

# Educational Technology as a Quality Resource for Training Future Teachers for their Pedagogical Creativity

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## ABSTRACT

The article examines the technologization of education as an important productivity resource for training future teachers for pedagogical creativity in the university education system. The purpose of the article is theoretical substantiation and experimental verification of the productivity of technological learning in the formation of pedagogical creativity of the individual in the conditions of the educational process of the university. With the help of a set of research methods (theoretical analysis of conceptual provisions that specify the essence of pedagogical creativity as an important characteristic of pedagogical professionalism and the possibilities of technological learning taking into account the capabilities and creative properties of each participant of professional training; Kettel's personal interviewer; questionnaire, observation, modeling and construction, pedagogical experiment) identified resource possibilities of technologyization of education in the formation of pedagogical creativity as a resource of success and career growth of students in an independent professional and pedagogical activity. Experimentally confirmed productivity of the structural-functional model of technological learning, which integrates methodological-target, content-procedural and result-reflective blocks; innovative technologies (informational, cognitive, cognitive-communicative, coaching, etc.), an ensemble of pedagogical design tools and resources, a set of pedagogical conditions that stimulate the positive dynamics of the level of formation of pedagogical creativity as a complex personal formation. The experimentally collected results allow us to assert that the technologization of education is realized through the use of pedagogical, informational and cognitive-communicative technologies, an ensemble of instrumental means and methodical equipment, in specially created pedagogical conditions is an effective resource of influence on the positive dynamics of the growth of the levels of pedagogical creativity of students as an important structural unit professionalism of a modern teacher.

**Keywords:** Technologization of learning, pedagogy, creativity, pedagogical conditions.

## INTRODUCTION

Reforming the education system causes new qualitative changes in the professional training of future teachers in the conditions of a higher education institution, increasing the level of professionalism, readiness for creative professional activity. Professional training of students in a higher education institution requires a comprehensive approach to the development of their ability to creatively solve educational and methodological problems and the implementation of a set of methodological approaches to the development of their ability to pedagogical creativity in the educational process.

The functionality of professional training is reflected in the systematicity, diversity of the educational process based on technology, digitalization, and its computerization. An important task of this process is the technologization of students' education as an important resource for their professional formation, the formation of professionalism and the ability to creatively solve professional problems. Updating the content of professional training, prospects of enriching

it with pedagogical creativity of students in the field of practical activities actualize the problem of computerization and technologization of education. The universalization and technologization of its content increases the productivity of

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influence on the professional growth of students, activation of their personal position in a creative approach to solving professional and pedagogical problems in independent activities.

An important problem of the professional training of future teachers is the formation of professional, technological and methodological knowledge, knowledge, abilities and skills, the ability to creative actions, non-standard solutions to professional tasks, the development of creative thinking and attitudes to pedagogical creativity in the conditions of the technologicalization of modern education. The search for internal resources that provide a high-quality solution to this problem actualizes the need to understand the trends in the development of pedagogical creativity, its impact on the professional growth of an individual, and the identification of opportunities for the technology of education as a reserve for the quality of professional training. At the same time, the search for ways to technologize education, to ensure the quality of professional knowledge, skills and abilities, and to focus on the creative solution of pedagogical problems is of particular importance, since the need for creative pedagogical personnel is constantly growing. It is not by chance that this problem is constantly gaining relevance.

The work, the authors of which justify the formation of a creative personality in the process of learning, arouse interest (V. Andrushchenko, 2009, N. Volkova, 2021, N. Guziy, 2016, Ye. Lodatko, 2004, N. Slyusarenko, 2021 and others). Many researchers were engaged in the search for ways of forming a personality and developing its creative qualities in the process of professional training: I. Bekh, 2001, I. Bila, 2014, A. Gurzhy, 1997, L. Nikolayenko, 2016, S. Sysoeva, 2006, N. Chuvasova, 2017 and others.). Of great interest are studies that model the system of professional training of the individual as a subject of innovative educational processes, professional development and self-development of the personality of students, their creative characteristics, scientific style of thinking (N. Kalinichenko, 2014, L. Kondrashova, 2014, V. Molyako, O. Muzyka, 2006, L. Nichugovska 2017, O. Savchenko, 2012 and others). In the process of researching the problem of pedagogical creativity, creativity is studied as a personality characteristic and is considered by scientists as the ability to acutely perceive a problem (A. Dailey, C. Martindale, J. Borkum, 1997), the ability to create new associations (A. Gruszka, E. Necka, 2002), the ability to take risks, overcome difficulties (Hilary Collins, 2010), transform experience into a new organization (P.Jonsson, I.Carlsson, 2000).

The urgency of the problem is motivated by a wide problem field, which can be presented in the form of contradictions between: its social significance and the level of its theoretical development; the need to develop the creative

potential of future teachers and the stereotypical idea of the effectiveness of their professional training; requirements for a modern teacher and the degree of development of his pedagogical creativity as the basis of students' creativity; opportunities for the development of students' pedagogical creativity and the insufficient level of understanding of this phenomenon by teachers of higher education institutions.

The indicated contradictions encourage the development of theoretical foundations for the development of pedagogical creativity of future teachers and the definition of a set of pedagogical conditions that stimulate the effectiveness of technological learning as an important resource for the formation of a creative specialist.

## METHODOLOGY

**The purpose of the research** is the theoretical justification and experimental verification of the model of formation of pedagogical creativity by means of technologyization of learning, content, technology of formation of creative qualities of students in the process of professional training in the conditions of university education. The goal was to develop a model for the formation of pedagogical creativity of an individual, identify the possibilities of differentiated and creative approaches to the organization of professional training aimed at stimulating pedagogical creativity of future teachers, and experimental verification of the conditions that ensure the productivity of the model. It was assumed that the formation of a creative personality in the conditions of the educational process of the university is possible with a creative approach to its organization; creating an emotionally favorable creative environment; humanization of relationships in the «teacher-student» system; harmonization of intelligence and emotions in the perception of educational material; activation of the process of self-development of creative abilities and creative style of activity of future teachers.

The solution of the problem was carried out with the help of methods: study and analysis of scientific literature for theoretical substantiation of the model of development of pedagogical creativity of the individual and identification of the conditions of its productivity; questionnaires, interviews, testing, observation - in order to study its actual state in practice; a pedagogical experiment to check the effectiveness of the experimental training program; mathematical statistics for quantitative and qualitative processing of the results of research and experimental work. Grades were given as the sum of points for the manifestation of indicators of pedagogical creativity, which were calculated according to the formula:

$$K_m = (Z_{m-p} + Z_{z-p} + Z_{k-d} + Z_{p-p}):$$

where  $K_m$  is the coefficient of formation of pedagogical creativity of the individual;

$Z_x$  is the sum of points obtained by the intensity of the indicators of each component of the structure of the individual's pedagogical creativity;

X - m-p, z-p, k-d, p - determination of the components of the structure of pedagogical creativity («m-p» - motivational and necessary, «z-p», - content-processual, «k-d» - creative-active, «p-r» - productive-resultative component). The final cut showed that, in general, the high level of pedagogical creativity of students decreased from 16.0% to 34.6%, the average level decreased from 51.6% to 48.2%, and the low level was 17.2% compared to 32, 4% at the beginning of the experiment.

Participants in the study - students 1-4 courses (192 people.) And teachers (20 people) Kryvyi Rih State Pedagogical University, Kryvyi Rih, Ukraine. The study was conducted in the period from 2021 to 2024.

## RESULTS

The diversity of social and psychological-pedagogical factors that influence the formation of a specialist's personality is concentrated in their creative relationship to the chosen professional field of activity. A creative attitude involves the active participation of future teachers in the rationalization of pedagogical work, the use and creation of pedagogical innovations and innovations that affect the development of creative abilities, the ability for creative actions, a non-standard approach to the performance of professional functions.

Pedagogical creativity of students in the conditions of technological learning is a subjective innovation that positively affects the development of the ability of future teachers for creative activity, enriching the creative potential of their personality. The development of pedagogic creativity in the conditions of technological learning necessitates the need to find ways and means of solving professional tasks and performing professional functions, which differed in the quality and creative nature of their implementation, and an innovative approach to practical pedagogical work.

We proceed from the fact that the pedagogical creativity of students is an independent, pedagogically directed activity in the conditions of technological learning, which has in its content a significant, subjectively new technological and methodological solution to pedagogical problems and effectively influences the formation of a creative personality, the development of creative abilities, which ensure not only the use, but also the creation of pedagogical innovations, their introduction into pedagogical practice. The term «pedagogical

creativity» is used to characterize two aspects of professional training: 1) systematic, purposeful work on enriching the creative potential of an individual, developing their creative abilities; 2) organization of technological-methodical activity in the conditions of technologyization of education to create an innovative technological-methodical product.

On the basis of the developments of various scientists regarding the study of the problem of creativity, which substantiated various ways and means of its solution, we assumed that the differentiation in the degree of complexity of pedagogical tasks depending on the abilities and individual development of the personality of future teachers allows organizing professional training in such a way as to ensure the necessary technology of education technological tools, methodological equipment, creation of a set of pedagogical conditions for full and active participation in non-standard activities of technological and methodological orientation

Pedagogical creativity as an important characteristic of pedagogical professionalism is formed in the conditions of practical technological and methodological activity, development of new objects in the process of solving professional and pedagogical problems. The ability of students to creatively perform professional tasks in the conditions of online learning allows us to objectively assess our own capabilities of creative thinking and action, analyze the practical significance of creating a technological and methodological product and, based on it, perform practical innovative actions.

In the process of development and construction, the student looks for new elements in a familiar technological and methodological object, finds opportunities for its renewal, ways and means of modernization based on analysis and correlation with own constructive solutions in achieving the planned product.

We assumed that in order to develop a system of training future teachers for pedagogical creativity (creation of new technological and methodological objects), it is necessary to include students in the process of modeling, construction, that is, creating a new product, achieving the planned result in the projected structural and functional model of the formation of pedagogical creativity as an important characteristic of pedagogical professionalism.

We considered the model as a system of interconnected structural components that ensure the orderliness of the goal and tasks, content, methodology, technology, monitoring, evaluation and correction of the achieved results. The model in its content combined structural blocks: methodological-targeted (which provided for setting the goal of forming the pedagogical creativity of future teachers in the system of professional training based on methodological approaches:

systemic personal-oriented, competence-based, creative activity, technological and principles of self-activity, interaction, cooperation and co-creation, emotional comfort, initiative, activity); content-technological (reliance on fundamental knowledge of pedagogical creativity as a basic characteristic of pedagogical professionalism and active technological and methodological activity as an important factor in the development of a creative personality with the help of innovative technologies, methodical equipment of the educational process and tools of pedagogical design, forecasting, modeling, construction and creation of a new product) and monitoring and evaluation (a set of methods: observation, analysis of results, questionnaires, testing, evaluation and self-evaluation of achievements in positive dynamics levels of pedagogical creativity according to the criteria and indicators of pedagogical creativity).

We proceeded from the fact that the abilities for pedagogical creativity are formed in the conditions of practical activities with the aim of developing new objects, solving problems of technological orientation. Therefore, in the experimental training program, the formation of pedagogical creativity of future teachers was realized in the process of technological-methodical activity, the basis of which is the search for new elements in a familiar technological-methodical object, identifying the possibilities of its modernization, modeling, designing and creating an innovative product. Technological and methodological activities were aimed at harmonizing its informational and procedural sides and using various forms of its organization (business and role-playing games, trainings, competitions, exhibitions of student works, showcase stands, mini-exhibitions, and presentation of booklets, portfolios, etc.). The level of pedagogical creativity is due to the active participation of students in various seminars-workshops («Creativity of a modern teacher - how does it manifest itself?»; «Innovative technologies - what is their role in education?»; psychological trainings («Creativity and means of its development in the conditions of technological learning?»; methodological tournaments («We model the perspective of our own professional growth?»; pedagogical festivals («From student creativity to pedagogical creativity?»; competitions: pedagogical techniques, methodical skills, use of innovative technologies in solving technological and methodological problems; presentations: a model of the technological equipment of a modern lesson, the construction of one's own teaching tools, methodical findings in the performance of creative tasks, etc.

In the process of experimental training, a significant role was assigned to creative tasks, event-role situations, discussions, dialogues, business games, individual and collective trainings. The experimental training program

was aimed at creating the necessary conditions for the implementation of a training system for the formation of pedagogical creativity of future teachers. First, a creative educational environment was built in which students could take an active creative position, freedom of choice of creative tasks and modeling methods, design for the creation of new projects, innovative products of technological and methodological orientation. Secondly, work was carried out on mastering the knowledge and skills of creative activity, which serve as factors of a creative approach to solving professional problems and achieving positive results in the creation of methodical and technological products of subjective novelty. Thirdly, attention was paid to psychological-pedagogical support and scientific-methodical provision of technological-methodical activities.

The levels of formation of pedagogical creativity were determined as the average of the arithmetic indicators of all structural components of this complex personal formation (motivational-necessary; content-innovative; creative-active; emotional-volitional; reflective-evaluative).

To implement the structural-functional model of the formation of pedagogical creativity of students in professional training, modeling and construction technologies of new technological-methodical objects, creation of a new product of technological-methodical purpose were used. The tasks included the design and modeling of innovative classes, the development of methodical recommendations, instructions and technological training tools. When developing creative tasks, the students' attention was focused on the complex use of tools and the fulfillment of requirements that ensure the creation of new technological and methodical products with the help of innovative technologies. The basis of creative tasks was modeling and construction as a set of technological, organizational, methodical, aesthetic tasks for transforming traditional solutions into innovative ones. The methods of their solution were conception, hypotheses, synthesis, abstraction, generalization, comparison of traditional and new projected products and creation of more economical and qualitative ones.

Modeling and construction in technological-methodical activity is the process of creating an image of a technological-methodical product, which arises in the reflection of the student, and then is expressed in schemes, technologies, models, methodological recommendations, instructions for the creative achievement of projected goals. In this process, active thinking actions are manifested: tasks, a sequence of technological operations and creative actions are projected. The interaction of thinking and practical operations serves as a factor in the pedagogical creativity of students. Productivity of these processes was determined by the need to master the



skills of planning, modeling, construction, determining the stages of technological and methodical activity, approbation of new products and creating the necessary conditions for students' creative actions. The evaluation of the achieved results was carried out on the basis of the presentation of the students' self-made creative projects.

In the process of performing research tasks, students showed different opportunities for creative activity, which allowed them to be united into three groups and necessitated the differentiation of tasks of technological and methodical activity for each of them. The first group united students who did not encounter difficulties in innovative activities when performing technological and methodological tasks. They independently planned modeling work, construction of technological and methodical products, independently developed their own idea. The students of this group were expected to perform tasks of the highest degree of complexity, which required creative actions, an innovative approach to the performance of creative tasks. The second group united students who encountered difficulties at some stages of technological and methodical activity. They constantly felt the need for pedagogical help to find innovative solutions. For them, tasks were practiced, the execution of which involved a sequence of modeling, construction and development of a technological and methodological product based on a ready-made sample. The third group united students who hesitated in finding their own idea of a creative solution to a technological and methodological problem, felt the

need for constant supervision and help of the teacher in performing creative tasks. Tasks for them involved actions based on a ready-made sample of making technological and methodological decisions.

The differentiation of creative tasks of technological-methodical activity with an orientation to the possibilities and creative abilities of students stimulated the awakening of interest in pedagogical creativity, activated creative actions, the need for non-standard actions, the need for an innovative approach to solving technological-methodical problems.

From the table 1. it can be seen that at the stage of the ascertainment experiment, a low and medium level of pedagogical creativity prevails in all its structural components. After the completion of the formative experiment, a positive dynamic of the levels of the structural components of pedagogical creativity from low, medium to high level was outlined.

From the table 2. it can be seen that the high level of formation of pedagogical creativity was 13.8% in CG and 12.9% in EG; average level — 34.3% in CG and 30.6% in EG; low level – 51.9% in CG and 56.5% in EG. The value of the statistical criterion  $\chi^2$  at the stage of the ascertainment experiment is equal to  $\chi^2_{\text{emp}} = 0.524$ , which is less than the critical value  $\chi^2_{\text{krit}} = 5.991$ . These data indicate the absence of a statistically significant difference in the levels of formation of this complex personal formation in students of the control and experimental groups.

**Table 1: Levels of structural components of pedagogical creativity of future teachers after completion of the formative stage of the experiment (in %)**

Levels	Structural components of pedagogical creativity									
	motivational and necessary		substantive and innovative		creative and active		emotional and willful		reflective and evaluative	
	CG (94 )	EG (98 )	CG (94 )	EG (98 )	CG (94 )	EG (98).	CG (94 )	EG (98 )	CG (94 )	EG (98 )
High	15,8	25,7	18,4	29,3	10,9	8,5	23,9	32,7	5,1	22,7
Medium	47,4	54,1	47,4	52,8	30,2	51,2	42,4	53,8	40,6	43,5
Low	36,8	20,2	34,2	17,9	58,9	40,3	33,7	13,5	54,3	33,8

**Table 2: The dynamics of the levels of pedagogical creativity of future teachers in the conditions of technological and methodological activity (in %)**

Levels	Pedagogical creativity			
	Declarative stage		Formative stage	
	CG (94 people)	EG (98)	CG (94)	EG (98)
High	13,8	12,9	16,4	25,1
Medium	34,3	30,6	39,8	50,0
Low	51,9	56,5	43,8	24,9

The results of experimental training in the experimental group confirmed the positive dynamics of the level of formation of pedagogical creativity of future teachers in the field of technological and methodological activity. Thus, in the experimental group, the high level increased by 12.2%, the average level - by 19.4%, the number of students with a low level decreased significantly from 56.5% to 24.9%. In the control group, there are also changes in the level of pedagogical creativity from low to medium and high, but these changes are insignificant. Thus, the number of students with a low level of pedagogical creativity in technological and methodological activities decreased by 8.1%, with an average level increased by 5.5%, and with a high level by 2.6% after the completion of experimental work. The value of Pearson's statistical criterion for the levels of formation of pedagogical creativity by means of technological-methodical activity exceeded the critical value (5.991) and is  $\chi^2_{\text{emp}} = 8.300$ , which makes it possible to talk about the effectiveness of the professional training system in the conditions of technologyization of education.

## DISCUSSION

The generalization of scientific developments on the problem of research and the results of research and experimental work allows us to talk about the effectiveness of training future teachers on the principles of creative technological and methodological activity, the results of which are positive dynamics of the levels of pedagogical creativity of students in the conditions of technological learning. The collected data after the completion of the research confirmed the positive dynamics of the levels of pedagogical creativity of students.

The productivity of the system of training future teachers for pedagogical creativity in the conditions of technological learning is ensured by technological and methodological activities aimed at modeling and designing a new product, using innovative technologies and active creative actions, orienting educational material to innovative solutions to professional and pedagogical problems, in various forms and methods, special technologies and means of performing creative tasks, pedagogical conditions in which each student has the opportunity to show pedagogical creativity, enrich his own creative potential to gain experience in creative actions.

A feature of the formation of pedagogical creativity of future teachers is the focus of professional training on familiarizing students with the theoretical foundations of pedagogical creativity and technological-methodical activity, which is a stimulus for modeling and designing a new product, initiative, independence, creativity of actions as important qualities of a creative personality. These features of training have been confirmed in the studies of various authors. Foreign

scientists (Arnseth & Hatlevik, 2010, Grabe, 2007, Ghavifekr, Afshari & Amla Salleh, 2012) consider the problem of technologicalization of the educational process as an important problem of finding resources to increase its productivity. They associate the solution of this problem with the use of various technologies, which not only have a positive effect on the quality of education, but also on the mastery of thinking skills and the development of Clark's creativity Burton (2004, p. 220) noted that knowledge is of great importance in the professional formation of specialists. 2017) recognize the importance of fundamental knowledge in various sciences, which confirms our thesis about the need to harmonize intellect and emotions in the process of mastering future teachers with professional knowledge and the acquisition of experience in creative technological and methodological activity. The results of our research were confirmed in the works of foreign scientists (L. Cendell, 2002, Harden, R. M., & Grosby, Har., 2000, Clement, Mary C., 2018, Filozofiazycja, 2011, M. Fullana, 2007, etc. The theoretical foundations of creativity and creative technological-methodical activity serve as important factors in the formation of pedagogical creativity of future teachers.

The analysis of psychological works allows us to state that the emotional-necessary structure of pedagogical creativity includes intellectual (thinking, memory, reflection), sensory (emotional) and volitional spheres. Therefore, the success of forming this complex personal education depends on the level of development of these components and its impact on the professional growth of future teachers. In the conditions of technologization of education, modeling and construction have important opportunities for the development of creative properties, creative abilities, interest in technological and pedagogical activities of innovative orientation in the system of professional training of future teachers.

The use of various forms and methods of training, practically oriented to the specifics of technological and methodological activities: creation of instructions, recommendations for methodical support of the web marathon of event-role situations, Internet festivals, methodical studios, master classes, development of creative projects, construction and modeling of technological and methodological products, their presentation and use in the educational process, ensure positive dynamics of the levels of pedagogical creativity of future teachers in the conditions technological and methodical activity and provides the necessary conditions for the manifestation of opportunities and creative abilities of each of its participants. Creative actions of students in these forms affect the flexibility of thinking, the need for constant updating of knowledge, the development of the ability to think outside the box, act creatively in constantly changing situations.

## CONCLUSIONS

The collected data allow us to say that the predicted goal has been achieved. It has been experimentally confirmed that the training of future teachers by means of technological and methodological activities using innovative technologies, modeling and construction methods ensures positive dynamics of the level of their pedagogical creativity as an important characteristic of pedagogical professionalism.

Abilities for pedagogical creativity are formed in the conditions of practical technological and methodological activities, the development of new objects in the process of solving creative tasks by means of modeling and construction, and the use of technological teaching aids. The ability of students to creatively solve technological and methodological tasks allows them to objectively assess their own capabilities of non-standard thinking, to act creatively, to analyze the practical significance of the created creative project, the level of formation of their own pedagogical creativity as an important characteristic of the professionalism of a modern teacher.

Training focused on the development of pedagogical creativity of future teachers is a qualitative characteristic of the new pedagogical system (an integrated set of goals, ways, methods and forms of acquiring, deepening and expanding the experience of creative activity, social maturity and a high level of professionalism, on the professional growth of the creative capabilities of the individual, aimed at self-development of their innovative and reflexive actions), the leading idea of which is the creation of pedagogical innovations, updating of instrumental means of technological content in accordance with the requirements of the educational situation and in the interest of creative growth of future teachers.

The productivity of the formation of pedagogical creativity is conditioned by the creation of pedagogical conditions (a creative educational environment, the manifestation of activity, the involvement of innovative learning methods and their use as a tool for practical actions, idea generation, the construction of a creative project, systematic psychological and pedagogical support), which ensure the positive dynamics of the levels of the formation of pedagogical creativity future teachers.

Based on the results of the conducted research, we can add a conclusion about the need for further improvement of professional training based on the principles of co-creation, creativity, reflexivity, focus on harmonizing the content and procedural, emotional and intellectual aspects of technological learning, activation of creative actions of students, the result of which is the growth of pedagogical creativity of future teachers as an important resource for improving the quality of university education.

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