FORMING LOWER SECONDARY EDUCATION STUDENTS' READINESS FOR INNOVATIVE ACTIVITIES IN NATURAL-MATHEMATICAL COURSES

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Summary

The article examines the issue of pedagogical conditions for the formation of the readiness of lower secondary school students for innovative activities during the lessons of the courses of the natural-mathematical cycle. A set of pedagogical conditions that positively influence the formation of students' readiness has been proposed. It has been proven that providing a comfortable educational environment, constant support of the motivation and readiness of pedagogical workers for innovative activities, systematic use of digital educational resources and a complex of creative, research and applied tasks has a positive effect on the level of readiness of lower secondary school students for innovative activities during the lessons of the courses of the natural-mathematical cycle. It has also been stated that the formation of basic school students' readiness for innovative activities is a complex and long-term process that is impossible without the creation of appropriate pedagogical conditions. A comprehensive and multifaceted approach to the formation of readiness would give an innovative product (result) only with a clearly developed algorithm, which would be followed by all participants in the educational process at secondary education institutions. It has been noted that innovative activity in the lessons of mathematics, physics, economics, chemistry, biology, geography, astronomy, etc., is a priority task of the respective teachers, because these subjects cause anxiety among the students of education and due to their complexity, students lose interest in studying them.

Key words: conditions, pedagogical conditions, innovative activity, readiness for innovative activity, students, courses of the natural-mathematical cycle.

DOI https://doi.org/10.23856/5805

1. Introduction

Radical, intensive changes which are taking place in the world economic space require changes in forms, methods, approaches, principles, means and ways of organizing activities in all spheres of human life. Economic processes focus the attention of specialists on changing the format of training personnel who would carry out their professional activities in the conditions of such changes, which means that the education system is also changing. The basic step in changing the system of higher education is, definitely, secondary education, which should provide higher education institutions with applicants who have not only fundamental knowledge, skills and abilities, but also possess a wide range of competencies, have a high level of readiness for innovative activities, and as a result, and readiness for changes in professional activity. Currently, the regulatory and legal framework of our country is being improved and an educational policy for the implementation of the State Standards of Primary and Basic Education is

being pursued *(Derzhavnyi standart pochatkovoi osvity, 2018; Derzhavnoho standartu bazovoi i povnoi zahalnoi serednoi osvity, 2020)*. Fundamentalist views, which are indicated in the State Standards, are precisely the competency-based approach to the education of students, which serves as a platform for forming students' readiness for innovative activities. Unfortunately, in recent years we have been observing the decline of domestic natural-mathematical and economic education in our country, which significantly affects the development of Ukraine. That is why we consider the problem of developing and implementing pedagogical conditions that would contribute to the formation of lower secondary school students' readiness for innovative activities in the process of studying the courses of the natural-mathematical cycle to be urgent *(Kontseptsiia Novoi ukrainskoi shkoly, 2016)*.

The purpose of the article has been the theoretical justification and experimental verification of pedagogical conditions for the formation of basic school students' readiness for innovative activities in the process of studying the courses of the natural-mathematical cycle.

2. Main part

In order to study the problems of pedagogical conditions, we consider it necessary to consider the essence and content of such definitions as «condition» and «pedagogical conditions».

Based on advanced pedagogical experience, we could conclude that the concept of «condition» must be considered from two sides (condition as a circumstance and condition as a rule) *(Lynenko, 1995)*. First, ***a condition*** *is a favorable circumstance, in the process of compliance of which the expected result of innovative activity can be obtained;* second, ***a condition*** *is a rule, the fulfillment of which in a given sequence, in compliance with all requirements, and under favorable factors, will lead to obtaining the final innovative educational product.*

We come to the conclusion that the concept of «pedagogical conditions» cannot be interpreted so unambiguously, because pedagogical conditions affect the learning outcomes of students, that is, they must be considered from the point of view of the principles of education, and therefore, pedagogical conditions should represent a set of factors or factors that positively affect the educational level of the students *(Tsys, 2018)*.

Thus, in our research, we interpret ***pedagogical conditions*** *as a set of factors (external and internal) that ensure the organization, regulation and interaction of education seekers in the process of including them in a fundamentally new, active creative, research activity (both during the educational process and during the extracurricular activities), which directly contribute to the formation of their readiness for innovative activity.*

Considering the above, we selected the following pedagogical conditions based on basic didactic principles:

- creation of a comfortable, innovative educational environment in order to ensure the activity and independence of the student's personality, during the research of new information in the process of studying the courses of the natural-mathematical cycle;
- systematic and consistent use of digital educational resources in order to obtain fundamentally new knowledge in the process of studying the courses of the naturalmathematical cycle;
- strengthening the motivation and readiness of pedagogical workers to carry out innovative activities in order to organically combine various forms, methods and means of such activities;
- saturation with research and applied content of lessons and their connection with real life.

Let's get more acquainted with the didactic content and innovative potential of each of the pedagogical conditions we had selected for the formation of basic school students' readiness for innovative activities in the lessons of the courses of the natural-mathematical cycle.

The creation of a comfortable, innovative educational environment in order to ensure the activity and independence of the student's personality, during the study of something new in the process of studying the courses of the natural-mathematical cycle *involves the implementation of such didactic principles as: the principle of activity and independence of the personality and the principle of developing and educational learning.*

The didactic basis of this condition is that the greater the student's creative activity, the higher the quality of knowledge acquisition. It is also obvious that, if the assimilation of fundamentally new knowledge takes place in a comfortable environment (where it is possible to consider the age and individual characteristics of the student), the level of education and readiness of the child for any type of activity (including innovative ones) increases significantly. The child feels free, sees a benevolent and humane attitude towards oneself as an individual, receives moral upliftment and as a result awakens in himself stable incentives for learning.

The pedagogical condition proposed by us had ensured interaction between the teacher and the student in the process of innovative activity, the establishment of partnership pedagogy with all participants in the educational process (including with parents during face-to-face, distance and mixed learning formats). Also, it has been possible to provide a comfortable, innovative educational environment with the active use of online messengers to receive feedback from the teacher with students and parents. Online messengers (in most cases Telegram, Viber, and Whatsapp) had enabled teachers to continuously communicate with students in the distance learning process, conduct consultations, use didactic material for successful student learning, explain unclear tasks, and answer problematic questions that arose during the students' process of independent performance of tasks, to encourage and motivate students to innovative activities in less formal circumstances, to ensure the continuous comprehensive development of students' personalities.

Strengthening the motivation and readiness of pedagogical workers to carry out innovative activities, in order to organically combine various forms, methods and means of such activities *involves the implementation of the principle of a rational combination of forms and methods of educational activity.*

This condition is based on the fact that only a motivated teacher who is ready for innovative activities could and should use the most diverse forms of organization of education: lesson, excursion, workshops, as well as various ways of interaction of students in the educational process: individual work, work in permanent and changing pairs, in small and large groups, etc. In addition, learning can be carried out in various types of children's extracurricular activities: in hikes, trips, and interest clubs.

In order to create this condition, we had held non-standard meetings of pedagogical councils and institution councils during which teachers have been introduced to the basics of innovative activity, ways of its implementation, new pedagogical technologies, forms, methods and means of including students in innovative activity. Also, a series of master classes, quests and pedagogical workshops has been held in order to awaken teachers' internal incentives for this type of activity. Stimulating and hindering factors of innovative activity, which showed positive dynamics, have been studied.

Systematic and consistent use of digital educational resources for the purpose of obtaining fundamentally new knowledge in the process of students studying the courses of the natural-mathematical cycle *involves the implementation of the following didactic principles:*

the principle of clarity, the unity of concrete and abstract, and the principle of systematicity and consistency.

The didactic value of this condition is that the effectiveness of learning depends on the purposeful involvement of the senses in the perception and processing of new information. A person perceives a large amount of information, but the use of digital educational resources helps the child to imagine, to build correct images of this or that phenomenon, which is the basis for the development of higher forms of thinking. A person perceives a large amount of information, but the use of digital educational resources helps the child to imagine, to build correct images of this or that phenomenon, which is the basis for the development of higher forms of thinking.

It should be noted that the use of visualization in education has its limits. The fact is that concrete thinking, which is directly based on the perception of things with the help of the senses, is the first stage in the development of human thinking, and abstract thinking develops on its basis. That is why digital educational resources help the teacher in the development of online games, tasks, quests, projects, which significantly contribute to the development of students' motivation for innovative activities.

Mastering the modern achievements of science and technology, culture, and activity experience should be organized systematically and consistently. Such mastery by has been organized by us and built on the logic of science and determined by the tasks of education and the age capabilities of the students. Also, we had organized a planned order of innovative activity in the learning process, in which each stage of the joint activity of the teacher and students has been based on the previous stages and opens the way to further progress, obtaining a fundamentally new result of innovative activity.

The usage of digital educational resources in the lessons of the courses of the natural-mathematical cycle in the basic school had provided a direct process of forming the readiness of students for innovative activities. Thanks to digital educational resources, it becomes possible to visualize and structure the knowledge acquired by the student, to solve problematic, research situations, to implement a knowledge test with further independent processing by the student of his own mistakes, to get his own innovative experience.

Saturation with research, applied content of lessons and their connection with real life implements the principle of connection of learning with life, with practice.

The didactic potential of the specified condition is that it contributes to the development of a democratic society and requires that the process of carrying out innovative activities stimulates students to use the acquired knowledge in practice, to analyze and transform the surrounding reality, to develop their own views.

The pedagogical condition we proposed had ensured the effectiveness of training and made it possible to check the quality of the organization of innovative activities. It has taught students to build logical connections such as: *practice —criterion of truth, a source of cognitive activity and areas of use of learning outcomes.*

Involvement of lower secondary school students in finding solutions to problematic research problems with the help of digital educational resources contributed to increasing the level of cognitive interest in innovations. While solving such tasks, we had used network services (Mindmeister.com, tag clouds, online crosswords and puzzles), carried out activities related to the topic of the lesson (interactive web quests, online competitions or creative tasks using social networks, for example, posting a short biography of prominent scientists on the personal profile page in social networks, conducting intellectual challenges).

An experimental study of the pedagogical conditions for the formation of basic school students' readiness for innovative activities in the process of studying the courses of the

natural-mathematical cycle has been organized on the basis of the Kharkiv Gymnasium No. 12 of the Kharkiv City Council of the Kharkiv Region. During the experimental study, the students have been grouped into three groups according to the specifics of the curricula under which they receive their education. The experimental group EG1 included students of 6-A and 6-B grades (academic year 2022/2023) with a total number of 67 respondents. 6-A and 6-B are experimental classes for the implementation of the State Standard of Lower Secondary Education «New Ukrainian School» and study mathematics at an advanced level (sub-profile 6-A - physics for the curious, 6-B - financial literacy). The control groups of CG1 included students of grades 5-A and 5-B (academic year 2022/2023) with a total number of 66 respondents studying mathematics at an advanced level (sub-profile 5-B – physics for the curious, 5-A – financial literacy), CG2 consisted of students of grades 6-B and 5-B (academic year 2022/2023) with a total number of 71 respondents studying English at an advanced level (pre-profile 5-B – German, 6-B – French). The total number of respondents who took part in the experimental study is 204 people.

The confirmatory stage of the study has been conducted at the beginning of the 2021/2022 academic year. The task of the ascertaining stage in all studied groups has been *to establish the actual level of readiness of students for innovative activities.* The results of the ascertaining stage of the study made it possible to find out that the level of readiness of students for innovative activities in all studied groups is approximately the same.

In order to identify changes in the formation of students' readiness for innovative activities in the lessons of the courses of the natural-mathematical cycle, in the process of distance and mixed learning, we had implemented the pedagogical conditions we have had highlighted. The results of the formative stage showed a positive effect on the readiness of students for innovative activities in the EG1 group, while there were almost no changes in the CG1 and CG2 groups.

In the process of implementing pedagogical conditions and studying their influence according to the motivational and goal criterion, we had obtained the following changes in indicators: there has been an increase in indicators of a high level by 9%, a sufficient level by 13%, due to a decrease in indicators of an average level by 14%, and a low level by 8%. There have been practically no changes in the control groups.

The results of the study of the influence of pedagogical conditions according to the information-research criterion showed positive changes in the indicators. There has been an increase in indicators of a high level by 9%, indicators of a sufficient level by 14%, due to a decrease in indicators of an average level by 12%, and indicators of a low level by 11%.There have been practically no changes in the control groups.

Implementation of pedagogical conditions and research of their influence according to the innovation-research criterion, we obtained the following changes in indicators: there was an increase in indicators of a high level by 11%, a sufficient level by 24%, due to a decrease in indicators of an average level by 26% and indicators of a low level by 9 %. There have been practically no changes in the control groups.

It is worth noting that the realization of the need to achieve success, which contributes to the formation of goals and is the basis of perseverance in solving innovative tasks, is important in shaping the readiness of lower secondary school students for innovative activities. It should be noted that if the need to achieve success is not realized, there is a high probability of a decrease in the success of educational and cognitive activities, and as a result, a decrease in the level of students' readiness for innovative activities. That is why it is important to create the necessary pedagogical conditions for the realization of the child as an individual, forming in them the habit of carrying out innovative activities. Also, in the process of research, it has

been concluded that the better the innovative activity of schoolchildren is organized with the involvement of tasks of a creative, research, and applied nature, the more successfully their adaptation to modern conditions would be carried out, which thereby confirmed the appropriate level of readiness of basic school students for innovative activities.

3. Conclusions

Thus, our research had showed that the use of the pedagogical conditions proposed by us for forming the readiness of lower secondary school students for innovative activities in the lessons of the courses of the natural-mathematics cycle would positively affect the level of this readiness. It has been proven that the use of active innovative forms, methods and means of implementing innovative activities, creating a comfortable atmosphere of communicative interaction with the help of online messengers, providing an innovative educational environment, systematic and systematic use of digital educational resources, solving creative, research, applied problems in lessons, the volume of the content and the novelty of the educational material, respect for the student's personality contribute significantly to the active formation of basic school students' readiness for innovative activities in the process of studying the courses of the natural-mathematical cycle.

Taking into account the above, we can claim that the experimental study of the pedagogical conditions we had selected for the formation of students' readiness for innovative activities confirms the significance, expediency and importance of their use during the implementation of the educational process by institutions of secondary education.

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