and teaching). The specifics of developing an appropriate pedagogical model will be an important area for further research, as digital tools are developing dynamically, and the formation of certain sustainable paradigms will require taking this process into account.

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