

Pedagogical conditions for supporting the personal self-development of a fifth-grade pupil in the process of mathematical education

Condiciones pedagógicas para apoyar el autodesarrollo personal de un alumno de quinto grado en el proceso de educación matemática

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ABSTRACT:

The possibility of providing pedagogical support for personal self-development of fifth-grade pupils in the process of mathematical education is substantiated theoretically and experimentally, the essence of the concepts of "self-development of the personality", "a pupil's personal self-development", and "pedagogical support of a pupil's personal self-development" are clarified. The process of mathematical education as a space for pedagogical support of the fifth-grade pupil's personal self-development has been studied, based on the increasing interest in the study of mathematics that promotes the qualitative mastering of mathematical material; pedagogical conditions for the successful pedagogical support of a pupil's personal self-development have been proposed on the basis of the person-oriented and activity-based approaches. The ways of implementing the proposed pedagogical conditions for the pedagogical support of a fifth-grade pupil's personal self-development in Mathematics lessons have been developed and experimentally tested.

Keywords: self-development, mathematical

RESUMEN:

La posibilidad de proporcionar apoyo pedagógico para el autodesarrollo personal de los alumnos de quinto grado en el proceso de educación matemática se fundamenta teórica y experimentalmente en la esencia de los conceptos de "autodesarrollo de la personalidad", "autodesarrollo personal del alumno", "Y" apoyo pedagógico del autodesarrollo personal de un alumno "se aclaran. Se ha estudiado el proceso de la educación matemática como espacio para el apoyo pedagógico del autodesarrollo personal del alumno de quinto grado, basado en el creciente interés en el estudio de las matemáticas que promueve el dominio cualitativo del material matemático; Se han propuesto las condiciones pedagógicas para el apoyo pedagógico exitoso del autodesarrollo personal de un alumno sobre la base de enfoques orientados a la persona y basados en la actividad. Las formas de implementar las condiciones pedagógicas propuestas para el apoyo pedagógico del autodesarrollo personal de un alumno de quinto grado en las lecciones de Matemáticas se han desarrollado y probado experimentalmente.

Palabras clave: autodesarrollo, educación

1. Introduction

The search for the influence of the modern system of mathematical education on the development of a growing person who strives for self-development by conscious awareness of their pathway of free personal development, being responsible for themselves and for the environment, is a relevant problem in modern conditions, when democratic transformations take place all over the world and in the Russian society. However, as the consequence of the conservative commitment of school education to the training of graduates with some knowledge and skills, many pupils need pedagogical support. There is a need for other methods, techniques, and technologies of the viably designed targeted pedagogical support for personal self-development of different age group pupils; and accordingly teachers should be able to apply modern methods of pedagogical support for personal self-development of their pupils. The above explains the relevance of the chosen topic.

The purpose of the study

To substantiate and reveal the essence of the concept of “pedagogical support for the student’s personal self-development” in the process of mathematical education and to determine the pedagogical conditions of the pedagogical support of the 5th grade pupil's personal self-development, aimed at increasing the basic motivation of the study to a higher level of mastering mathematical material and to test their effectiveness in practice.

Objectives of the study

1. To identify general theoretical approaches to understanding the essence of pedagogical support for the pupil’s personal self-development.
2. To explore possible ways of improving mathematical education through pedagogical support of a fifth-grade pupil’s personal self-development.
3. To determine the pedagogical conditions under which the pedagogical support of the personal self-development of the pupil of the 5th class can have a significant influence on the increase of interest in mathematics, the main motivation of learning, leading to a qualitative acquisition of mathematical material.
4. To experimentally test the effectiveness of the pedagogical conditions necessary for providing pedagogical support of a fifth-grade pupil’s personal self-development by means of mathematics.

During the transition from primary to secondary school, there is a reduction in a fifth-year pupil’s interest in studying a subject. Among the reasons of this, according to Rice, is that “secondary schools are less personality-focused, than primary ones”. From this point of view, the process of mathematical education becomes successful when it acquires a certain personal meaning for the pupil. To achieve this goal, special significance is acquired by pedagogical support of the pupil’s personal self-development, through the organization of which it is possible to induce the pupil to realize the meanings, life goals and the methods of activity.

1.1. Literature review

A pupil’s personal self-development is highly important to the pedagogical science in the context of implementing the ideas of humanistic education. In their concepts, philosophers regard a person as a self-developing system, as a spiritually-moral being, constantly striving for self-improvement, and argue that the constant rise to the “absolute” leads to the development of personality (Maslow, 2014; Rogers, 2002; Fromm, 1998; Sharonin, 2013, and others). The studies done by the following scholars are devoted to the study of the essence of personal self-development: R.S. Vasilieva, (2010); D. McClelland, (2007); N.A. Simanova, (2011); A.V. Suvorova, (1996); B.F. Skinner, (1954); S.L. Frank, (2001); D. Halpern, (2000); G. Eyestad, (2014); S.V. Yaremchuk, (2005), and others. In order to

activate the processes of cognition and communication necessary for personal self-development, philosophers consider it necessary to understand the meanings, the life goals, the ideals and methods of activity.

To determine the pedagogical conditions of supporting a 5th grade pupil's personal self-development in Mathematics lessons, the authors relied on the ideas set forth in the sense of humanistic psychology (Antonio, 2004; Gerasimov, 2016; Rogers, 2002; Maslow, 2014, Nikolaeva, 2016), making it possible to determine the result of a person's self-development - self-actualization of the "I-concept."

In the context of these ideas, the authors view mathematical education as a space for pedagogical support aimed at ensuring the successful personal self-development of each pupil through the organization of a learning process based on the principles of humanistic psychology and pedagogy. The essence of the process of pedagogical support of the pupils' personal self-development is that the teacher directs their efforts in order to create an atmosphere of trust and acceptance, respecting everyone's dignity, contributing to the assertion of the pupil's self-worth. The main task of a Mathematics teacher is not only to give a certain amount of mathematical knowledge, stipulated by the state standard, but also to foster the pupils' desire for active and conscious activity. Mathematics is an instrument of learning about the surrounding environment; it gives the pupils an opportunity to show their own individuality in the selectivity of learning, methods and means of mastering the educational material. The teacher organizes the process of learning, taking into account the value orientations and preferences, the individual psychological and age characteristics of pupils.

The content of pedagogical support of a pupil's personal self-development is aimed at personal self-development in the process of mathematical education, the basis of which is represented by the personality-oriented and activity-based approaches.

The personality-oriented approach provides for the commitment of pedagogical support of the pupil's personal self-development to the revealing of individuality, the development of the "I-concept" of the internal potential in terms of personality and self-discovery.

The activity-based approach involves the ability to engage creatively in various activities and to communicate constructively with peers, respecting everyone's dignity and right to express their opinion and the ability to consider alternatives and take rational ways in decision-making, and the ability to justify their own opinion with convincing arguments.

The strength and depth of acquiring the material are determined by the variety of associations facilitating the mastering of mathematical objects, reasoning, and solving problems by controlling the perception of comprehending the methods of reality cognition by showing the beauty and grace of mathematical reasoning.

Study hypothesis: The implementation of pedagogical support of a fifth-grade pupil's personal development will be most effective if the following pedagogical conditions are observed: the transition from transferring the ready knowledge to learning in the process of constructive activity using your own experience, where knowledge is acquired through appropriate "discoveries" on the basis of joint efforts of pupils in a group or a joint search with the teacher; individualization and differentiation of education, taking into account each pupil's natural inclinations, abilities, providing equal conditions for their self-development; mutual respect, equality, motivation in the process of communication, interaction between the participants of the educational process; the use of such pedagogical technologies of joint research and creative activity as: a project technology, the technology of problematic education and upbringing, a case technology, etc.

2. Methodology

The theoretical methods (theoretical analysis, synthesis, generalization) and empirical methods (observation, measurement, pedagogical experiment) are used in the study.

In order to reveal the pupils' personal self-development, an experiment was conducted in mathematics lessons of the secondary school No. 17, 33 in Yakutsk with 542 (179/182/181) 5th grade pupils taking part from 2014 to 2017. The purpose of the experiment was to

identify the pupils' self-development through increasing their interest in mathematics.

In the experiment, the priority direction of the teacher's activity was the formation of activity types and the general culture through pedagogical influence, such as a combination of form and style of communication, aimed at revealing the personality of the pupil in the course of communication with them. It is the dialogue that acts as a specific educational environment stimulating the joint activity of the educational space participants, characterizing a high degree of favorableness and amiability.

In the authors' work, the teaching was conducted on the basis of the pedagogy of cooperation, which makes it possible to build training in an environment of care and attention, where the pupil is a full subject of the learning, thereby creating conditions for their creative realization. In this situation, working in dialogue mode, the pupil penetrates deeper into the system of human relationships, actively accumulating spiritual and moral values, and social experience. Particular attention was paid to the entertaining presentation of the material (entertaining examples, experiments, facts, etc.), an unusual form of presenting the material that the pupils find surprising; educational games, the creation of situations of dispute and discussion, the pupil's independent solution of emerging problems with the subsequent justification of the chosen forms and ways of achieving them. Purposefully and systematically conditions were created for the pupil to become aware of their individual nature, for their self-development through the development of skills to establish contacts; to articulate your thoughts logically, clearly, briefly, and succinctly, to listen patiently, to objectively evaluate the information you hear; to choose adequate measures for resolving conflict situations; to co-exist in the team, to organize and perform joint activities.

Based on the method of forming the cognitive interest proposed by S.S. Mirzoev (2011), the authors present their methodology for increasing the pupils' interest, which is as follows:

1. Adjustments have been made to the contents of the course of mathematics in the primary school in the sphere of strengthening the practical, search, and research activities.
1. Long-term planning for the mathematics course has been made, with special emphasis on the forms of conducting lessons, technologies and methods of teaching; homework, which activates the pupils' cognitive activity. All this taken together should increase the pupils' interest in the subject.
2. The relationship of lessons with out-of-the-class, extra-curricular activities, where special attention is paid to the organization of independent search and creative activity of pupils.

3. Results

In the study, the authors paid special attention to the presence of the pupils' interest in the subject, which determines the positive attitude to the learning process, increases the pupils' motivation to study mathematics, thereby affecting the quality of knowledge acquisition.

On the basis of the levels and criteria for the formation and development of independent cognitive activity proposed by V.V. Drosina, (2000) and S.V. Mitrokhina (2009), the following criteria and indicators for an increase in the pupils' interest have been developed: active, conscious and intellectual ones, which are determined by three levels of formation of interest in mathematics: low, medium and high (Table 1).

Table 1
Levels and criteria for the formation of interest in mathematics

Levels	Criteria		
	active	conscious	intellectual
low	lack of activity in the process of cognition; lack of independence;	a low level of conscious interest; weak motivation for cognition; poorly manifested independent activity in the	A low level of intellectual interest; a low level of striving for independent activity in the learning

	teacher's monitoring is required	learning process	process
medium	rare manifestation of the activity of interest, driven by external factors (i.e. teacher, classmates, friends, parents, etc.)	rare manifestation of the conscious interest in cognition, driven by external factors	situational manifestation of independent activity in cognition in the presence of external drivers
high	active involvement in the process of cognition, activity stimulated by internal and external factors	stable involvement in cognitive independent activity in the learning process, a conscious interest in the result of the product	exclusively independent cognitive activity in the learning process, shows involvement in cognition

The following indicators of the formation of interest in the study of mathematics have been singled out:

1. Proficiency and the quality of training.
2. An increase in the number of pupils taking part in subject Olympiads, conferences, various competitions (mathematical battles, mathematical merry-go-rounds, mathematical holidays, mathematical tournaments, etc.).
3. An increase in the number of pupils participating in research, projects and creative activities.

In order to determine the formation of interest in mathematics, an indicator showing the growth of the pupils' personal self-development, observations were made of pupils during the educational activity and conversations with them. In the 2014-2015 academic year, at the ascertaining stage of the experiment, measurements were taken in the classes where the conditions of pedagogical support for the fifth-grade pupils' personal self-development, developed by the authors, had not yet been implemented. And in the following two years the measurements were taken in the 5 experimental classes.

Table 2
Dynamics of proficiency and quality of training the fifth-grade pupils (number of pupils, in %)

Academic years	2014-2015 (179)		2015-2016 (182)		2016-2017 (181)	
	proficiency	quality	proficiency	quality	proficiency	quality
Based on the results of the primary school	179 (100%)	151 (84.4%)	182 (100%)	147 (80.8%)	181 (100%)	153 (84.5%)
Based on the results of the fifth grade	176 (97.2%)	98(54.8%)	181 (99.5%)	102 (56%)	180 (99.5%)	113(62.4%)

The data in Table 2 confirm the idea expressed by Rice and Dolgin that during the transition from primary to secondary school, the level of proficiency decreases. However, it is possible to track the growth in the level of proficiency in mathematics during the experiment (from 54.8% to 62.4%), with the same level of proficiency.

Table 3

Academic year	School			City		
	Olympiads	Conferences	Competitions	Olympiads	Conferences	Competitions
2014-2015	24 (13.4%)	3 (1.7%)	11 (6.2%)	2 (1.1%)	0 (0%)	37 (20.7%)
2015-2016	31 (17.0%)	14 (7.7%)	31 (17.0%)	4 (2.2%)	5 (2.8%)	61 (33.5%)
2016-2017	52 (28.7%)	35 (19.3%)	41 (22.7%)	6 (3.3%)	12 (6.6%)	72 (39.8%)

As can be seen from Table 2, the number of pupils taking part in school Olympiads has significantly increased from 13.4% to 28.7%. The participation rate in city schools is low for objective reasons, as the number of participants is limited to two pupils from a school. In 2016-2017 academic year, there were six participants, because one of the schools participating in the experiment was given the privilege of presenting two teams as the overall winner for the previous academic year. The pupils' interest in the participation in conferences increased. While in 2014-2015 academic year no pupils took part in the city conference, in 2016-2017 academic year 12 pupils took part in the conferences.

The increase in the number of pupils participating in research, projects and creative activities can be inferred from the "competitions" columns of Table 3. Based on this indicator from the table, it should be noted that fewer pupils participated in school activities than in city ones. This is explained by the fact that the following events are held in the city: "Mathematical Holiday", "Oral Olympiad in Mathematics", "Problem Solving Based on Analogy" and "Kangaroo" in which children began to take an active part thanks to the conditions of pedagogical support of the fifth grade pupils' personal self-development.

Table 4

Distribution of pupils by levels of formation of their interest in mathematics

Academic year	active			conscious			intellectual			LL, %	ML, %	HL, %
	LL, %	ML, %	HL, %	LL, %	ML, %	HL, %	LL, %	ML, %	HL, %			
2014-2015	48.8	36.6	14.6	46.3	37	16.7	53.5	34.9	11.6	49.2	36.3	14
2015-2016	45	39.3	15.7	40	41.8	18.2	52.63	26.32	21.05	45	37.4	17.6
2016-2017	43	44.2	12.8	43.1	32.8	24.1	48.7	27	24.3	44.2	37	18.8

Note: LL - low level, ML - medium level, HL - high level.

In the control classes in 2014-2015 academic year a low level of interest in Mathematics (49.2%) prevails. After the experiment, this indicator decreased to 44.2%, while the high level of interest increased from 14.5% to 18.8%, and the medium level grew from 36, 3% to 37%.

Therefore, there is positive dynamics in the formation of interest in mathematics, and this

was facilitated by the created conditions of pedagogical support for the fifth-grade pupils' personal self-development.

Thus, the created pedagogical conditions, the organized system for diagnosing the level of the increase in the interest in mathematics, makes it possible to objectively assess the degree of the pupil's personal self-development.

3.1. Discussion

The study confirmed the possibility of optimal pedagogical support for pupils' self-development. Taken as a basis for the authors' activities, the person-oriented and activity-based approaches form the pupil's activity, their readiness for learning activity, and the solution of problematic tasks through equal relations of partnership with the teacher.

Scientific novelty of the study

The possibility of providing pedagogical support for the personal self-development of a fifth-grade pupil in the process of mathematical education has been substantiated theoretically and experimentally;

- in understanding the essence of the self-development process, the authors rely on the philosophical understanding of man – not only as the supreme value and purpose of the social order, but also as a subject of comprehensive responsibility for one's actions;
- the essence of the process of pedagogical support of the pupil's personal self-development has been revealed; this process consists in the fact that the teacher directs their efforts to create an atmosphere of trust and acceptance, respecting everyone's dignity, promoting the pupil's self-worthiness, leading to the unleashing of their personal potential;
- the process of mathematical learning has been studied as a space for pedagogical support aimed at ensuring the successful personal self-development of each pupil through the organization of the learning process based on the principles of humanistic psychology and pedagogy;
- the pedagogical conditions for pedagogical support of the fifth grade pupils' personal self-development in the lessons of Mathematics have been substantiated, taking into account each pupil's natural inclinations and abilities;
- the content of pedagogical support of the pupils' personal self-development in the process of mathematical education has been determined, which is based on the following approaches: the person-oriented and activity-oriented ones;
- the effectiveness of the influence of pedagogical support of the pupil's personal self-development on the awareness of meanings, a life goal, and modes of activity has been shown.

Thus, the personal self-development of a primary school pupil can be defined as the learner's activity in terms of personal opportunities based on the formation of interest in the subject, which leads to a conscious development of their personal potential.

The practical value lies in the fact that the pedagogical conditions for the provision of pedagogical support of the pupils' personal self-development in the process of mathematical education have been defined, including methods and techniques that presuppose a person-oriented and creative direction in the process of teaching Mathematics, in which each pupil's individuality is revealed and developed, and their personal self-development takes place. The results obtained can be used in the practical work of Mathematics teachers.

4. Conclusions

The essence of the concepts "a person's self-development", "a pupil's personal self-development" and "pedagogical support of the pupil's personal self-development" have been considered and clarified, their interaction has been presented.

Pedagogical conditions have been determined, under which pedagogical support of the fifth

grade pupils' personal self-development can have a significant influence on the increase of interest in mathematics, being the main motivation of learning, which leads to qualitative acquisition of mathematical material.

The effectiveness of pedagogical conditions for the pedagogical support of the pupils' personal self-development has been experimentally checked, where it was found that their implementation in the lessons of Mathematics in the fifth grade leads to the development of a steady interest in mathematics and to a higher level of mastering the mathematical material in accordance with the educational standard.

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