

Training Intending Technologies Teachers for Forming Middle School Students Artistic and Technical Skills

Vira KUROK¹, Halyna VOYITELYEVA², Olha LYTVYN³, Tetyana KHORUZHENKO⁴, Nadiya BORYSENKO⁵

¹ Corresponding Member of the National Academy of Pedagogical Sciences of Ukraine, Doctor of pedagogical sciences, Professor, Head of the Chair of Technological and Professional Education of Oleksandr Dovzhenko Hlukhiv National Pedagogical University, Hlukhiv, Ukraine, virakurok@gmail.com

² Candidate of pedagogical sciences, associate professor of the Chair of Technological and Professional Education of Oleksandr Dovzhenko Hlukhiv National Pedagogical University, Hlukhiv, Ukraine, finagalina@rambler.ru

³ Candidate of pedagogical sciences, associate professor of the Chair of Technological and Professional Education of Oleksandr Dovzhenko Hlukhiv National Pedagogical University, Hlukhiv, Ukraine, gllon@i.ua

⁴ Candidate of pedagogical sciences, associate professor of the Chair of Technological and Professional Education of Oleksandr Dovzhenko Hlukhiv National Pedagogical University, Hlukhiv, Ukraine, horujenkota@ukr.net

⁵ Candidate of pedagogical sciences, senior teacher of the Chair of Technological and Professional Education of Oleksandr Dovzhenko Hlukhiv National Pedagogical University, Hlukhiv, Ukraine, nbori7enko@gmail.com

Abstract: In the course of the research, pedagogical conditions of training intending teachers of technologies for forming artistic and technical skills of middle school students were substantiated. They envisage intensification of interdisciplinary links in the process of forming artistic and technical skills of intending teachers of technology, creating the artistic and creative educational environment on the basis of intersubject connections of the teacher and students, introducing the optional course “Fundamentals of artistic and technical creativity”. The comparative analysis of the results of the study at the beginning and at the end of the experiment showed the effectiveness of the identified pedagogical conditions, the introduction of which into the educational process helped to increase the level of readiness of intending teachers of technologies for forming artistic and technical skills in middle school students. The study of the state of professional training of intending technologies teachers for forming middle school students artistic and technical skills was conducted. Analysis of the source base revealed that the problem identified in pedagogical theory and practice was not developed and was not the subject of the special research. On the basis of the critical analysis of the features of training intending technologies teachers for creative project-technological activity, stages of its implementing and a number of scientific works, the meaning of the concept of “artistic and technical skills” was revealed. Scientific search helped to highlight a number of interrelated components in the structure of technology teachers' readiness for forming artistic and technical skills of middle school students: motivational, cognitive, operational, reflexive; criteria of forming the investigated quality, their indicators; levels of forming (initial, intermediate, sufficient, high) of the designated readiness.

Keywords: *artistic and technical skills; technologies teachers; middle school students; training.*

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1. Introduction

During the last decades the higher education system in Ukraine has shown a tendency to increase innovation in the field of vocational training of the next generation of intending teachers. This is due, first of all, to the growing role of the intellectual functions in the professional activity of any specialist, the need to reorganize the modern institutions of the general secondary education in accordance with the conditions of nowadays, and provide it with the qualified pedagogical staff. General requirements for training specialists in the educational field “Technologies” are increasing in relation to their involvement into the practical activities, gaining obligatory experience in the creative work.

As a consequence, the priorities in training intending technologies teachers for the middle school are changing, there is the current requirement to improve the conditions, forms and methods of organizing the educational process in the higher education institutions providing their training.

2. Literature review

Analysis of the psychological and pedagogical literature on the problem of teachers training allowed to determine the main areas of research: the content and methods of training teachers of technologies (Kurok, 2018); training technologies teacher for providing the project-technological activity at the labor training lessons (Kobernyk, O., 2001); training intending technologies teachers for different types of creative activity (Orshans'ky, L., 2008).

Scientists focused their research on the various areas of artistic and technical activity. Thus, Kolesnyk (2007) studied the organization of the artistic and technical creativity of students at the out-of-school educational establishments; Levytska (2008) researched the development of children's artistic creativity at the out-of-school educational establishments of Ukraine; Horol et al.'s (2000) investigations are focused on the development of students' technical and artistic creativity; Slipchyshyn's (2019) studies substantiate the methodical system of the artistic and technical design in the professional training of intending skilled workers; Hipters' (1998) attention is directed to the artistic creative activity of students of HEE (higher education establishments) of Ukraine; Androshchuk (2019) revealed the organizational and pedagogical conditions for training intending technologies teachers for organizing extra-curricular artistic and technical activities of students.

Gill's (2019) research highlights the researches into the structure of teaching technology education, analyzes the factors that both support and impede secondary school technologies teachers, scientists Jones, A. and Compton(1998) investigated ways to increase the effectiveness of teaching and learning technologies as model of teacher's development in the technological education; Suligoj et al. 2020 studied students' perceptions and experience in the field of critical thinking and students' capability of creative designing in mastering different subjects.

However, in spite of the considerable achievements, there is still no unified approach to defining skills to provide project and technologies activities. Such skills, in our opinion, include the artistic and technical skills. The problem of training intending technologies teachers for forming creative artistic and technical skills of middle school students is not well developed in the pedagogical theory and practice.

The purpose of the article. The article is aimed at identifying, substantiating and experimental testing the pedagogical conditions of training intending Technologies teachers for forming creative artistic and technical skills of middle school students. This requires revealing the concept of “artistic and technical skills”, determining the structure of the Technologies teachers willingness to form these skills of middle school students, criteria, indicators and levels of their forming.

3. Research methods and methodology

To solve the problems of the research we used a complex of methods: analysis and generalization of the philosophical, psychological-pedagogical, educational-methodical literature in order to determine the state of elaboration of the problem of training intending technology teachers for organizing the project-technological activity of students at labour training lessons; generalization, comparison in order to clarify the conceptual categorical apparatus of the study; systematic analysis for substantiation of the pedagogical conditions of training intending Technologies teachers, forecasting the effective forms and means of their realization; questionnaires, testing, questioning, pedagogical observation of the educational process, self-observation, self-assessment, analysis of products of students' creative activity to diagnose the level of intending teachers of technology for forming the artistic and technical skills of middle school students; pedagogical experiment (stating, forming, controlling) with the purpose of studying the state of readiness of intending Technologies teachers for forming the artistic and technical skills of middle school

students and checking the effectiveness of the pedagogical conditions of training students for forming these skills for the middle school students; mathematical processing the research results, determining their statistical significance and assuring their probability and objectivity.

4. Results

The content of the professional training of technologies teacher is defined by the educational branch “Technologies”, the State standard of basic and complete general secondary education. The basis of this training is the subjective-transformative activity of a man in the material world aimed at creating the educational environment oriented to disclosing and developing students' abilities in the personally-oriented sphere of designing and manufacturing products and familiarization in the process of work with different materials, information and other resources.

The purpose of the educational field “Technologies” is the formation and development of project-technological and information-communication competences for realizing the creative potential of students and their socialization in the society. A number of subjects are responsible for the content filling of the sphere, among which the prominent place is occupied by labour training.

As T. Machacha (2015) rightly points out, the subject design-technological competence is formed in the process of the subject-transformation, project-technological activity. It is a fundamental core of the subject “Labour Training” at middle school; providing labour training teachers and Technologies teachers with it requires special knowledge and skills.

The problem of forming skills is always relevant as they are at the heart of any training. Knowledge of the nature and ways of their forming is important, in particular, for the theory and practice of training intending teachers for their professional activity.

At the same time we are convinced that to help students to fully realize their creative potential, Technologies teachers need to know the mechanisms of human brain work and be able to use them in the educational activities to develop students' creative skills. As a result of our theoretical study of the problem of forming skills we come to the conclusion that in order to develop the creative abilities of the individual it is important to arrange the joint work of the two hemispheres of the brain, to learn to combine the two types of perception and to create objects of work on the basis of their creativity. It is not enough to be able to just imagine

something, to have interesting ideas, to be able to translate them into life, to choose the right techniques for accomplishing the work, to use the necessary tools to help them to design a creative product. This should be clearly understood by the technologies teachers and used in their professional activities, in particular when engaging students into the development of creative projects.

The above mentioned gives reasons to claim that any activity, designing and technological in particular, provides for the inseparable unity of the image which is constantly, at every stage of its implementing, kept in the mind of a person, and the technical implementation of actions in various ways. In the process of the creative activity the conscious image becomes artistic.

The process of creating a project at the labour training lessons fully corresponds to the macro-structure of activity described by Tvorohova (1997). It starts with developing the image, the idea of the future object of work, its appearance. By means of the material (wood, metal, textile materials, etc.) the image finds its vivid embodiment in the form, it becomes artistic. Then the design is considered, the technique and technology of executing the product are determined, the sequence of project realization and, if necessary, its manufacture, decoration, quality check, realization are carried out. Thus, we can summarize that the design activities have logically interrelated artistic and technical components.

Thus, creativity at the labor training lessons includes imagination (as the artistic process - emerging and forming ideas) and the implementation of certain techniques in life (as a technical process - the implementation of ideas in life, material form). Accordingly, the combination of artistic and technical components at the labor training lessons is indivisible and is a natural requirement of creativity in the students project-technological activity.

Thus, *artistic and technical skills* fully cover all the stages of the project-technological activity, permeate it and appear as one and indivisible unit.

On the basis of the critical analysis of the features of training intending teachers of technologies for creative project-technological activity, stages of its implementation, a number of scientific works on the problem of forming skills which provide certain stages of the project-technological activity at middle school the meaning of the concept of "*artistic and technical skills*" was revealed. They are understood as the ability of a person to create artistic images and to realize them in the form of real objects or models by applying the selected techniques.

Artistic and technical skills are integrative and constitute a synthesis of artistic and technical components. In this context, L. Orshans'ky's (2011) statement that the technical one does not accidentally belong to the place after the artistic is important, it (the technical one) is a kind of translation of the abstract artistic language into the practical language of the technical component (as it was discussed by V. Rothenberg), i.e. translating the creative concept into a real project form.

To sum up, it should be noted that the effectiveness of the process of project-technological activity, artistic and technical creativity of students depends on its skillful organization and professional activity of the teacher of labour training and technologies. Therefore, intending specialists should have sufficient amount of necessary knowledge, skills, be ready to involve students in the creative process at the lessons of labour training. This means that Technologies teachers need to have specific skills, including artistic and technical ones.

Readiness is a prerequisite for successful performing the person's professional activity. It integrates the psychological and personal characteristics, the qualities of the person, caused by the system of the professional requirements for the specialist. This willingness can only be the result of a specially organized process of training Technologies teachers for their professional activity (Myronovs'ka, 2009).

The scientific search helped to highlight in the structure of intending Technologies teachers readiness for forming artistic and technical skills of middle school students the following interrelated components: motivational, cognitive, operational, reflexive.

The motivational component of readiness implies that the intending teachers have their personal motives, interests, needs, aspirations to form the artistic and technical skills of middle school students.

The cognitive component of readiness involves mastering and operating by students a set of knowledge about the essence and place of the artistic and technical skills in the technological training of middle school students, about the method of their forming. According to Prusak (2006), knowledge is not any cognitive image, but only the one correlated with a certain subjective variety. In order to transmit knowledge it is necessary to present it as a way of organizing a certain subject diversity and to organize active cognitive activity of students in managing this diversity.

The operational component is based on a set of skills for forming the artistic and technical skills of middle school students; demonstrates the willingness to put into practice the acquired knowledge, skills and abilities in the future professional activity.

The prerequisite for effective training of intending specialists is the effectiveness of knowledge – the availability of skills to apply them in solving practical problems which, according to Yahupov et al. (2013), provides a concrete definition of the main directions of knowledge in practical activity and meaningful characterization of methods, procedures and techniques actions on the use of the theoretical and practical knowledge.

The basis of training, a means of mastering the artistic and technical skills is practice. Systematization, generalization, improvement of artistic and technical skills of intending Technologies teachers, assimilation of methods of forming these skills for middle school students occurs in the process of direct work on practical tasks, projects when the student is aware of and masters various aspects of this process.

The reflective component characterizes self-knowledge and introspection by the teacher of his/her one's own activity. The ability to treat oneself reflectively in the process of activity is first and foremost related to the constant interaction with the others, the desire to understand their thoughts and actions.

According to the components of intending teachers of technologies to forming artistic and technical skills of middle school students, the criteria of formation of the studied quality are determined: motivational value (indicators: understanding and perception of the essence, places of artistic and technical skills in the technological training of students of middle school; technical skills, desire to own them, use them in their practical activity and to form them for middle school students, motivation to succeed in forming the artistic and technical skills of students of middle schools, professional necessity for readiness to form the artistic and technical skills of students in middle schools, etc.); cognitive; behavioral and activity (indicators: mastery of intending teachers of technologies of artistic and technical skills; ability to use artistic and technical skills in the educational process and to form them for students; possession of methods of forming artistic and technical skills of students); reflexive-diagnostic (indicators: the ability to reflect the implementation of activities, the ability to self-assess their willingness to develop artistic and technical skills of middle school students; self-analysis, self-correction; analysis of activities performed to develop artistic and technical skills of middle school students). The levels of readiness (initial, intermediate, sufficient, high) of the readiness were characterized.

The result of training intending Technologies teachers for forming artistic and technical skills of middle school students can be seen in the formation of high and sufficient levels of all the components of the structure

of the mentioned readiness. This is what determines the effectiveness of their specific professional activity related to forming the artistic and technical of middle school students.

According to Yu Babansky (1988) “the effectiveness of the pedagogical process naturally depends on the conditions in which it takes place”. Conditions include the environment for the emergence, existence and development of a phenomenon or process beyond which they cannot exist.

Pedagogical conditions of training intending Technologies teachers for forming artistic and technical skills of middle school students are seen as a set of objective possibilities of content, methods, organizational forms and material and spatial environment aimed at improving the process of forming artistic and technical skills of intending Technologies teachers.

In order to identify these pedagogical conditions, the authors found out the state of training the named specialists for the specified activity with the help of the authors' questionnaire. The questions were focused on identifying: the level of awareness of the importance of training for the implementation of project-technological activities at school, forming students' artistic and technical skills; interest in mastering artistic and technical skills; forms and methods of training intending teachers of technologies for the project-technological activity, art and technical creativity.

The analysis of the results of the questionnaire, as well as interviews with intending teachers of labour training and technologies showed that students are not sufficiently involved in designing and technology activities during their studies in higher education institutions, are not systematically engaged in the manufacturing products by different techniques, experience some difficulties in the organization technological activity in general secondary education institutions. In training intending Technologies teachers, higher education institutions use mainly traditional methods and forms of education which do not provide the conditions for the development of creative abilities of students' personalities.

Detecting by means of testing the current state of students' possessing the studied quality showed that 58% of the respondents have knowledge of artistic and technical creativity and product design. Regarding the knowledge on the essence of artistic and technical skills and methods of their forming for middle school students, it was found that they are mainly at the intermediate and initial level (67%), the artistic and technical skills of students are different.

As a consequence, the task is to identify the pedagogical conditions that will provide training intending technology teachers for forming artistic and technical skills of middle school students. They advocate those opportunities for content, methods, organizational forms, and the material and spatial environment that will enhance the formation of motivational, cognitive, operational, and reflective components of teachers' willingness to undertake these activities.

Based on the theoretical analysis of the conducted research on the problem and the results of the stating stage of the experiment, the system of the pedagogical conditions for training intending technology teachers for forming artistic and technical skills of middle school students training intending technology teachers for forming artistic and technical skills of middle school students, namely: 1) ensuring interdisciplinary links in the process of forming artistic and technical skills of intending technology teachers; 2) developing the artistic and creative educational environment on the basis of subject-subject interaction between the teacher and students; 3) introducing the optional discipline "Fundamentals of artistic and technical creativity".

The implementation of the first condition involves: developing a motivational focus on creative project and technological activity; mastering intending labour training and Technologies teachers with theoretical knowledge of the nature, place and purpose of project-technological activity; development of artistic and technical skills, as well as skills of performing all stages of the project-technological activity; continuous self-improvement of artistic and technical skills in project and technological activity; generalization, systematization of acquired knowledge and application of artistic and technical skills in the process of performing qualification diploma works; introduction of a complex of interdisciplinary and creative tasks into the educational process to the disciplines of the cycle of professional scientific-subject training.

The implementation of the second condition implies: the use of innovative pedagogical technologies to increase students' motivation to carry out project-technological activities and mastering artistic and technical skills; mastering future methodological knowledge and skills in forming artistic and technical skills of students; applying the pedagogical practice to improve the skills of intending Technologies teachers in organizing project-technological activities and forming artistic and technical skills of middle school students. It is a means of creative application of acquired artistic and technical skills, consolidation of methodical training for project-technological activity, forming individual creative style of intending specialists.

The necessity of developing the optional course “Fundamentals of artistic and technical creativity” arose because the technical and technical training of students of technological specialties is currently differentiated and not systematized. The optional course plays a generalizing, systematic role in the process of professional training students, is an intermediate link between the theoretical assimilation of knowledge of artistic and technical training and their practical application in the real world of modern school. It is aimed at systematizing, summarizing, improving the artistic and technical training of intending teachers of technologies, obtained during the study of the disciplines of cycles of vocational and pedagogical and professional scientific-subject training and mastering the method of forming artistic and technical skills of middle school students.

The pedagogical experiment to test the effectiveness of the pedagogical conditions for training intending technology teachers for forming artistic and technical skills of middle school students was carried out on the basis of four pedagogical universities of Ukraine.

At *the stating stage* of the experiment, the documentation of educational institutions in the context of the study was analyzed, methodological support for the experiment was developed; the pilot study was conducted among 392 students of higher education institutions in Ukraine who train intending Technologies teachers and 40 teachers of labour training and technologies; experimental (90 persons) and control (95 persons) groups were determined, the levels of readiness of intending technology teachers for forming artistic and technical skills of middle school students were measured and compared according to the fitting criterion χ^2 .

The study of the state of readiness of intending technology teachers for forming artistic and technical skills of middle school students among university students of the control and experimental groups showed that the motivational component of readiness for this activity is formed at a high level for 25 persons (27.8%) of experimental groups and 29 persons (30.5%) of control groups; high level of cognitive readiness component is characteristic of 12 persons (13.3%) of experimental groups and 10 persons (10.5%) of control groups; operational readiness component was formed and at a high level for 9 persons (10%) of the experimental groups and 10 people (10.5%) of the control groups; the reflective component – for 5 people (5.6%) of the experimental groups and 7 people (7.4%) of the control groups. The reasons for this are the low motivation of the intending technology teachers to carry out the project-technological activity, which is provided with artistic and technical skills; in the absence of systematic and planned involving students into designing and technological activities and

forming artistic and technical skills; in the haphazard training of students for providing the activities under study in general secondary education institutions.

The forming stage of the experiment took place in the natural conditions of the educational process of the educational institutions and was aimed at the theoretical substantiation and experimental verification of the pedagogical conditions, forms and methods of training intending technology teachers for forming artistic and technical skills of middle school students.

At this stage, the students of the experimental groups were trained in the created artistic and creative educational environment on the basis of subject-subject interaction of the teacher and students through the study and implementation of modern teaching technologies, the use of innovative forms and teaching methods that promote the development of creative abilities, enhancement of motivation to carry out project-technological activity and forming students' readiness to organize project-technological activity.

Thus, the content of practical lessons in the disciplines of the cycle of professional scientific-subject training (“Technological Workshop”, “Fundamentals of designing and modelling”, “Fundamentals of design”, “Artistic processing of materials”, “Technical creativity”) includes the complex of interdisciplinary tasks (“Fundamentals of designing and modelling”: creating ideas of future products, executing clauses “Fundamentals of design”: development of design and technological documentation; “HOM: developing artistically decorated elements of future products”; “HOM. Ukrainian folk crafts”, “Technological Workshop”, “Technical Creativity”: developing products based on the developed documentation using artistically decorated elements) and creative tasks (creation of a lapbook, development of intellect maps, construction of the product according to the specified requirements, determination of geometric bodies by dividing things into smaller parts).

While learning the optional discipline “Fundamentals of artistic and technical creativity” students improved their ability to determine the representative system of a man; to develop imaginative thinking, motor-movement sphere of students, visual-motor coordination with the help of specially selected trainings, exercises and tasks; to select tasks for forming artistic and technical skills, taking into account the leading representative system of the student; to develop fragments of lessons on forming artistic and technical skills.

In order to stimulate the work of the brain, stimulate research interest, develop logical thinking, the ability to analyze and draw conclusions,

students were offered training “Unique capabilities of the brain”, a bias test for defining representative systems, differential diagnostic questionnaire of Ye. Klimov as well as the implementation of logical operations (solving anagrams, removing unnecessary words, inserting a missing word, searching for analogies). In addition, practical work was carried out to develop the skills to develop fragments of lesson plans for the development of artistic thinking of students, combinatorial abilities, the use of information and communication learning technologies in designing work objects. Improvement of skills in the organization of project-technological activity and formation of artistic and technical skills of middle school students occurred in the process of passing the pedagogical practice at school by intending Technologies teachers. Students were tested during their qualification diploma work, one of the sections of which included the design and production of the selected object.

In the control groups of each educational institution, training intending technology teachers for forming artistic and technical skills of middle school students was carried out traditionally.

Detecting the dynamics of the levels of readiness of intending teachers of technologies for forming the artistic and technical skills of middle school students was carried out by means of questioning, observation, conversation, expert evaluation (motivational criterion); testing (cognitive test); diagnostic and creative tasks, observation, expert evaluation (operational criterion); interviews, questioning, self-assessment, peer review (reflective criterion).

Summary results of the levels of intending technology teachers’ readiness for forming artistic and technical skills of middle school students are presented in Table 1.

Table 1. Summarised results of the level of formation of intending Technologies teachers readiness for forming middle school students artistic and technical skills, (%)

Readiness components	Levels	EG (90 persons)		CG (95 persons)		χ^2	
		Before	After	Before	After	Before	After
		Motivational	Initial	5,6	2,2	9,5	8,4
Intermediate	23,3		11,1	20,0	12,6		
Sufficient	34,4		32,2	40,0	44,2		
High	36,7		54,5	30,5	34,7		
Cognitive	Initial	23,3	12,2	30,5	21,1	4,1	50,6
	Intermediate	40,0	13,3	41,1	36,8		
	Sufficient	23,3	42,2	17,9	28,4		

	High	13,3	32,2	10,5	13,7		
	Initial	42,2	13,3	43,2	38,9		
Operational	Intermediate	26,7	17,8	22,1	18,9	1,4	37,8
	Sufficient	21,1	42,2	24,2	29,5		
	High	10,0	26,7	10,5	12,6		
Reflexive	Initial	42,2	13,3	46,3	42,1	1,7	58,9
	Intermediate	33,3	20,0	30,5	25,3		
	Sufficient	18,9	41,1	15,8	22,1		
	High	5,6	25,6	7,4	10,5		

Abbreviations meanings: CG—control group, EG—experimental group.

5. Discussions

The results shown in Table 1 give grounds to claim that introducing pedagogical conditions for training intending teachers of technologies for forming artistic and technical skills of the middle school students in the experimental group provided for the increase in the number of students with the high level of motivational component formation – by 17.8 %; cognitive component – by 18.9%; operating component – by 16.7%; the reflective component – by 20%. The students of the control sample showed insignificant changes.

The validity of the experimental data obtained is confirmed by mathematical statistics using the fitting criterion χ^2 ($\chi^2_{\text{critical}} = 11.34$). At the beginning of the experiment, the same input state of readiness of the control and experimental students was confirmed. At the control stage, significant differences were found between the levels of readiness of students of the control and experimental groups for forming the artistic and technical skills of middle school students (with 95% of probability) which proves the non-coincidence of the obtained experimental data.

6. Conclusion

Based on the results of the study the following conclusions can be made: 1) it was found that the problem of training intending Technologies teachers for forming artistic and technical skills of middle school students is currently relevant and multifaceted. The basis for the successful training intending specialists in the educational field “Technologies” for the professional activity is the involvement of students into creative activity with forming artistic and technical skills that provide it; 2) in the readiness structure, the following interrelated components were distinguished: motivational, cognitive, operational, reflexive. Their set provides optimum professional training of intending Technologies teachers and fully reflects

the specifics of training intending Technologies teachers for forming artistic and technical skills of middle school students. The criteria of the defined readiness (motivational-values, cognitive, behavioral-activity, reflexive-diagnostic) covering a number of indicators were defined and the levels of formation (initial, intermediate, sufficient, high) of the defined readiness were characterized; 3) pedagogical conditions of training intending Technologies teachers for forming artistic and technical skills of middle school students were identified and scientifically substantiated. These pedagogical conditions were realized in the educational process by involving students in the systematic purposeful designing and technological activity, generalization and systematization of the artistic and technical skills formed for the students and mastering them while forming these skills for middle school students, conducting pedagogical work which provided for the creative application of the acquired artistic and technical skills by the students. Comparative analysis of the results of the study at the beginning and at the end of the experiment showed the effectiveness of the pedagogical conditions, the introduction of which in the educational process helped to increase the level of readiness of intending Technologies teachers for forming artistic and technical skills of middle school students.

The conducted study does not cover all the aspects of solving the problem of training intending Technologies teachers for forming artistic and technical skills of middle school students. Prospective directions of the further investigation include training intending Technologies teachers for the organization of students' independent work for the improvement of the artistic and technical skills and organization of artistic and technical creativity of students in the out-of-school activities.

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