TRAINING TEACHERS TO WORK IN THE CONDITIONS OF DIGITAL TRANSFORMATION OF EDUCATION

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Abstract: In the modern educational paradigm, determined by the rapid development of digital transformation, training teachers to work in new conditions has reached a strategically important stage. The academic paper analyzes the process of preparing teachers for the effective use of digital technologies in the educational environment. Particular attention is paid to the key stages of training and assessment of the results of the experiment. The authors present empirical data in the form of tables that reveal the level of teachers' competence of the experimental and control groups at different stages of training. Analysis of these data shows that the program was successful in training of teachers for the new challenges of the digital age. The academic paper is intended for researchers and practitioners in the field of education seeking to understand and optimize the process of teachers' training. The research results provide a basis for developing more effective curricula and strategies aimed at successfully adapting teachers to the dynamics of digital transformation in modern education. The academic paper highlights not only the technical aspects of teaching digital technologies to teachers but also the importance of the pedagogical approach and adaptation of teachers to the new requirements of the educational environment. The training programs were evaluated using statistical methods, such as the calculation of chi-square values, which allow determining the statistical significance of differences between the experimental and control groups.

Keywords: Digital transformation, Training teachers, Digital technologies in education, Teacher's competence, Professional development, Educational innovations, Learning efficiency, Modern pedagogy, Pedagogical strategies.

1 Introduction

Education has become one of the key segments subject to global changes in the modern world, following the rapid development of technology. Digital transformation is penetrating every aspect of our lives, including education. Teachers who are faced with the task of teaching the knowledge and skills of a new generation are forced to adapt to changing conditions and introduce digital technologies into the learning process. Training teachers to work in the conditions of modern digital transformation is becoming a crucial success factor in ensuring high quality education. Teachers are required not only to master traditional teaching methods but also to actively learn innovative approaches and effectively use digital tools in the learning process. The role of the teacher in the era of digital change is becoming a key component of the educational process. More and more educational institutions are faced with the need to integrate modern technologies into the educational process in order to effectively meet the challenges of modern society. Successful overcoming of this challenge requires competent training and support of educators. Teachers equipped with the relevant knowledge and skills are able not only to use modern educational tools effectively but also to inspire students to think critically, be creative and learn independently.

2 Research purpose and objectives

The research purpose is to analyze the stages and programs of training teachers to work in the conditions of digital transformation of education in order to identify key components and successful strategies.

The Research Objectives:

1. To identify the main parameters that influence the success of teachers' training, including technical skills, pedagogical strategies and psychological well-being.
2. To review the main stages of teachers' training for digital transformation, identifying their key features.
3. To determine the levels of teachers' training to work in the conditions of digital transformation of education.
4. To compare and statistically verify the results of the training of teachers who have completed the program with the results of the control group, identifying differences in the levels of competence.

3 Literature Review

The scientific article by Oleksenko S. and Khomenko O. (2023) describes the implementation of the need for professional development of teachers of social studies in the context of the crisis. The study by Petrenko L. (2023) examines the conceptual principles of training future teachers in a higher pedagogical educational institution in the conditions of digital transformation of society. The publication of Anishchenko O. (2018) is devoted to the models of centers of adult education in Ukraine. Dotsenko N. et al. (2021) consider the organizational and pedagogical conditions for teaching higher education seekers using competency-based learning tools. Kyrychenko M., Otich O. and Oliinyk V. (2018) examine the challenges and prospects for developing postgraduate education in the information society. Safronova S. (2023) studies the development of a teacher's professional competence in a new Ukrainian school. Sobchenko T. M. devotes her research to the problems of blended learning, highlighting its concepts and tasks. Solohub O. S. and Humeniuk V. V. (2022) consider the preparation of andragogues for the organization of the educational process using distance learning technologies. The scientific article by Stechkevych O and Bukach A (2023) is devoted to the methodological aspects of forming the teacher's digital competence in non-formal education. The publication of Batsurovska I. (2021) is devoted to MOOCs in the system of e-learning for masters.

Hryhorova M. O. and Hryhorov G. O. (2023) explore online education and hybrid learning models in the conditions of adaptation of traditional pedagogical approaches in the era of digital transformation. The study by Hrynevych L. M., Morse N. V., Boiko M. A. (2020) is devoted to teaching scientific pedagogy as a basis for the formation of innovative competence in the context of digital transformation of society. Dushchenko O. (2021) considers the current state of digital transformation of education. Zhupanik O. (2023) explores the essence and structure of professional training of future teachers for teaching foreign languages in the context of digitalization of the educational process. Kucherak I. (2020) considers digitalization and its impact on the educational space in the context of the formation of key competencies.

The scientific work by Korsun S. (2022) is devoted to the issues of global civil society in the context of digital transformation. Magilias Y. (2022) also emphasizes the leading aspects of the digital transformation of society. The research of Ovcharuk O. (2023) is devoted to monitoring teachers' readiness to use digital tools in the conditions of war in Ukraine. Orshanskyi L., Nishchak I. and Yasenytskyi V. (2024) consider the challenges and benefits of digital transformation of the vocational education system. Stiika O. Ya. (2023) examines the formation of information and digital competence of future teachers in the conditions of distance learning and explores the features of digital transformation of teachers' professional training in Ukraine.

The scientific article by Tsiuniak O. P. and Sultanova L. Yu. (2021) is devoted to the issues of understanding the problem of professional training of future primary school teachers in the conditions of digital transformation of education. Chemerys R., Briantseva R., and Briantsev O. (2022) explore ways to improve design education in the context of the strategy of digital

transformation of education and science in Ukraine. The study by Moshennyk T. (2023) highlights modern educational paradigms in the professional development of a teacher. The studies of Yasinska O. (2022) consider the challenges and prospects of electronic document management in the context of digital transformation. The publication of Shulzhyk Y. O., Hrytsko R. Y. and Pekanets S. R. (2022) is devoted to the leading aspects of change management in the conditions of digitalization.

At the same time, the issue of training teachers to work in the conditions of digital transformation of education remains insufficiently studied.

4 Methods Applied

The analysis of literature sources provides an assessment of current scientific studies in the context of training teachers to work in the conditions of digital transformation of education. The application of statistical methods in the research was used to assess the degree of statistical significance of differences between the groups. The χ^2 value is calculated to determine whether there are statistically significant differences in competence levels between the experimental and control groups. Structured interviews and questionnaires were conducted with participants of the teacher training program to better understand their perceptions of the program's effectiveness, identify successful strategies, and pinpoint possible areas for improvement. A qualitative analysis of the data was conducted to identify common themes and patterns, as well as to reveal non-obvious factors that influence the results of the training program.

These methods provide a comprehensive and in-depth analysis of the effectiveness of teachers' training in the conditions of digital transformation, as well as the identification of key factors influencing the success of this process.

5 Results

Digital transformation covers all areas of our lives and education is no exception. Modern technologies are transforming traditional teaching methods, requiring teachers to adapt to new conditions. The preparation of teachers to work in the digital environment is becoming a crucial factor in successful education in the modern world. There are several important aspects of this issue.

1. *Strategies for integrating technology into the educational process.* Teachers' training should include mastering modern educational technologies and the development of strategies for their successful integration into the educational process. This involves the use of interactive whiteboards, online platforms, educational applications, and other tools that facilitate more effective learning.

2. *Development of digital literacy skills.* Teachers should be digitally literate to effectively use modern technologies in the educational environment. This includes the ability to work with various programs, understand the basics of digital security, and the ability to critically evaluate information from the Internet.

3. *Learning online pedagogy.* The development of online education necessitates training teachers to use the methods of online pedagogy. This includes the ability to create interesting and engaging online lessons, effectively manage groups of students in a virtual environment, and use various online resources.

4. *Support for psychological well-being.* Digital transformation can cause stress and anxiety for teachers, especially for those who have no experience in working with technology. Therefore, an important aspect of teachers' training is teaching methods of coping with stress and supporting psychological well-being.

5. *Collaboration and exchange of experience.* It is useful for teachers to share experiences and best practices in using digital technologies. Training should stimulate collaboration between teachers, creating conditions for the exchange of ideas and the development of joint projects.

6. *Permanent updating of knowledge.* The digital environment is changing all the time and it is important for teachers to be prepared to constantly update their knowledge. Advanced training courses, seminars and webinars on using new technologies should become an integral part of professional development.

In general, training teachers to work in the conditions of digital transformation of education requires a comprehensive approach. Modern teachers should be ready to use technologies, developed in the field of digital literacy; they should be able to teach effectively online and maintain their psychological stability in a rapidly changing educational context. In this way, they will be able to provide quality education to the new generation, prepared for the challenges of the modern world.

Training of teachers to work in the conditions of digital transformation of education was carried out in four stages (Table 1).

Table 1. Stages of training teachers to work in the conditions of digital transformation of education

Stages	**Features**
1. Getting an overview	At this stage, teachers get an overview of the main technologies and tools used in the digital learning environment. They learn the principles of interactive whiteboards, online platforms, and other modern educational tools. This stage is aimed at forming a basic understanding of digital technologies.
2. Development of skills	At this stage, teachers actively develop their digital literacy skills. They learn how to effectively use various programs, applications and resources, and understand the principles of digital security. This stage focuses on deepening knowledge and skills for successful work in the digital environment.
3. Mastering online pedagogy	At the stage of mastering online pedagogy, teachers learn how to create interesting and engaging online lessons. They master the skills of effective management of virtual groups of students and optimal use of online resources in the educational process. This stage focuses on the use of digital tools in pedagogical activities.
4. Support for well-being	At the last stage, teachers receive training on how to support their psychological well-being in the context of digital transformation. This includes strategies for coping with stress, developing emotional resilience, and creating conditions for psychological support for colleagues. This stage is aimed at providing teachers with resources to work effectively in the new environment.

Based on these stages, teachers were trained to work in the conditions of digital transformation of education. We have identified three levels of teachers' training to work in the conditions of digital transformation of education.

1. *Primary level of training*. At the primary level, teachers are introduced to the basics of digital technologies and their potential in the educational process. The training includes familiarization with basic tools such as interactive whiteboards and basic programs. At this level, teachers acquire basic computer skills and an understanding of the use of technology in teaching.

2. *Intermediate level of training.* At the intermediate level, teachers expand their knowledge and skills in the field of digital learning environments. They learn in depth about the possibilities of online platforms, various educational programs, and methods of using interactive technologies to enhance the learning process. At this stage, teachers can undergo specialized courses aimed at developing online lessons, efficient use of online resources, and development of individualized educational materials.

3. *Advanced level of training*. At the advanced level, teachers become experts in the field of digital transformation of education. They possess profound knowledge not only of technology but also of methods and strategies for its effective use in a variety of educational scenarios. At this level, teachers can implement innovative approaches, train colleagues, and actively participate in the development of educational programs adapted to the digital environment. They are able to integrate modern technologies to create individualized educational pathways and ensure a high level of student engagement.

On the basis of the levels outlined, the research was conducted among teachers who were undergoing in-service training at postgraduate pedagogical educational institutions in Ukraine. The experiment involved 211 secondary school teachers. There were 105 teachers in the experimental group and 106 colleagues in the control group. The experimental group had to work with operating systems, office programs, and basic Internet functions. Teachers gained insight into how to integrate technologies into the learning process to increase learning efficiency. At the intermediate level, teachers are taught more complex and advanced aspects, namely, how to effectively use various educational resources online to improve the learning process. The training includes methods for creating engaging and interactive online lessons using a variety of multimedia tools. Teachers are trained to ensure the safety of their students in the digital environment. At the advanced level, teachers are prepared for more complex tasks. Teachers deeply study advanced technologies such as artificial intelligence, virtual reality, etc. and their application in education. The training includes the skills of transferring knowledge and experience to other teachers, conducting workshops. Teachers can be involved in developing research projects on integrating technologies into education and adapting educational programs to new requirements.

The results of the experiment were verified using Pearson's $\chi 2$ statistical criterion before and after the experiment on training teachers to work in the conditions of digital transformation of education, and they are presented in Table 2.

Table 2. The results of training teachers to work in the conditions of digital transformation of education after the experiment: calculation of the empirical value of $\chi 2$ based on the results of the input control

Level	Number of percent (EG), %	Empirical frequency n_i (EG)	Number of percent (CG), %	Empirical frequency n_{i1} (CG)	$(n_i-n_{i1})^2$	$(n_i-n_{i1})^2/n_{i1}$
Primary level	11,43	12	27,36	24	144	6,00
Intermediate level	65,71	69	68,87	73	16	0,22
Advanced level	22,86	24	3,77	9	225	25,00
Total amount	100	105	100	106		31,22

Empirical value χ^2=31,22. Critical value for the degree of freedom ν=2. Let us determine the critical value for a given degree of freedom for levels of statistical significance χ_{kp}^2 $\rho \leq 0{,}05$ and $\rho \leq 0{,}01$.

$$\chi_{kp}^{\ 2} = \begin{cases} 5{,}991; (\rho \leq 0{,}05) \\ 9{,}210; (\rho \leq 0{,}01) \end{cases}$$

$\chi_{ev}^2 \geq \chi_{cv}^2$, which means that there are significant deviations between the distributions; this means that they belong to the zone of significance. It is obvious that training teachers to work in the conditions of digital transformation of education, which was carried out in the context of the experimental group, is promising.

A statistical and comparative diagram of the results of training teachers to work in the conditions of digital transformation of education at the end of the experiment is presented in Figure 1.

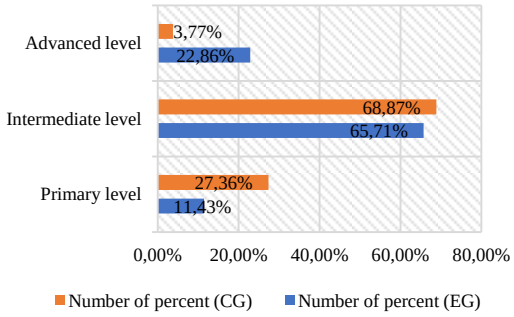

Figure 1. Statistical and comparative diagram of the results of training teachers to work in the conditions of digital transformation of education at the end of the experiment

The diagram shows the results of the research on the effectiveness of the program of teachers' training by different levels of competence in the experimental and control groups. The values in the table are expressed as percentages and show the distribution of teachers according to their level of training.

At the primary level, the training program in the experimental group is characterized by a low percentage of teachers who are at the primary level of training compared to the control group. The difference between the indicators exceeds 15%. At the intermediate level, there is a similar distribution of teachers in both groups. The difference in indicators does not exceed 5%. The training program allowed the majority of teachers to reach

an intermediate level of competence, and the results of the experimental and control groups are almost identical. At the advanced level, the training program proved to be particularly effective in the experimental group, where significantly more teachers reached a high level of competence compared to the control group. The indicators of the experimental group exceed almost 20% in comparison with the control group.

6 Discussion

The digital transformation of education is undoubtedly bringing significant changes to the teaching profession, requiring new skills and approaches to teaching. At the first stage of the discussion, it is worth noting that the low percentage of teachers at the primary level in the experimental group may indicate the need for more effective methods of introducing teachers to the world of digital technologies. Those who are just starting their learning curve might require a more customized approach or extra resources. It is also important to note the high percentage of teachers at the advanced level in the experimental group. This may indicate the success of the program to support teachers in developing advanced digital skills. Nevertheless, it should also be borne in mind that the low percentage of teachers at the advanced level in the control group emphasizes the importance of lifelong learning and updating programs in the face of rapid technological development.

7 Conclusions

The results of our research demonstrate the importance and relevance of teachers' training programs in the conditions of digital transformation of education. Digital transformation requires teachers to possess both technical skills and a deep understanding of innovative teaching methods. Training programs play a crucial role in meeting this requirement. The results of the analysis show that teachers have different levels of digital competence at different stages of the program. This emphasizes the need for individualized and adaptive approaches to learning. The differences between the experimental and control groups indicate the significance of the chosen training program.

In the context of the prospects for further studies, it is possible to identify the need for additional research with a focus on the analysis of complementary factors, such as teachers' individual characteristics, quality of support for educational institutions, etc. for a more complete understanding of the diversity of results; studying the long-term effects of the training program on the professional career of teachers, including their adaptation to the constantly changing educational environment; studying the impact of preparation for digital transformation on the psychological well-being of teachers and their stress resistance in the face of constant change. These research directions provide an opportunity to deepen our understanding of the process of training teachers for the digital transformation of education and develop recommendations for further improvements in this area.

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