Project technology as a means of schoolchildren communication skills development

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Abstract. Project technology is the basis for creating a practical research environment in the framework of school education and is seen as a master unit in the formation of a teenager's communication skills, which requires the development of a framework, both educational and scientific. Research projects involve collaboration between students, as well as a student and a teacher, which develops interpersonal skills, contributes to the development of emotional intelligence, conscientiousness, citizenship in children and, at the same time, innovation, identity. The purpose of this article is to study the main contributions of the practical application of design technologies for the development of the communication skills of the school audience through the formation of cognitive, motivational and activity-practical components. In the article, the authors present the results of the correlation between the data on the application of design technology in the experimental group, using the Fisher criterion (φ-criterion), proving the positive dynamics of improving self-determination, empathy, tolerance and creativity as the main characteristics of the criteria for the selected components of the formation of the communicative abilities of schoolchildren.

1. Introduction

One of the most important trends in modern education, along with its digitalization, internationalization and lifelong learning, is the introduction of progressive teaching methods that contribute to the development of schoolchildren's communication skills, which are necessary for two-way communication in society, an active process of information exchange between subjects, in the process of which mutual understanding arises between interlocutors, contributing to the formation of competitive behavior in the labor market.

The formation of the personality of a student with well-developed communication skills is one of the leading problems of school teaching and upbringing. It is through communication that a person's socialization is achieved. Communication is based on mutual understanding, interaction and need for communication [1]. Modern education is designed to help students master the skills of finding alternative ways of solving life problems, expressing personal opinions, the ability to hear someone else's point of view, to be tolerant of opinions that may not correspond to personal beliefs, the ability to work in a team and be responsible for overall success, which assumes the formation of communication skills [2].

Formation of schoolchildren communicative abilities and the leading role of communication in the development of the personality of a teenager was studied by such scientists as L.S. Vygotsky, D.B.
Elkonin, A.A. Bodalev, M.I. Lisin, B.F. Lomov and others. Summarizing the research data, a number of blocks of communication skills of schoolchildren have been identified:

- the ability to assess the human dignity in oneself and in other people;
- the ability to respond kindly to fair criticism and calmly to irrational one;
- the ability not to succumb to aggressive, provocative behavior of an interlocutor;
- the ability to accept and provide mutual support;
- skills of reflective listening;
- skills of empathic behavior;
- skills of congruence;
- the ability to make contact with other people

The development of a student's communicative abilities is considered in the general context of socialization, taking into account the development, implementation of the plan, assessment of its effectiveness, as well as correction based on activity-based communication and self-motivation [3]. In the past few years, the topic of modernization of the educational process has begun to occupy a special place in the educational discourse, which predetermines the introduction of new formats for mastering the skills of project technologies. The technology of projects is, first of all, a joint activity of a teacher and a student, based on a certain idea in accordance with specific goals. Project activity allows you to integrate interdisciplinary areas, realize potential of teenager's curiosity and, at the same time, form the ability to communicate.

2. Materials and methods
Within the framework of the All-Russian competition of scientific and technological projects "Big Challenges", we conducted a study among 25 ninth grade schoolchildren to study the formation of communication skills through participation in project activities. To assess the degree of formation of communicative skills, we selected the cognitive, motivational-value and activity-practical components and determined the following criteria:

- cognitive, which is revealed through subject knowledge and possession of scientific research methods;
- motivational value, which is determined by motives, value orientations, the ability to empathy;
- the activity criterion is the practical implementation of the acquired knowledge and skills [4].

Self-determination as a personal factor plays an important role in the development of the communicative abilities of the student's personality [5]. It is a necessary component of the development of self-awareness, value orientations, awareness of their physical and mental abilities. With the help of the ranking methodology, we carried out a diagnosis of self-determination in students who are doing well and poorly at school. The teenagers were given a list of classmates and asked to analyze their peer popularity and personality traits. Also, students determined their own place in this list. After the teachers supplemented the information received, the degree of adequacy of the child's self-esteem was derived. As a result of the study, we obtained the following data: among children who succeed with good and excellent marks, adequate self-esteem is observed in 66.7% of students, in 18.6% of teenagers it is overestimated and in 14.7% of teenagers it is underestimated. Among schoolchildren who got satisfactory marks, only 11.8% assess themselves adequately, 8.2% have overestimated and 80% underestimated themselves.

In the course of the experiment, in order to diagnose the real state of the formation of the components of the individual's communicative abilities, we have checked current state of knowledge. We determined the initial level of the cognitive component based on the results of check current state of knowledge test papers reflecting knowledge of the subjects. All the students coped with the test tasks, that is, there were no “unsatisfactory” marks, which corresponds to 100% of academic performance, 12 students received a “satisfactory” mark, which corresponds to 52% of knowledge.

To study the motivational-value component, we used the methods of studying the motivational sphere of students according to M.V. Matyukhina and the level of empathic tendencies of schoolchildren according to I.M. Yusupov. The data obtained indicate the prevalence of narrow personality categories
and motives for avoiding trouble among the majority of respondents, and the scales reflecting broad social and educational-cognitive motives are significantly underestimated [6]. The percentage of schoolchildren with an average level of empathy, which is characterized by the ability to understand the feelings of another individual, the ability to provide support at the right time was only 23%.

To study the initial level of the activity component, we conducted a survey of students to find out the motives that most determine their desire to be engaged in project activities. The results showed that 26% of schoolchildren believe that this deepens their knowledge of the discipline, 18% see project work as an opportunity to express their creative ideas, 66% of schoolchildren consider participation in a project as an opportunity to receive a high grade in a subject.

The project "Biotechnology in vertical gardening of settlements on the example of the city of Yelets" is complex in nature. The choice of topics is related to the practical issue of environmental pollution, which is relevant in everyday life and, at the same time, requires the application of knowledge not in one discipline, but from different subject areas, using the potential of students' creative thinking, research skills and personal life experience. The project is relevant, since, firstly, there is a dense development of multi-storey buildings in the city, where shops, pharmacies, polyclinics, and administrative buildings are located on the ground floors. At the same time, there are no parking spaces, car owners park on the sidewalk. Secondly, there is a lack of space to create an environmentally friendly comfortable environment in a given area with a load of cars, which does not allow using conventional landscaping methods. Vertical landscaping with eco-graffiti elements will enrich and complement the architectural appearance of buildings, make it more expressive. The object of the study was the landscape design of an eco-parking for cars in a densely populated area of apartment buildings in the city of Yelets, and the subject of the study was vertical gardening with elements of eco-graffiti made from moss using biotechnology.

At the preparatory stage of the project, a sociological survey was conducted with passers-by on Heroes Street in the city of Yelets. Based on the results of a survey of thirty respondents aged 19 to 66, we found out that every driver has regular difficulties with parking and traffic.

We began the practical implementation of the work with a visual inspection of the site, buildings and study of the map of the area. The examination revealed the requirements, wishes, and also gave a preliminary assessment of the feasibility of the project. Using Yandex maps, we calculated the parameters of a place for a vertical installation: the perimeter of an eco-parking (175 m²), an area (1500 m²), thirty individual parking spaces (155 m) with entrance and exit. Eco-parking is a ground covering fixed in a cellular base with a perennial vegetation cover, the root system of which is protected from damage by the cellular base frame. To construct it a special green lawn grate made of durable frost-resistant plastic is used. The grate is laid on the prepared soil, covered with earth and sown with lawn grass. After that, the lawn must be watered and cut. Plants will be planted in mats of coconut substrate, which is characterized by high air permeability, moisture capacity, neutral acidity, and the impossibility of developing pathogenic microflora in it. The structure will provide periodic irrigation of the plant root system with a nutrient solution using an automatic irrigation system from above. The outdoor phytoconstruction will be a seasonal facility. In autumn, the modules with plants need to be moved to the greenhouse for storage. For winter, letter designs can be covered with green cloth and decorated with artificial spruce branches, in addition, it can be equipped with LED lighting.

They decided to separate the parking lot from the green installation with a hedge made of Barberry Thunberg, which has an excellent haircut and keeps a beautiful shape. Due to its squat, dense bush and unusually decorative color of leaves from purple, violet to bright red, it can also be used in border plantings. On this territory there is a 64-meter concrete wall of the boiler house of the fifth microdistrict of the city. Here we offer an unusual and modern approach to landscaping - mossy eco-graffiti. It is better to collect moss for eco-graffiti on pavements, from wet bricks, cement roads, etc. Moss collected from trees will grow better on wooden surfaces, and for concrete bases it is better to take the plant from the soil. To create pictures of moss on the walls, you need to prepare a special mixture, which will become the basis of the picture. In addition to the main ingredient, you will need a hydrogel intended for plants, ordinary fermented milk products, which will serve as a nutrient base for the plant, and warm...
water for soaking moss. The moss is thoroughly washed, three to four handfuls of moss soaked in warm water are placed in a blender, about a glass of kefir, a few tablespoons of soaked hydrogel and sugar are added. Mix the composition for a couple of minutes to get a thick pasty mass. The surface on which the drawing will be applied is thoroughly cleaned, then the composition is smeared on the surface of the walls with a brush. Water such graffiti with a spray nozzle. Our compositions are simple, they are the main brands of the city of Yelets. The first image is a sketch of eco-moss graffiti of the emblem of the city of Yelets and the famous Yelets lace. The second sketch shows the Ascension Cathedral and the date of the city foundation. The third sketch is an image of the Eletsky chimes and felt boots, which are made using a unique technology.

As a striking element of eco-parking, we offer phytomodules in the form of letters 1.7 meters high and 1.1 meters long (only 11.5 meters) with plants made of durable eco-plastic. This is a global trend that has gained great popularity in different cities around the world.

Next, we proceeded to the selection of plants. We chose seeds for sowing a lawn according to the criteria of winter hardiness and resistance to trampling. Varieties of fescue gray correspond to these conditions. It forms a dense cover with a low tillering node. While it develops, ryegrass, which is a high-speed, but not winter-hardy grass, will play a decorative role. The optimal composition of the lawn mixture is 75%, three or four varieties of red fescue and 25% of ryegrass. The seeds are sown by scattering them over a well-shed surface. The norm is 50 g per 1 m².

To maintain the growth and development of plants in vertical phytomodules, it is necessary to use phytohormones. The lawn grass of the eco-parking requires regular feeding with nitrogen-containing mixtures. It is desirable to use phytohormones for plants in phytomodules in two stages. The first stage is 1 week after planting for better rooting. We have prepared our own plant growth stimulant from aloe. A tablespoon of squeezed juice was poured into two hundred milliliters of water. The mixture was placed in a cool place without access to light, covered with a lid and kept for a week. Then it was further diluted so that the total volume was five liters. After that, the cuttings of plants can be treated with the mixture. At the second stage, ready-made industrial phytohormones were used to stimulate the immune system, regulate plant growth, and adapt them to stressful weather conditions.

As a result, upon the completion of the project "Biotechnology in vertical gardening of settlements by the example of the city of Yelets", we received a design, a model of eco-parking, which may become an ideal alternative to asphalt when arranging parking spaces in urban areas. In our work, we have shown how the multifunctionality of such an ecological parking lot can be used to solve many other functional and decorative tasks of urban landscaping.

During the execution of a complex practice-oriented project, each student felt the significance of his own work, interest in the acquired knowledge that could and should be useful to them in life, had the opportunity to show his creativity, individuality and independence, which is the main requirement for the development of the teenagers' communication skills [7].

3. Results and discussion

To complete our study of the development of a student's communication skills through design technology, we compared the results of the ascertaining and formative experiment on the components we selected that determine communication skills.

To process the obtained results of our measurements, we applied the Fisher criterion ($\phi$-criterion). With its help, we were able to assess the reliability of the differences in the percentages of the two samples. The essence of Fisher's angular transformation is to convert the percentage to the value of the central angle. A smaller percentage will correspond to a smaller angle $\phi$, and a larger percentage will correspond to a larger angle [8].

$$\psi = 2\arcsin\sqrt{P},$$

where $P$ - percentage expressed in fractions of a unit.

The reliability of the differences is determined by the discrepancy between the angles $\phi_1$ and $\phi_2$ - the greater this convergence, the greater the value of $\phi$, and the more likely the differences are reliable.

The results of the final testing showed the quality of knowledge of 68%, which is 12% higher than the primary data. We put forward hypotheses:
1. $H_0$: the percentage of schoolchildren who completed the control test is no more than the percentage who completed the items in the original test.

2. $H_1$: the percentage of students who completed the control tasks is greater than the percentage who completed the tasks in the original test.

We get: $P_1 = 52\%$—students who successfully completed the tasks in the control testing; $P_2 = 68\%$—students who completed the assignments during the initial testing.

Percentages correspond to the following angle values $\varphi = 2\text{arcsin}\sqrt{P}$:

$P_1 = 52\% \rightarrow \varphi_1 = 2.165$

$P_2 = 68\% \rightarrow \varphi_2 = 1.731$

We determine the empirical value of the criterion by the formula:

$\varphi_{emp} = (\varphi_1 - \varphi_2) \cdot \sqrt{\frac{n_1 \cdot n_2}{n_1 + n_2}}$

We find the critical value from the application table:

$\varphi_{cr} = \begin{cases} 1.64 & \alpha = 0.05 \\ 2.28 & \alpha = 0.01 \end{cases}$

Since $\varphi_{emp} = 3.32$ fell into the zone of significance, $H_0$ is rejected и $H_1$ is accepted.

Thus, the differences in the percentage of control and primary testing are statistically significant at the level of significance $\alpha = 0.01$.

When analyzing the results of the definition of the level of empathic tendencies of teenagers at the end of the study, it should be noted that the indicators on the scale “broad social motives” increased by 12.8%, and “educational and cognitive” by 5.9%. On the “narrow social motives” scale, on the contrary, there is a decrease in values by 14.4%. We put forward hypotheses:

1. $H_0$: the percentage of schoolchildren with broad social and educational and cognitive motives is no more than the percentage with narrowly social motives.

2. $H_1$: the percentage of schoolchildren with broad social and educational and cognitive motives is greater than the percentage with narrowly social motives.

We get: $P_1 = 48\%$—students with broad social and educational and cognitive motives; $P_2 = 23\%$—students with narrowly social motives.

Percentages correspond to the following angle values $\varphi = 2\text{arcsin}\sqrt{P}$:

$P_1 = 48\% \rightarrow \varphi_1 = 1.803$

$P_2 = 23\% \rightarrow \varphi_2 = 1.304$

We determine the empirical value of the criterion by the formula:

$\varphi_{emp} = (\varphi_1 - \varphi_2) \cdot \sqrt{\frac{n_1 \cdot n_2}{n_1 + n_2}}$

We find the critical value from the application table:

$\varphi_{cr} = \begin{cases} 1.64 & \alpha = 0.05 \\ 2.28 & \alpha = 0.01 \end{cases}$

We build an axis of significance:
Since $\varphi_{emp} = 3.82$ fell into the zone of significance, then $H_0$ is rejected and $H_1$ is accepted.

4. Conclusion
We invited high school students to express their views on project activities in the future. According to our survey, 59.8% believe that participation in the implementation of the project allowed them to develop and realize their abilities, make friends with the class and increase their self-esteem.

Our study of the development of the student's communicative abilities through design technologies proves that the use of this method is a motivating factor that promotes the organization of educational cooperation and interaction, which allows us to maximize the possibilities of expressing our own ideas, to tolerate the worldview of other people and the world around us in general.

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