

## ACQUISITION OF MATHEMATICAL KNOWLEDGE THROUGH PROJECT LEARNING ACTIVITY IN FIRST GRADE

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**Abstract:** The aim of the study is to examine the mathematical knowledge of first graders, acquired in terms of educational project activities. In math classes, students work together with the teacher on modeling practical situations mostly, that are close to project activities. This is an interactive type of activity that necessitates students to work in a team, to collaborate so that the final product of their joint work can be presented to the audience in an interesting and engaging way. Mathematics plays a key role in children's development because it teaches them to think, to form logical conclusions, to look for a shorter path or a better solution. It also teaches them critical thinking, the ability to see the whole picture and be able to divide it into smaller parts. The teaching of mathematics in the first grade is aimed at mastering the basic knowledge, skills, and attitudes related to mathematical literacy and modern key competencies of students. It enriches and expands arithmetic and geometric knowledge and skills while developing logical and creative thinking, skills for information handling, independent work, and teamwork, mastering common ways of intellectual work. The project learning activity in mathematics allows the learning and educational goals to be realized in the integrative conditions of active interaction both between the students and between the teacher and the class.

**Keywords:** project activity, interactive methods, training, mathematics, creativity

### 1. INTRODUCTION

The mathematical education, in contemporary school, is connected to the other subjects. It significantly affects the development of students. Mathematical knowledge and skills contribute to a better understanding of modern society and adaptation to it. The math education in the first grade lays the foundations for its study in the upper grades.

Creating and using didactic systems, consisting of signs and properties, is extremely useful for students, because students are more aware of the concepts, understand the relationships between different concepts, and also recall previous knowledge.

When using project activities, the students can "peek" into real life; with the implementation of projects they can enter the adult world, and get acquainted with their work environment, its connection with time and resource constraints, discover the relationships between activities and their results, see the real applicability of their knowledge.

### 2. THE METHOD OF THE PROJECTS IN PEDAGOGICAL ACTIVITY CONDITIONS

The methods of teaching, according to M. Andreev, “build the procedural side of the technology of education, give it life, to a large extent determine its appearance and together with the content are its core. Therefore, they are the focus of efforts to raise the quality level of preparation of adolescents for life and work, which they will exercise” (Andreev, M., 1986: 25). The effectiveness of training methods largely depends on the effectiveness of training as a whole.

In the pedagogical field, there is an indisputable opinion that in order to have effective learning outcomes it is necessary to use such methods that motivate the student, make him roll up his sleeves, and systematically assimilate the learning content, according to his strengths and abilities. There is no one-size-fits-all recipe for these methods, but one of them could be the project method.

In the learning process, the learning activity is carried out in the form of continuous interaction between the teacher and the students. Learning has a pronounced individual character and in each of the first graders, it is carried out differently. When teaching the material, the teacher inserts his emotional and value assessments into the content of the subject. Regardless of the teacher's desire in the learning process, his beliefs influence: priorities, motivation, life views. If the authoritarian-dominant role of the teacher in the learning process is removed, preconditions are created for the development of students' creative thinking. They acquire a leading role in the process of knowing and discovering truths. Working on projects enables the teacher not only to teach but also to guide and direct the student's cognitive activity.

The project method appeared in the early twentieth century in the United States. It is also called the method of problems and is associated with the ideas of the humanities in philosophy and education, developed by the American philosopher and educator John Dewey and his student William Kilpatrick.

The method of projects has attracted the attention of Russian educators since the beginning of the XX century. The ideas for project training arose in Russia in practice in parallel with the developments of American educators. Under the guidance of the Russian pedagogue ST In 1905, a small group of collaborators was organized by Shatsky, who tried to actively use project methods in teaching.

Later, already under Soviet rule, these ideas began to enter the school, but not quite deliberately and consistently, so in 1931 the project method was condemned and since then until recently no serious attempts have been made in Russia to resume this method. in school practice. At the same time, it is actively and successfully developing in Western schools. In the United States, Britain, Belgium, Israel, Finland, Germany, Italy, Brazil, the Netherlands and many other countries, the ideas of the humanistic approach to the education of John Dewey and his project method are widespread and popular due to the rational combination of theoretical knowledge and their practical application to solve specific problems of the surrounding reality in the joint activity of the students.

H. Schreiner defines the project as a set of certain actions, which create a real object and subject or a different theoretical product. A process that is essentially a creative activity.

The project method in school education is considered as an alternative to the classroom system. The modern project of the student is a method for activating the cognitive activity, for developing creativity, and at the same time for forming certain personal qualities.

The project method is aimed at applying the acquired knowledge and skills and acquiring new ones.

In the method of projects as a pedagogical technology finds its realization a set of ideas, most vividly presented by the American pedagogue and philosopher John Dewey (1952), who argues that a child's childhood is not a period of preparation for his future life, but the full life itself. Therefore, the education he receives should be based not on the knowledge that will one day serve him in the future, but on what the child needs today, on the problems of his real life.

One of the main tasks of project-based learning is the active involvement of students in the learning process. They should listen, read, write, discuss, or solve problems. Students must learn to combine their activities with those of others, to collect and process the necessary information in an appropriate way for the implementation of one or another project, individually or together with other students and learn to understand the reality of life through experience. In this context, I. Stamenova mentions that: "The project activity enables the teacher to organize the learning work of the students, taking into account their interests and abilities" (Stamenova, I., 2018: 60). The basis of the method is the development of cognitive and creative habits in students, skills to build their knowledge, skills for orientation in the information space, development of critical thinking. The project method is always aimed at students' independent activity - individually, in pairs, in groups - which they perform over a period of time. This approach is naturally combined with the group approach to learning.

Working on the project method implies not only the presence and awareness of a problem, but also the process of its detection, resolution, which includes clear action planning, the presence of a plan or hypothesis to solve this problem, a clear distribution of roles (if refers to group work), ie tasks for each participant subject to close interaction. All the results of the implemented projects must be, as they say, tangible, objective, ie if this is a theoretical problem, its concrete solution is expected, if it is practical, a concrete practical result, which is ready for implementation.

### **3. BASIC REQUIREMENTS FOR USING THE PROJECT METHOD IN MATHEMATICS EDUCATION**

"The period of primary school age (7-11 years) is characterized by the fact that it is intensive physical and psychophysiological development of the child, which provides an opportunity for systematic schooling" (Stoimenova, Y., 2010: 59-60 ). The acquisition of learning knowledge by students, especially in the first grade, is characterized by several specifics caused by their emotional and cognitive characteristics. This requires the use of new, active teaching methods, part of which is the project method. Apart from the psychological characteristics of the first-graders, the educational activity in mathematics also has its specificity given the peculiarities of the science itself and the educational content. This requires compliance with certain requirements when organizing project learning activities in mathematics:

- Existence of significant research and creative problems (tasks), requiring integrated knowledge, research search for their solution;
- Practical, theoretical and cognitive significance of the expected results;
- Independent, in pairs, in groups of students;
- Defining the ultimate goals of the projects;
- Determining the basic knowledge from different areas needed to work on the project;
- Structuring the content of the project (with indicated results at each stage, if provided);

- Use of research methods: highlighting the problem and the resulting research tasks, highlighting the hypothesis for their solution, discussing the research methods, shaping the final results, analysis of the data, taking stock, editing, conclusions.

The most difficult moment in introducing research projects in the learning process is the organization of this activity, and especially the preparatory stage.

In the annual distribution of the material for the school year, the teacher must choose the leading topic, several topics, or a section on which projects will be developed. It is then necessary to formulate project topics for each class. The list of proposed topics, requirements, and organizational form (individual or group) is published on the school website and is available to each student at a convenient time. The student has the opportunity to choose the topic of his project. Working on the projects will require students to acquire the necessary knowledge according to the program and to gain experience.

The accuracy in the design of the project is determined by the clarity and correctness in determining the objectives, noting the expected results, the establishment of the initial data. The application of methodological recommendations or instructions is very effective, where the necessary and additional literature for self-education, the requirements of the teacher to the quality of the project, the form and methods of qualitative and quantitative evaluation of the results are indicated. Sometimes it is possible to note the design algorithm or some other step-by-step division of activity.

According to the National Program for the Development of School Education and Preschool Education and Training (2006-2015), the choice of project topics may be different in different situations. In some cases, this topic can be determined by specialists in the field of education under approved programs. In others, to be offered by teachers, taking into account situations in their subject, the natural professional interests, interests and abilities of students. In cases, the topics of the projects can be suggested by the students themselves, who are guided by their interests, not only purely cognitive, but also creative and practical.

The topics of the projects may concern a theoretical issue of the school curriculum to deepen the knowledge of individual students on this issue, to differentiate the learning process. Most often, however, the themes of the projects, especially those recommended by the education authorities, relate to some practical issue relevant to real life, and besides, requiring the application of students' knowledge in more than one subject, and from different fields, as well as creative thinking and research habits. In this way a completely natural integration of knowledge is achieved.

#### 4. STAGES IN THE REALIZATION OF THE PROJECT-BASED TRAINING IN MATHEMATICS

The organization and implementation of project-based activities is a process that is characterized by its specifics and is implemented within several main stages (Table 1).

*Table №1 Stages of organizing a project activity in mathematics*

Stage	Task	Students` activities	Teacher`s activity
Beginning	Defining the topic, specifying the goals, choosing a working group	They specify the information, discuss the task	Motivates students, explains the purpose of the project, observes
Plannig	Analysis of the problem, identification of sources of information, formulation of tasks and selection of criteria for evaluation of results, allocation of obligations in the group	Formulate tasks, specify information (sources), select and justify their assessment criteria	Helps in analyzing and summarazing (if necessary), monitors

Making decisions	Collection and clarification of information, discussion of alternatives ("brainstorming"), choice of optimal option, specification of the activity plan	Work with information, synthesize and analyze ideas, perform the research	Monitors, consults
Implementation	Project implementation	They carry out the research and work on the project, shape the project	Monitors, advises (on request)
Evaluation of results	Analysis of project implementation, results achieved, (successes and failures), reasons for doing so, analysis of the achievement of the objectives set	Participate in the collective self-analysis of the project and self-assessment	Monitors, guides the analysis process (if necessary)

The most difficult thing for the teacher in the process of working on a project is his role as an independent consultant. The role of students in learning is also changing: they are active participants in the process. Working in working groups helps them learn to work in a team. At the same time, such constructive critical thinking is formed, which is difficult to learn in the classroom form of education. Students gain their view of the information. They are free to choose the ways and types of activity to achieve the set goal, no one tells them how and what they need to do.

If the project has shortcomings, it also has a positive pedagogical significance. At the stage of self-analysis, and then of defense, the teacher and students analyze in detail the logic and causes of failures. Making sense of mistakes motivates students to work harder and harder. In this way, they develop the ability to evaluate and self-evaluate.

As Andreev notes in "Integrative tendencies in learning" in the last stages of design, both the student and the teacher analyze and evaluate the results of the activity, which are often identified only with the project. There are at least two results when using the project method. The first is the pedagogical effect of attracting students to acquire new knowledge and their logical application: the formation of personal qualities, motivation, assessment and self-esteem, the ability to make choices and to understand the consequences of this choice and the results of their activities. Andreev recommends that the novice project manager write short summaries of the results of his observations to the students, which will allow him to be more objective during the defense itself.

The second component in the evaluation of the result is the project itself. In doing so, it is not the volume of information used, but the implementation and work that achieves the objective set. In order to avoid negative results, gaps in the design, processing or completion of the project, at different stages of its implementation, the teacher can be included as a member of different working groups.

## 5. STIMULATING THE MATHEMATICAL ACTIVITY OF THE STUDENTS THROUGH THE WORK ON EDUCATIONAL PROJECTS

In order to establish the influence of the interactive methods on the cognitive activity and in particular the project method, an experiment was conducted with first-grade students from VII Secondary school "Kuzman Shapkarev", Blagoevgrad. There are 24 students in the class in which the study was conducted. The separate teams were 6 with 4 children in a team, and in each team, there was one person in charge to control the activities of his teammates.

The tasks set for the first graders relate to:

1. Test their knowledge of performing arithmetic operations with numbers up to 20, handling the units of measurement to indicate value.
2. Distribution of responsibilities to each member of the team by the pedagogue, who observes and supports the work process in all students. Thus, if the group leader monitors the implementation of all activities, the second participant reads the task, the third focuses on key points of it to help structure the implementation, the fourth teammate thinks about dividing the main task into subtasks.
3. Presentation of the project by presenting the developed materials, which reflect the main accents on it.

During the project the skill of each participant to work with mathematical concepts and data was traced.

To establish the mentioned skills, a 3-level rating scale was established, consisting of the following designations:

1. Low level of formed skills for working with mathematical data. The student does not orientate properly in the provided information, fails to implement any of the subtasks of the project.
2. Average level of knowledge shown. Understands the content of the information provided, but finds it difficult to apply it in practice.
3. High level of specialized skills for working with mathematical data. Can interpret the data and include them in the relevant project implementation activities.

The first-graders worked on the birthday preparation project.

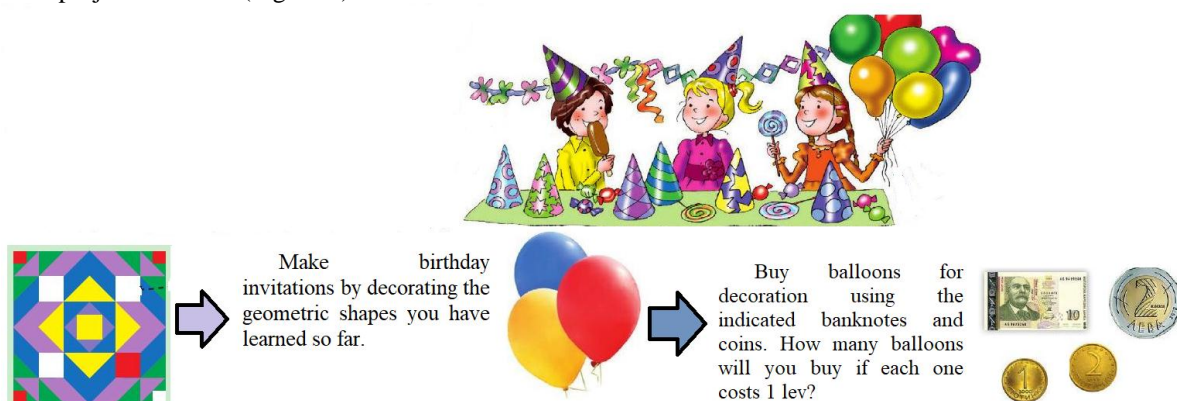
**Presentation of a model of "Preparing for a birthday"**

**Project goals:**

1. Consolidation of knowledge for addition and subtraction of numbers up to 20;
2. Consolidation of knowledge about units of value;
3. Recognition of geometric shapes and development of skills for orientation in space.

**Project progress:**

After the project activity teams are formed and each member of the team understands his task, the teacher sets the topic of the project, namely preparation for a birthday. The teacher provides each team with maps with instructions for the project activities (Figure 1).



After presenting the projects it was found that in general the students show a high level of skills for working with data and orientation in the mathematical reality of the project activity.

**Table №2 Results of a survey conducted with first-grade students**

Number of students in the class	Stages of research	Low stage	Avarage stage	High stage
24	<ul style="list-style-type: none"> <li>✓ Low stage</li> <li>✓ Avarage stage</li> <li>✓ High stage</li> </ul>	0%	15%	85%

**6. CONCLUSION**

The project method requires careful planning of the activities of both the teacher and the students. Planning is realized on two different levels. The first level concerns the whole learning process, in the course of which the teacher must teach certain knowledge and form certain skills. The second level refers to the planning of specific projects, which students carry out independently, and this requires motivation and support from the teacher. Although the differences in the roles of teacher and students are preserved, in this method the leading role of the teacher is not so emphasized. It stands in the background and realizes its functions through general planning, common activities and evaluation. The wide variety of tasks allows students to participate in the work in many different ways. They can choose their share of the activity according to their previous experience, abilities and ambitions, without any special methodological effort from the teacher. Project-based learning can be used at different levels in the initial stage of the learning process - as an alternative to its overall organization, as a means of solving a specific cognitive or practical problem, as part of didactic and educational tools for building theoretical and practical competencies and personal skills.

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