7. Development of skills for problem detection, choice of work strategy, decision making, activity planning

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Introduction

Project-based learning is a learning strategy that covers different subjects at the same time. This is achieved by the teacher encouraging students to identify a real problem through research, to develop a solution, applying evidence of support and to present the solution in an interesting and interactive way, using a set of contemporary visualization tools

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The trainers are given the task to increase the motivation for learning, to form skills for lifelong learning and social skills, etc. Many of these tasks cannot be solved through traditional teaching and learning methods. Interactive methods are successful in which students actively participate in joint or independent activities to create or discover facts and dependencies. Such teaching methods are problem-based learning, research methods (learning by discovery, learning by doing) and the application of information and communication technologies, combined teaching methods, etc.

Interactive teaching and learning methods have several major advantages over traditional methods:

- increased attractiveness of training;
- practical application of knowledge, skills and competencies to achieve certain goals;
- reducing the amount of teaching time

The development and application of modern educational models, which include interactive methods of teaching and learning, meet the current needs of improving the quality of education in mathematics, science and technology.

Context, approach, and implementation

The **AutoSTEM** project is related to the study of natural sciences, mathematics and technology at an early stage and is designed for children between 7 and 10 years. The topic of the workshop organized in 4th grade is "Project-based learning", as it is closely related to the subjects of mathematics, technology and entrepreneurship, which are compulsory subjects for primary school students in Bulgarian schools.

The project started with a 40-minute introduction to various projects made by students from different European countries and materials published on YouTube.

The participants were 21 students aged 9 years old and divided into 5 teams from the 4th grade of the 32 School "St. Kliment Ohridski" . They made a construction of a drawbridge within two consecutive lessons in Mathematics and Technology, and Entrepreneurship.

The students were acquainted with the overall concept of the project and chose the topic to work on.
As an independent task, the teacher asked them to research various bridges in Europe. The children were excited at the prospect, even as they were introduced to the project and the ideas,

Before starting their own work, they watched the instruction for constructing the toy using a video available on YouTube (https://www.youtube.com/watch?v=Ah-l88JAAaE). Thanks to it, they were able to see clearly exactly what was required and how they would work in the time available.

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Drawbridge construction:

During the independent work, the children concentrated, diligently and carefully, especially when working with the glue gun, where they had help from the teacher.
The project helped the children to improve their organizational skills as they had limited time and resources. It also helped them develop independence and autonomy, as they were required to work with almost no outside help.

The teacher divided the children into 5 teams of 4-5 students, and each group had to make a separate structure. According to the teacher, if one part of the class is engaged in one activity and another in another, there will be chaos and the activities will not be synchronized. These groups worked with little help from the teacher and support for the math and technology problems, and the techniques they used. They determined by themselves which of the available materials to use.

They made an action plan, that included a sequence to assemble the structure and drew pictures. The children had to organize themselves and their roles in each teams in order to be able to work as quickly and efficiently as possible. They had to ensure that no one would be inactive or that one person would do all the work.

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During the implementation of the project and the construction of the bridge, a competitive element appeared which is extremely important for the students in primary schools. When they compete with each other, it encourages them to work faster, more efficiently and better.

At the end of the workshop, the students corrected any problems with the bridge construction with minimal help from the teacher. They demonstrated their work to all the participating classes, and to their parents. An exhibition in the school building was organized and all the materials made by the students were shown.

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The main advantage of **AutoSTEM** is that young students work to develop and improve their creative skills and mathematical and technical literacy.

Challenges

Some of the students had a problem assembling some parts of the structure. The teacher plays a more passive role than that of the student, which is the main characteristic of project-based

learning. With the advancement of technology and the digitalization of our daily lives, there is no way that the learning process will not change. The teacher should be well acquainted in advance with the steps to be followed; that the necessary materials and tools are available, that the work is planned and that there is enough time.

The teachers helped the children to correct their mistakes and the children tried again on their own. This approach - self-study and teamwork - had a positive effect on the discipline of children in the classroom. The children were more organized and motivated to work.

Results

Why does **AutoSTEM** help children learn to plan and work in a team?

AutoSTEM shows children how important it is to work in an orderly way, to plan and not to be chaotic in your actions. To make the individually assigned products, students must first plan well how they will continue, and this is where the teacher is most involved in the project, in the presentation of the idea, the presentation of a video that shows how the products are made, and giving quality, and adequate instructions for the work.

The practical implementation allows the children to be active participants and the main actors in the learning process. Unlike traditional lessons, in which the teacher takes this role, here the students are given the opportunity to judge for themselves what, when and how to do, of course following the instructions and requirements. However, this does not limit them to decide at what pace to work, how exactly to glue the individual elements

of the product and who to play what role in group work. This freedom is extremely inspiring and stimulating for children and makes them act actively, dynamically and productively.

By developing students' creativity, ingenuity and technological skills, the project enriches children's knowledge and abilities in various subject areas such as mathematics, art, architecture, technology and entrepreneurship. In order for the Bridge to work, children have to calculate and measure everything they will glue, cut and assemble, which in turn is closely related to their mathematical knowledge and skills (units of length, drawing angles and sections, addition and subtraction up to 100).

It turns the lesson into a fairy tale with its own plot, an interesting story about a problem that can be solved or an activity that can be developed. Learning happens on the way to producing the solution. In project-based learning, the main role of the teacher is to teach in a way that motivates students to want to learn and to participate in creating something.

The children can show what they have learned in the different subjects or the whole section, explore the connections between the individual units, cooperate with each other, and evaluate themselves and their classmates. What they do is not just test or make a specific product, but a real in-depth understanding of the whole process.

Discussion

The method of project-based learning was used in a teaching practice with the development of various structures with moving mechanisms. This type of group work unites children and increases their motivation to participate in the learning process.

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Their creative thinking develops and an interest in mathematics, natural sciences, and technologies deepens.

This successful method can also motivate and involve students with a reduced interest in mathematics and technology.

All students in the class gave very positive feedback and expressed a desire for this type of lessons to be held more often.

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