

Development of technical creativity of Kazakh youth is the basis of socio-economic and cultural development of the whole state

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Abstract

The problem of technical creativity as a type of spiritual production is the subject of socio-philosophical research, which has its own content and structure. The purpose of the presented article is to disseminate the results of the study on the formation of the foundations of technical creativity among the Kazakh youth of secondary schools of the Aktobe region in the period 2017-2020. The methodological apparatus of the research: the socio-philosophical problems of technical creativity were introduced by the researchers S. L. Rubinshtein, P. S. Engelmeyer; psychological characteristics of personality abilities - Ch. Spearman, V.N. Druzhinin; communicative, regulatory and cognitive functions of the psyche - B.F. Lomov, S.V. Myskin. Research base: participants in the pedagogical process of secondary schools No. 23, 17, 27, 1, 26, Aktobe, Aktobe region of the Republic of Kazakhstan. According to the research results - the levels of creativity were highlighted: low, medium, sufficient, high; the functional capabilities of a subject teacher, focused on the development of creative thinking, activation of imagination.

Key words: technical creativity, Kazakhstani youth, practical activity, general education, functionality, levels of creativity

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1. Introduction

The democratisation and humanisation of society, determining the state concept of a general education school as a social institution, designed to equally provide the educational needs of the individual, society and the state, impose new requirements on the activities of teachers and students (Law of the Republic of Kazakhstan, 2019). First of all, they consist of revealing the moral, cultural and creative potentials of both the personality of the student and the personality of the subject teacher in changing their relationships on the basis of cooperation and joint activity with an active position of the student.

Today, the differentiation of school education has increased – grammar schools, lyceums and colleges have appeared to provide an increased level of education; specialised training has been introduced with the aim of professional self-determination of schoolchildren; and students are involved in the work of creative associations based on their cognitive interests. However, in general, the social order of society – the development of a creative personality – does not provide enough innovations. Old contradictions have become aggravated and new ones have appeared due to the need to make the school more humane and attractive, while the mass school remains predominantly authoritarian, forming a conformist-oriented personality, not creating conditions for the creative manifestation of the personality of both the student and the teacher.

Modern socio-economic conditions and the indicated contradictions convince of the need to reform the existing concept of mass reproductive education into the concept of an individually creative approach to the student (Nazarbayev, 2018). It is in adolescence that the ability to reflect is manifested – knowledge about the border of one’s own knowledge and the ability to go beyond these limits. Revealing the high creative potential of the younger generation, the formation of creativity and personality determines the tasks of constructive transformation and improvement of the education system.

All of the above presupposes the search for new content and organisational forms of education, attaching special importance to its methodological component, the most important components of which are a developed creative imagination and the ability to develop it.

Modern requirements that an individual and society make to the results of education have determined the need for radical changes in the content of education, which are implemented in a creative approach – in the system of continuous formation of creative thinking, the development of creative abilities, including technical creativity in the younger generation. The main goal of the creative education system is to awaken the creator in a person and develop the inherent creative potential in him.

The purpose of the presented article is to disseminate the results of the conducted study on the formation of the foundations of technical creativity among Kazakhstan youth of general education schools in Aktobe region during 2017–2020.

2. Methodological apparatus of the research

социально-философский проблем технического творчества внесли исследователи С. Л Рубинштейн, П.С. Энгельмейер; психологические особенности способностей личности – Ч. Спирмен, В. Н Дружинин; коммуникативная, регуляторная и познавательная функции психики – Б.Ф. Ломов, Мыскин С.В.

3. Results

The objective prerequisites for technical creativity are social, psychological, pedagogical, scientific and technical aspects. The problem of technical creativity as a type of spiritual production is the subject of social and philosophical research, which has its own content and structure. Starting with the works of Lomonosov, researchers such as Rubinstein (2018), Engelmeyer (2019) and American psychologist Charles Spearman showed that human intelligence is composed of three substructures: spatial intelligence (spatial imagination provides work with spatial schemes and structures), verbal or semantic intelligence (operating judgments, concepts and ‘metaphorical’ thinking) and formal or mathematical intelligence (operating with abstract symbols without reliance on visualisation) (Дружинин, 2019). Б.Ф. Ломов (Мыскин, 2020) представил традиционные взгляды на структуру совместной профессиональной деятельности. In this regard, one could talk about communicative, regulatory and cognitive (cognitive) abilities.

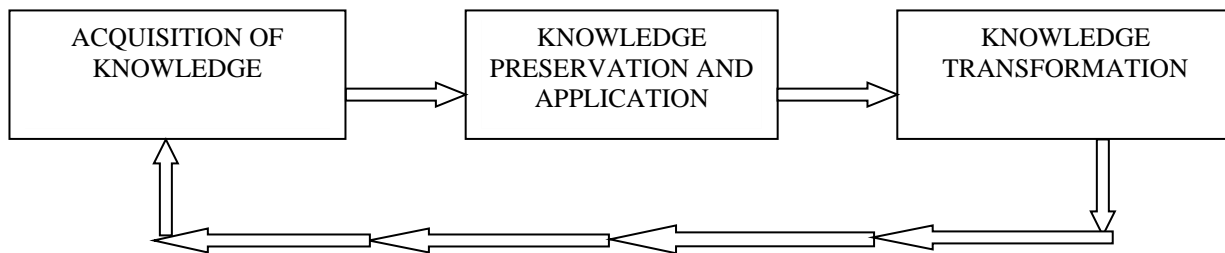


Figure 1. Three functions of the psyche according to Lomov.

Thus, the psychological components of a creative personality are inseparable from all substructures of human intelligence.

With regard to technical creativity, this issue is considered in more detail by Moldavanov, who emphasises the need to form the supporting properties of the creative personality of technical thinking, spatial imagination and observation in the formation of experience of technical creative activity (Шаштыгарин, 2019).

Technical creative activity always implies obtaining a result – the creation of a technical object of a certain level of complexity and novelty.

The result is used to judge the success of this type of activity and the level of creativity development. The main directions and objects of technical creativity of schoolchildren are presented in Table 1.

Table 1. Directions and objects of technical creativity of students

Improvement in learning process	Teaching aids and training equipment
Military–technical training	Sports and experimental models; vehicles for sports and tourism; technical means for holding competitions
Material production	Models: reproductive (copies), simulators and productive (projects); devices for practical use: devices for controlling technological processes and the environment, original tools, devices, devices and tools
Non-production spheres of economy	Technical means contributing to the improvement of labour processes; household items and decorations
Scientific research	Technical means for scientific observations and experiments

The most common methods of technical creativity for schoolchildren are:

- modelling;
- model and technical experiment;
- training and production technical experiment (Dunker, 2006).

The creative personality of a high school student is based on a set of general cultural and personal knowledge and skills, designated by us as competence, which is considered as the basis for the formation of a creative individuality – as a ‘nutrient medium’ for the development of the orientation of the personality, its individual psychological properties and abilities. They form the link between competence and those qualities that distinguish the creative personality of a high school student.

According to our data, the creativity of a high school student can manifest itself to a lesser or greater (close to ideal) degree and, therefore, reflect different stages of its formation. Абдыкаримов выделяет следующие:

- The first stage is characterised by a steadily manifested interest, a clearly expressed orientation of the individual to verbal–cognitive activity and ‘immersion’ in her environment. And although this activity of a high school student at this level is still of a reproducing (copying) nature, this stage is valuable already because the high school student accumulates a certain amount of knowledge, which is the basis for further improvement of his own activity and himself;
- The second stage is characterised by the development of imitative activity and is associated with an increase in the level of mastering verbal–cognitive activity, intensive creative mastery of the methods, means and techniques of this activity, on the basis of which it becomes possible to choose the option for carrying out the activity. Therefore, the nature of the high school student’s activity at this stage can be called creative imitation;
- At the third stage, the verbal–cognitive activity of the high school student is enriched through a gradual decrease in the total number of imitative (reproducing) actions, and, at the same time, an increase in initiative (born ‘here and now’ and not encountered before) actions and coordination actions (reconciling imitative and initiative, arising on their basis). In other words, this stage can be characterised as the stage of the first significant creative achievements of the individual;
- The fourth stage is characterised by the transition from imitation to independent creativity. The activity of a high school student is accompanied by a release from identification with the personality of a sample student, a sharp decrease in the number of imitative actions, an increase in the number of creative ones and is characterised by high, stable creative productivity associated with the discovery and implementation of new ideas, which indicates that the high school student has acquired an independent creative ‘I’;
- The fifth stage is characterised by increased creative activity of the individual and the presence of an individual creative style of verbal–cognitive activity (Ishanov & Bekmambetova, 2013).

The pedagogical aspect of the problem is associated, in our opinion, with the awareness and implementation in school practice of basic educational processes such as formation and development. In the psychological and pedagogical literature, these concepts are often used as synonyms, although they have different meanings. Self-determining in this regard, we understand the formation of the process of creating something, giving a certain form, completeness and development – the process of transition from the old qualitative state to a new one. Both processes are conditioned by certain factors and ways of achieving a certain result.

The process of the formation of a high school student’s creativity is based on the personality activity approach as the leading strategy of modern education, the main task of which is to identify and improve the creative possibilities of the individual and turn them into sustainable, socially valuable creative parameters.

It should be noted that these criterion indicators do not exhaust the whole variety of qualitative characteristics of the development of creative abilities of high school students, but in the context of the problems of our research it is the most significant.

With all the differences in approaches, researchers are quite unanimous in defining the essence of teachers' professional knowledge, but they do not always show initiative and do not feel the need for professional self-development and self-realisation. This is manifested in a decrease in the creative and innovative potential of teaching. This conclusion is also confirmed by the results of the ascertaining stage of the experiment. A survey of teachers of schools No. 23, 17, 27, 1 and 26 in Aktobe region showed that only 32% of the teachers represent the essence of pedagogical innovations; including the pedagogical conditions for the development of technical creativity of schoolchildren, the level of awareness of the ways of development of technical creativity of schoolchildren is not high enough.

Thus, 44% of the respondents are poorly oriented in the processes taking place at school, 39% do not consider themselves ready to develop the technical creativity of schoolchildren. At the same time, 25% strive to introduce innovative techniques that stimulate the creative potential of students, including the development of technical creativity of students. Among the main difficulties and obstacles on the way to the formation and development of technical creativity of schoolchildren, teachers included lack of special literature (48%), lack of an information system (29%), and lack of conditions and opportunities to engage in innovative activities to develop technical creativity of schoolchildren (18%).

Thus, the data of the studies carried out confirmed our thoughts about the importance and necessity of developing the technical creativity of schoolchildren. At the same time, the analysis of the current educational literature on psychology, pedagogy and private methods showed that the theoretical material concerning the essence and specifics of students' creative abilities and revealing the mechanisms of their use in the classroom is not fully presented.

In the next stage of work, in the course of experimental and pedagogical work, the state of mass practice was studied, wherein the conditions of the traditional educational process of a general education school teachers' activities was carried out to develop the technical creativity of schoolchildren. For this purpose, the control sections of teachers teaching in schools No. 17, 23, 27, 1 and 26 of Aktobe region were carried out, during which teachers were asked to answer questions of specially developed questionnaires.

The questionnaires made it possible to assess the following indicators of teachers' performance:

- Acquaintance with the concept of 'technical creativity of schoolchildren';
- Knowledge of its specific features and essential characteristics;
- The use of various types of activities to develop the technical creativity of schoolchildren.

The analysis of the data obtained showed that not all teachers can define the concept of 'technical creativity of schoolchildren'. Only 26% of the teachers surveyed indicated that they used techniques that develop the technical creativity of schoolchildren in their practical activities.

However, observations of the pedagogical activity of teachers during the period of the ascertaining experiment revealed many teachers who tried to apply in their practical activities methods that develop the technical creativity of schoolchildren, without realising them as such.

At the next stage of the experimental and pedagogical work, the knowledge of teachers about the essence and specifics of the technical creativity of schoolchildren was clarified; the awareness of actions for their use in the design and implementation of the educational process in a modern school was measured. For this purpose, in the course of working with teachers, they were offered questionnaires.

The data obtained showed that school teachers for the most part, not possessing theoretical knowledge about the essence of the problem under discussion, quite effectively use traditional forms of organising the educational process, but experience difficulties in using techniques that develop the technical creativity of schoolchildren in their practice.

The analysis carried out convincingly indicates that the traditional educational process of a general education school is not effective enough for the development of technical creativity of schoolchildren.

Based on the data obtained during the ascertaining stage, a programme for the preparation and conduct of experimental and pedagogical work was developed, which included:

- (1) Selection of psychological and pedagogical theories and concepts that act as methodological foundations for constructing a model of an experimental pedagogical system;
- (2) The development of scientific–theoretical and organisational–methodological aspects of modelling, contributing to the optimal construction of a pedagogical system for the development of technical creativity of schoolchildren;
- (3) Identification of psychological and pedagogical conditions and means that allow to effectively carry out experimental and pedagogical work in a general education school;

In this regard, when building a model of the system of the experimental pedagogical process, we needed:

- (1) to develop stages of experimental and pedagogical work, reflecting the dynamics of the formation of activities for the development of technical creativity of schoolchildren;
- (2) to determine the goals, reflecting the tasks, content and logic of the experimental and pedagogical work at each stage of the experimental work;
- (3) to develop a system of educational tasks aimed at the formation of an operational component in the structure of teachers’ activities to develop the technical creativity of schoolchildren;
- (4) to select a system of practical tasks that logically fit into the structure of the pedagogical process in a general education school, relevant to the activities of teachers and allowing to judge with a high degree of reliability the level of development of technical creativity of schoolchildren.

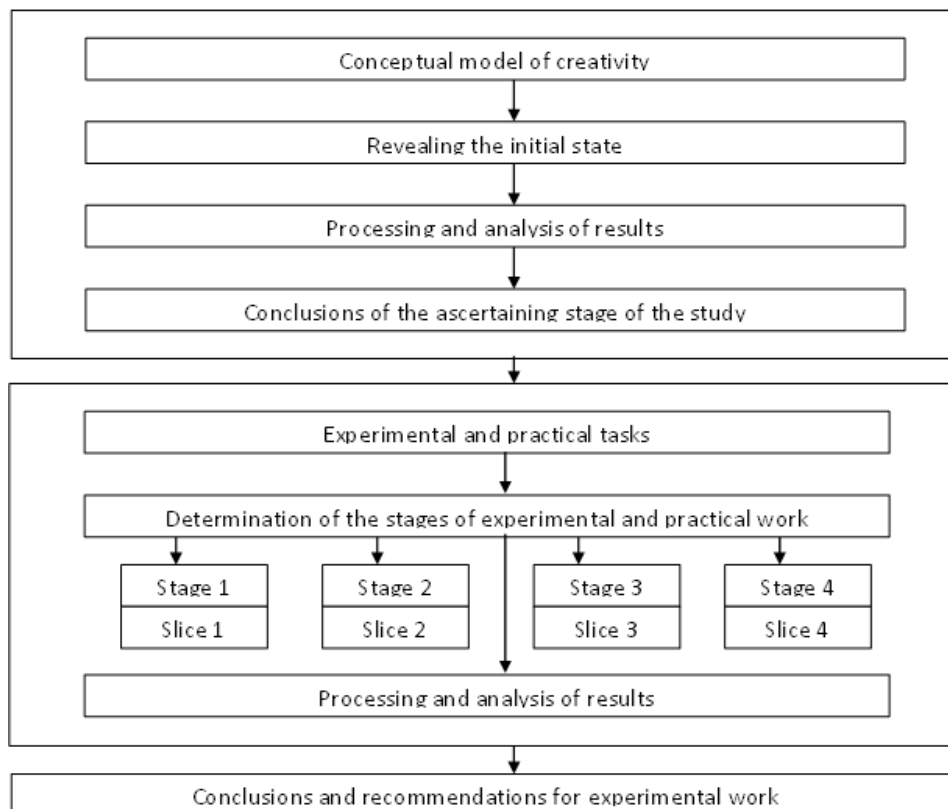


Figure 2. The structure of experimental and pedagogical work for the development of technical creativity of schoolchildren

Thus, the theoretically developed model is aimed at ensuring that the system of development of technical creativity of school students in the practical activities of teachers acts as a long and multifaceted pedagogical process, during which the formation of this activity as an integrative quality of the teacher's personality should be carried out in stages in a certain logical sequence. In this regard, the main task of building a model of the training system was to develop the content of successive stages of the pedagogical process aimed at developing the technical creativity of school students in the practical activities of teachers.

By the stage of experimental–pedagogical work, we mean a logically completed segment of the educational process, which corresponds to clear target attitudes, a certain subject content, specific didactic–methodological support and which reflects the corresponding level of teachers' activity in the development of technical creativity of schoolchildren.

The following provisions implemented in the course of experimental and practical work will contribute to the optimal achievement of the goal:

- The educational process of a general education school should be based on an activity approach;
- Purposefulness, consistency and continuity in the formation of the studied quality will be realised through a step-by-step methodology for the development of technical creativity of schoolchildren in the practical activities of teachers;
- The need for gradual inclusion of teachers in the system of development of technical creativity of schoolchildren, a greater percentage of success in professional activity;
- Organisation of special work on the special course 'Technical creativity at school'.

When conducting experimental work, we relied on an important methodological principle of consistent deepening and gradual complication of the content of the material and practical actions. Focusing on the developed model and using a complex of diagnostic methods (pedagogical observation, questioning, testing, conversations, performing various kinds of pedagogical tasks etc.), we studied the real state of the development of creativity of senior pupils of secondary schools No. 17, 23, 27, 1 and 26 Aktobe region in the process of organising verbal–cognitive activity. For this, technology lessons were attended in seventh grade, where students were observed, testing was organised in order to identify the students' abilities to the technical creativity of student and creative activity. The thematic and lesson plans of teachers are analysed and the experience of subject students is summarised. A questionnaire survey of teachers and students was carried out in order to clarify their attitude to verbal–cognitive activity in the educational process, the teacher's dialogue as the main means of developing students' creativity in the context of its implementation.

As a result, it was revealed that in the work on the development of the creativity of schoolchildren, it takes from 20% to 30%, depending on the purpose, content, tasks of the lesson, teaching methods of the teacher and the level of preparedness of the class. In most cases, the verbal–cognitive activity of teachers and students is limited to reproductive activities, in the process of which students are asked questions and tasks less often of a creative and more often of a reproductive nature.

The results of the questionnaire survey of schoolchildren indicate that, on the whole, they do not fully understand the essence of creative work and do not, to a large extent, possess the skills and abilities of creative activity. Most of the students (62%) showed indifference to creative types of work: 28% were positive and 10% were negative. We tried to analyse the current situation. It turned out that, as a rule, the organisation of creative work at school is not at the proper methodological level. This can be confirmed by the following example. A student of grade 10B Zhalgas K., who did not cope with the task in the lesson, came to the next lesson with a system of patterns that he deduced by analysing the experimental material at home. When asked what prevented him from doing this in the lesson, he replied: 'You see, we are used to the fact that the sooner you give an answer, the better'. This means that you understand faster and better than anyone. In the lesson, we solve in a reliable proven way: without mistakes and quickly. 'To the question Why then did you think at home?' – came

the answer: ‘Nobody measured time at home, think as much as you want, analyse, check, and as a result, original tasks and patterns are obtained. It was very interesting for me to answer’.

Using this example, we can see that the seemingly harmless norms of school practice actually lead to disastrous consequences, a standard and a template that hinder creative development, a lively and disinterested interest in reality.

To the question ‘What does it mean, in your opinion, to learn creatively?’ – schoolchildren answered the following: to get good grades, having mastered algorithmic methods of solving problems (62%), to replenish the volume of knowledge (27%) and only 11% of high school students stated to find an original solution to the problem on the basis of its independent statement.

In order to activate the functional and heuristic capabilities of a modern schoolchild in the process of verbal–cognitive activity, a technique for diagnosing the verbal–cognitive creativity of a senior pupil S. Mednik was carried out.

To diagnose the level of development of a person’s creativity in control (7C) and experimental (7B) grades, seventh graders (subjects) were offered sets of tasks, differentiated by the degree of complexity. A series of experimental work was carried out on 56 subjects (28 seventh graders in both grades). Most of the tasks were of a constructive and creative nature and assumed the highest level of awareness of the proposed material, the identification of originality of thinking and the ability to generate new non-standard ideas.

The technique consists of a warm-up and a series of tasks presented to the subject after a certain period of time. The warm-up is of great importance, since the subjects having a warm-up before the main series had a clear advantage over the subjects without it. Warm-up is necessary to facilitate the process of the subject’s entry into creative and creative activity and adaptation to it.

The warm-up in this modification is verbal tasks built according to the ‘principle of monism’: the subject is offered two words – the qualities of two different meanings of the homonym, it is necessary to choose a common word corresponding to each. Thus, the subject is only introduced to the activity of solving creative problems; however, the principle of solving the main tasks is not given.

Immediately after the warm-up, the first series of basic tasks is given. The rest of the series are conducted with the subject after a certain period of time (3–5 days) after the first series. A characteristic feature of the first series is that an instruction is given that does not contain an orientation towards achieving original results, i.e., the subject is simply asked to solve verbal–cognitive tasks, without any orientation towards the fact that original, imaginative and numerous solutions are needed.

In the second series, the subject is offered test tasks with classical instructions containing an achievement orientation that stimulates the emergence of original and numerous answers.

In the third series, the subject must solve a creative problem (model of a problem situation) with matches. This task is an excellent object, since the entire problematic situation is quite comprehensible and amenable to examination, and the radical restructuring of the material required for the solution indicates the impossibility of a random solution. The necessity and difficulty of such a restructuring directly corresponded to the goals of our experiment.

This task was presented to all subjects in the following formulation: ‘From six matches, four equilateral triangles must be made. The side is equal to the match’. Thus, the subject is objectively assigned the task from the very beginning – to build a three-dimensional figure—a tetrahedron. As in any creative task, in a puzzle with matches, a person discovers something new for himself. Some part of this new thing (a line is the geometrical place of points at the intersection of two planes, a tetrahedron is a tetrahedron) was known to him before, but was either forgotten or could not be immediately actualised in an unusual situation. The other part (the most economical way to construct

four triangles) is indeed a discovery for the majority, since a new aspect appears in the problem, which is not specially considered either in geometry or in stereometry (the issue of ‘saving’ the sides).

Experiments show that in the process of solving a given creative task, the determining role of the internal conditions of the personality, through which the mental processes – external conditions, are refracted and determined. The dynamics of the studied creativity can be traced in Table 2.

Table 2. State of the level of development of technical creativity of schoolchildren before and after the experiment (in%)

Creativity levels	Before teaching		After teaching	
	Studied classes		Control	Experimental
	Control	Experimental		
Low	34	32	18.3	6.2
Middle	48	44	58.4	57.6
Sufficient	15	18	14.8	23.7
High	3	6	8.5	12.5

The data obtained indicate that 12.5% of the students can form a high level of technical creativity, while in the control class only 8.5% could. The percentage of schoolchildren with a low level of technical creativity decreased from 18.3% in control classes to 6.2% in experimental classes. The results of the table reflect the presence of positive trends in purposeful systematic work on the development of technical creativity of the individual with the active use of the functional capabilities of the teacher and student, contributing to their fruitful interaction and cooperation.

More clearly, the dynamics of the growth of technical creativity of schoolchildren can be presented illustratively, in the form of a bar chart (Figure 3). The height of the bars in the diagram shows that the greatest progress is observed towards the sufficient (23.7%) and high (12.5%) levels in the experimental classes, and the smallest to the highest level (8.5%) in the control classes.

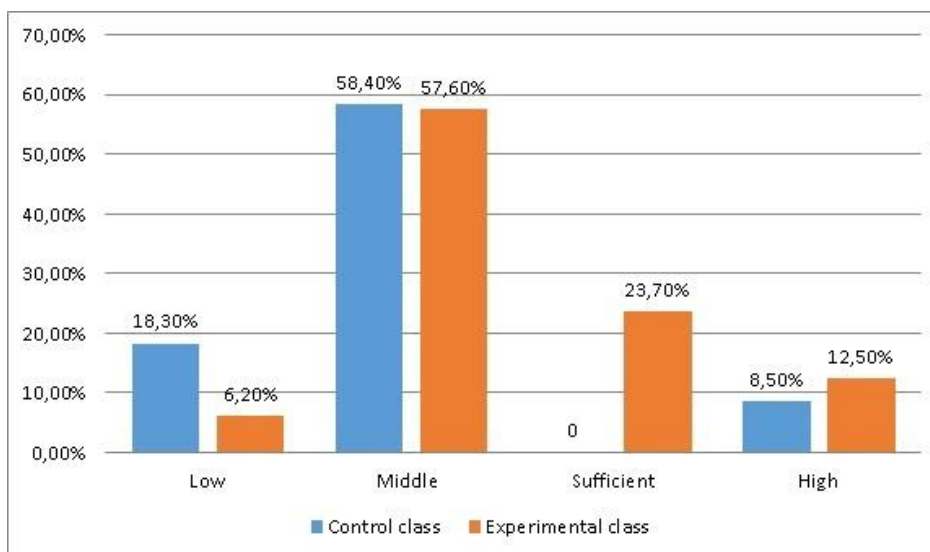


Figure 3. Dynamics of growth in the level of development of students' technical creativity

Thus, the results of the experimental work confirm the validity of the research hypothesis and allow us to speak about the effectiveness of the proposed methodology for the development of technical creativity of students.

4. Discussion

Based on the theoretical and methodological analyses of the essence of the development of technical creativity of schoolchildren in the practical activities of teachers, we identified the following stages in the formation of this activity as an integrative quality of the teacher's personality:

(1) Orienting, aimed at the formation of general ideas about the personality of a modern teacher and the specifics of his activities in the conditions of a personality-oriented educational process;

(2) Information and diagnostic, aimed at theoretical and empirical development of the characteristics of students in the course of experimental work;

(3) Integrating, aimed at structuring the obtained theoretical knowledge and practical skills in the course of performing qualification research work after conducting experimental pedagogical work.

Moreover, each stage of the model being created was aimed at the development of the technical creativity of schoolchildren. Since, according to the provisions of the theory of educational activity (Mukhina, 2019), each level of knowledge is capable of solving only a certain kind of pedagogical problem.

Proceeding from this, for each stage in the model of the system for the development of technical creativity of schoolchildren in the practical activities of teachers, certain theoretical knowledge was selected. This knowledge concerns the gradually deepening ideas about the essential characteristics of the technical creativity of schoolchildren.

5. Conclusion

Based on the analysis of psychological, pedagogical and philosophical literature, we assumed that an adequate reflection of the experimental pedagogical system is its model, understood as a theoretical project of a certain practical activity: under the model of an experimental pedagogical system for the development of student' technical creativity. We understand the theoretical reflection of a specific strategy and tactics. By the stage of experimental–pedagogical work, we mean a logically completed segment of the educational process, which corresponds to clear target attitudes, a certain subject content, specific didactic–methodological support and which reflects the corresponding level of development of the creative abilities of high school students.

The goal of each stage was certain quantitative and qualitative changes in the nature of the external and internal activities of teachers, which corresponded to similar changes in the formation of their activities to develop the technical creativity of schoolchildren.

The data obtained in the course of the experimental–pedagogical work, organised on the basis of the model developed by us, showed that at each stage of the forming experiment there was a certain tendency towards the prevalence of a higher level of formation of this phenomenon of students in the experimental group, which proves the need to organise the activities of teachers to develop technical creativity of students.

At the final stage of the experimental work, 45.6% of schoolchildren in the experimental group reached the productive level of activity, while it was 16.8% in the control group.

Based on our research, we made the following conclusions:

1. The problem of development of technical creativity of students is one of the most urgent in the field of education. New social and educational needs and needs of society dictate the need for training and education of creatively thinking, free from dogmatism and adaptability of individuals, capable of their own vision of problems, making original decisions in non-standard practical situations.
2. The scientific literature on pedagogy and modern psychology has accumulated a vast amount of knowledge characterising the nature of creativity. Despite the existence of different points of view

on the essential characteristics of this phenomenon, most scientists believe that creativity is a creatively conditioned component of outstanding personal achievements, present in the form of a dosed potential, suggesting a certain, individual stage of development. Creativity can manifest itself in thinking, communication and various activities. It can characterise the personality as a whole and its individual abilities.

3. Creativity as an integral quality of a person presupposes the highest level of development of creative abilities, which has a modified, constructive impact on the surrounding reality, intellectually enriching the life of modern society. Several approaches can be distinguished in studies of the personality traits of creative individuals. Some authors argue that creativity is a general quality of a person; however, most authors tend to highlight a number of qualities inherent in a creative person. One of the essential characteristics of a creative personality is its creative and motivational orientation.
4. In the course of the experimental and pedagogical work, we managed to establish that the development of technical creativity of students, both in the educational and in the educational process, is largely influenced by the functional capabilities of the subject teacher, focused on the development of creative thinking, activation of imagination, increasing cognitive interests, mastering knowledge through persistent search for original solutions to the problem and developing skills for the creative application of knowledge.

The basis of the methodology for the development of technical creativity of students in the process of creative activity is based on the step-by-step work developed by us, with both teachers and high school students. Experimental work has shown that the success of the development of the studied quality requires a systematic, methodically perfect use of the functions of presentation and clarification of the teacher in the process of creative activity as a means of creative interaction and cooperation between the teacher and students, focused on overcoming the latter's intellectual difficulties and achieving high results.

6. Recommendations

Based on the conducted research in the pedagogical process, we consider it appropriate to make the following recommendations:

1. In the conditions of the new socio-economic realities of the new century, there is an urgent need for people with independent thinking and creative organisation of work; in this connection, subject teachers in the pedagogical process must adhere to the scientific and theoretical prerequisites developed in the study for the development of technical creativity of schoolchildren in the process of creative activity;
2. The development of students' creativity requires pedagogical and psychological management of this process, which ensures the activation of thought processes and the creative involvement of the student in creative activity;
3. The process of development of technical creativity of schoolchildren in the context of creative activity in the study of a particular school subject should be carried out on the basis of a personal activity approach, taking into account the individual characteristics and abilities of each student for creativity;
4. Creative activity in the process of teaching and upbringing should be based on the ideas of pedagogy of cooperation and creative interaction; the content, organisational forms and methods of teaching and educational work at school should be distinguished by their focus on the formation and development of the technical creativity of schoolchildren;
5. The results of the experimental and pedagogical work prove the need to introduce the developed methodology for the development of technical creativity of students into the educational process.

References

- Dunker, K. (2006). Qualitative (experimental and theoretical) study of productive thinking. The psychology of productive (creative thinking) (pp. 21–234). *Psychology of Thinking* (translated from German).
- Engelmeyer, P. K. (2019). Теория творчества (р. 280). Издательская группа URSS.
- Шаштыгарин, М. М. (2019). Исследование технического творчества обучающихся (р. 150). Монография для педагогических специальностей.
- Ishanov, P., & Bekmambetova, Z. (2013). Requirements for the content of teaching materials for specialists' training in secondary vocational education. *European Researcher*, 54(7–1), 1871–1875.
- Law of the Republic of Kazakhstan. (2019). No. 389-13 RK. Zheti Zhangy.
- Мыскин, С. В. (2020). Структура и содержание профессионального общения. *Вопросы психолингвистики*, 1(43), 54–63. <https://doi.org/10.30982/2077-5911-2020-43-1-54-63>
- Mukhina, S. E. (2019). [The role of personal self-esteem in improving the effectiveness of students' learning activities]. *Professional Education in the Modern World*, 9(4), 3307–3319. <https://doi.org/10.15372/PEMW20190418>
- Nazarbayev, N. A. (2018). Kazakhstan-2030. Prosperity, security and improved well-being of all Kazakhstanis (р. 319). Bilim
- Титов, А. А. (2020). Мышление как процесс и как деятельность: анализ философско-психологических исследований мышления (Vol. 1, pp. 180–197). Педагогика и психология образования. <https://doi.org/10.31862/2500-297X2020-1-180-197>
- Vygotsky, L. S. (1934). Thinking and speaking. *Research psychology* (р. 324). OGIZ.
- Борисова, Н. В. (2018). С. Л. Рубинштейн о психологии человека как субъекта права/Н. В. Борисова // Институт психологии Российской академии наук. Социальная и экономическая психология, 3(11), 162–178.
- Дружинин, В. Н. (2019). Психология общих способностей: учебное пособие для бакалавриата, специалитета и магистратуры / В. Н. Дружинин. — 3-е изд. — Москва : Издательство Юрайт, 2019. — 349 с. — (Авторский учебник). — ISBN 978-5-534-09237-0. — Текст: электронный // ЭБС Юрайт [сайт]. <https://urait.ru/bcode/427496> (дата обращения: 14.03.2021).