

Education as a factor in the sustainable development of the Arctic and the northern territories of Russia

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Abstract. The article focuses on the problem of the socio-economic development of the small indigenous peoples of the North living in the Arctic and northern territories of Russia. It is noted that education, referred to in the UN documents as a “crucial factor for change”, plays a leading role in achieving sustainable development. The paper reveals certain peculiarities in the development and experimental verification of the method of ethno-oriented teaching of mathematics to students of the senior classes at schools of small ethnicities of the North. Discussing the work being done, it is shown that education is a resource of human and social capital, having a socially significant and personally oriented value, as well as an important factor in achieving sustainable development of the Arctic and northern territories.

Keywords: education, experiment, ethno-oriented teaching, ethnicities, small ethnicities of the North, school

1. Introduction

Currently, in the Russian Federation, the development of the northern territories and the Arctic shelf has an important geopolitical significance, securing the country's borders and strengthening its role in the eastern part of the Arctic. The largest transport projects implemented in the Republic of Sakha (Yakutia) (radical modernization of the river and navy, creating port infrastructure and a network of roads and railways) are also large-scale preparations for strengthening its presence in the Far North and the Arctic Shelf. As a result of their implementation, Yakutia should be transformed from a peripheral, marginal region into a nodal cross-border region, into a base for the development of the Arctic shelf [1].

The Republic of Sakha (Yakutia) is a strategically significant subject of the Russian Federation, located in the north-eastern part of the Eurasian continent at the intersection of the shortest paths between Asia, Europe and America. There are two priority areas of international trade and economic cooperation of the republic. The Arctic priority is implemented through the Northern Forum, the Arctic Council. Second, the Asian priority is actualized through a member of the Association of Regional Administrations of the Northeast Asian Countries, special attention is paid to foreign economic relations with the main consumers of export goods and potential investing countries (Japan, the Republic of Korea, China). In particular, the multi-vector partnership of Yakutia with the Heilongjiang Province (China) continues. The potential for cooperation between the two sides in the development of the mining industry of mineral resources and cross-border tourism is deepening [2].

In this regard, the socio-economic development of the indigenous peoples of the North, the preservation and protection of their original habitat and traditional way of life, their distinctive culture becomes relevant. Improving the quality of human and social capital, the level and quality of life of indigenous peoples become priorities for achieving sustainable development.

The world community recognized that education, called in the UN documents the “crucial factor for change”, plays a leading role in achieving sustainable development. In this regard, the documents of the UN and UNESCO, among the 17 global goals of sustainable development, highlight the fourth goal: “Ensuring inclusive and equitable quality education and promoting lifelong learning opportunities” [3]. According to N. A. Burmistrova, the use of mathematical competence as an indicator of educational achievements has a huge methodological potential to transform the learning environment, taking into account the principles of “education for sustainable development” [4].

As the analysis of the current situation shows, at present, in the arctic and northern regions of Yakutia the following is found: an acute shortage and aging of reindeer herders, low interest of the young generation in traditional farming, while simultaneously increasing the number of unemployed rural youth among the indigenous and minority peoples [5]. Today, there are not enough specialists with knowledge, skills, and experience in an emerging market economy. The training of qualified personnel from the local population, focused on the development and introduction of innovative technologies into production, is required. The peoples of the North need their own economists, veterinarians, livestock specialists, game managers, and specialists in tourism services.

The most rational way of solving this goal is the formation of new motivational and value relations of students, characterized by the improvement of positive motivation and an active lifestyle, directing and regulating their activities in socio-cultural development. In this regard, the problem of ethno-oriented learning is highlighted.

The purpose of this work is to develop and experimentally test the methodology of ethno-oriented teaching of mathematics to students of the senior classes at schools of small ethnicities of the North.

2. Materials and Methods

The object of this research is the process of teaching mathematics to students of schools of small ethnicities of the North. When performing work, a set of methods was used, including the following methods: methods of theoretical analysis (analysis of scientific, psychological, pedagogical and educational literature on the problems of regionalization and ethnopedagogization of mathematical education; modeling the ethno-oriented teaching of mathematics in schools of small ethnicities of the North), empirical methods (studying and summarizing the experience of teaching mathematics, monitoring the educational activities of students of schools of small ethnicities of the North), statistical methods (statistical processing of data obtained in the course of ascertaining and formative stages of a pedagogical experiment).

3. Results

The ethno-oriented teaching of mathematics, taking into account regional, national, and ethno-cultural features of the students’ educational activities in the senior classes of schools of small ethnicities of the North, was implemented in the following stages.

At the value-target stage, the analysis of regional, national, and ethnocultural features of the students’ educational activities and the updating of their personal qualities were carried out. In accordance with the need to improve the quality of mathematical training, the level of motivation to learn mathematics, the development of reflective skills, reduce the level of school anxiety and professional self-determination of students, the goals and objectives of studying an academic subject, its sections were set.

The design stage involved defining the ethno-mathematical training content in individual educational topics and sections. We selected effective forms, methods, and means appropriate to the national characteristics of children. Conditions for implementing ethno-oriented education in mathematics were created.

At the diagnostic stage, students' professional diagnostics was organized jointly with school psychologists and class teachers. Diagnostics and self-diagnosis of opportunities, aptitudes, preferences, interests, needs, primary occupational measurements, social attitudes of students were carried out. The possibility of including professionally oriented (applied) aspects of the topics and sections studied in the educational content.

The analytical stage involved analyzing materials for diagnosis and self-diagnosis, a synthesis of the results. At this stage, the conclusions were made, allowing students to self-identify with professional preference and getting them better introduced in the process of learning mathematics. Students were to fill out their activity portfolios.

At the construction stage, teachers and methodologists selected and reviewed real-world problems, in the plot of which mathematics is demonstrated as a means of solving economic and production problems, in accordance with the requirements and principles [6].

During the substantive stage, as the relevant mathematical material was studied, students were introduced to the modern professions of the region through solving problems with ethnoregional content. At the consultation and correctional stage, teachers, psychologists, parents, and class teachers provided help to students in choosing forms of extracurricular activities and forms for presenting the results obtained.

During the performing stage, students chose a form of extracurricular activities on the basis of individual personal and content-technological preferences (local history work, search and research, teaching, research and design activities, etc.). They continued to get acquainted with the professions characteristic of the North. The presentation of the results of extracurricular activities were in the forms of writing abstracts, presentations, scientific and practical conferences, competitions, etc. The results were recorded in the activity portfolio. At this stage, teachers performed information monitoring, as well as consulting and coordinating functions.

At the last estimated reflexive stage, assessment and self-assessment of their activities were organized. Students filled out activity portfolios. The criteria for evaluating final results of all tasks of extracurricular activities.

4. Discussion

The training experiment was conducted in schools of small ethnicities of the North, located in six arctic regions of the republic. The effectiveness of the proposed methodology was tested according to student performance. Comparison of learning outcomes and identification of their connections (independence) were carried out using the McNamara criterion.

Student's performance before and after the formative experiment is provided in Table 1. In that table A is a number of students who studied before and after the experiment with "good" and "excellent" grades; B – a number of students who studied before the experiment with "good" and "excellent" grades, and after the experiment – with "satisfactory"; C – a number of students who studied before the experiment with "satisfactory" grades, and after the experiment – with "good" and "excellent"; D – a number of students who demonstrated "satisfactory" performance before and after the experiment.

Table 1. Student performance in experimental groups before and after the experiment.

		Student performance after training (after experiment)	
		"Good" and "Excellent"	"Satisfactory"
Student performance before training (before experiment)	"Good" and "Excellent"	$A = 51$	$B = 7$
	"Satisfactory"	$C = 18$	$D = 61$

Since $n = B + C = 7 + 18 = 25 > 20$, the observed value of the criterion is calculated as follows:

$$K_{obsr.} = \frac{(B-C)^2}{B+C} = \frac{(7-18)^2}{7+18} = \frac{121}{25} = 4,84 \quad (1)$$

We see that the value of $K_{obsr.} = 4,84$ obtained by us exceeds the critical value of 3,84 for a given level of significance ($\alpha = 0,05$). Thus, assumptions about significant changes that have occurred in student performance as a result of introducing an ethno-oriented teaching methodology (formative experiment) have been confirmed. In other words, students' performance has significantly improved.

In addition, psychological diagnostics of students in experimental classes was carried out using the following tests: a technique for diagnosing the learning motivation of schoolchildren developed by M. V. Matyukhina (in N. Ts. Badmaeva's modification); Phillips' method of diagnosing the level of school anxiety; and a test for determining a level of reflexivity proposed by A. V. Karpov. According to the results of psychological diagnostics, positive changes in the level of academic motivation and reflexivity are recorded. Significant differences in the level of general anxiety of students before and after the experiment towards its reduction were revealed.

5. Conclusion

The experimental work show effectiveness of using the ethno-oriented methodology in teaching mathematics. This is offered by us with the aim of improving the quality of mathematical training and the level of academic motivation, to form and develop reflexive skills, to reduce the level of school anxiety, as well as to improve self-determination of students in schools of small ethnicities of the North. Thus, education acts as a resource of human and social capital, having a socially significant and personally oriented value, as an important factor in achieving sustainable development of the Arctic and Northern territories.

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