EDUCATIONAL TECHNOLOGY IN PROBLEM-BASED LEARNING

Petra Pejić Papak, Jasminka Mezak, & Lidija Vujičić
Faculty of Teacher Education, University of Rijeka (Croatia)

Abstract

The problem-based approach to teaching aims to enable students to understand and evaluate the content taught. Organizing activities that involve problem solving includes: Creating a problem situation, defining the problem, selecting a problem-solving method, analyzing the results, drawing conclusions, and applying the acquired knowledge to new problem situations. Active learning with the help of technology enables faster implementation of planned activities. The main task of the teacher in problem-based teaching is to ensure conditions for creative and research activity of students in all the mentioned phases.
The Faculty of Teacher Education in Rijeka, Croatia participated as a partner in several European projects aimed at implementing problem-based methods using educational technology in the learning and teaching processes of students, preschool educators and primary school teachers.
The goal of these projects was to contribute to the development of creativity and logical thinking in children so that they can apply what they have learned to new problem situations. The most important activities of the project included the teaching of students as well as the professional development of educators and teachers in various innovative teaching methods using information and communication technology. This paper presents the educational activities for solving problems in practice with the aim of achieving the planned learning outcomes.

Keywords: Problem-based learning, educational technology, educational activities, educator, teacher.

1. Introduction

The modern technological society, the rapid progress of technology and new learning strategies have become challenges in the education of new generations. This is a complex task for teachers who are expected to successfully teach these future generations. Teachers and educators need to be up to date with 21st century competencies and skills and be able to select appropriate activities and digital tools for their students (Hoić_Božić et.al., 2019). Using digital educational tools, teachers conduct new, more engaging activities for students that encourage active learning. Through the correct use of digital educational content, we adapt the teaching process to the abilities and needs of the students and meet different learning outcomes. The use of digital educational content, as well as its creation, depends on the didactic approach to teaching, in which the student is actively involved. Therefore, the role of the teacher is also changing, who develops the self-confidence of the student by accompanying the student in learning, motivates him, advises him and leads him to the goal. In order to improve the quality of pedagogical practice, teachers are increasingly using a problem-based learning with use of digital tool in the teaching process.

2. Problem-based learning

Problem-based learning is a student-centered approach in which students learn about a subject by working in groups to solve an open-ended problem. The problem-based approach to teaching aims to enable students to understand and evaluate the content taught. As reported by Tawfik et al. (2021) given the dynamic nature of domain practice, educators are looking for ways to better develop problem solving, and one of the most common strategies is problem-based learning, which provides learners with the opportunity to solve the different types of problems.
Problem-based learning is defined by the following principles: active process related to the learner's role, student-centered and self-directed engagement, engaging in collaborative activities and an individual drive toward problem-solving, iterative non-linear learning process related to structure, reflective observation or engagement. It is important for childrens to understand the nature of a problem

and the implications of it. Students should be encouraged to formulate a problem in their own words. Creativity thinking is necessary to come up with ideas to solve the problem and find new approaches, so teamwork is often a key component in problem solving. The organization of problem-solving activities includes: creating a problem situation, defining the problem, choosing a problem-solving method, analyzing the results, drawing conclusions and applying the acquired knowledge gained to new problem situations. Teachers can play a new role in the teaching process to support a student and change the learning task to allow the student to solve problems or complete tasks that would otherwise be unattainable. The teacher intervenes in context at the right time for a given student, which increases the student's ability to solve the task (Mezak & Pejić Papak, 2019). The ICT can also provide access to a variety of information, including digital libraries, data for analysis, tools for organizing ideas and for presenting ideas. Digitization is already helping student to develop problem-solving skills by using fun educational games.

3. Projects aimed at implementing problem-based methods using educational technology

The Faculty of Teacher Education in Rijeka, Croatia, participated as a partner in several European projects aimed at implementing problem-based methods using educational technology in the learning and teaching process of students, preschool educators and primary school teachers.

The Erasmus+ Algolittle project was created with the aim of increasing the competences and acquiring knowledge and skills of undergraduate students of early and preschool education related to the use of algorithmic thinking skills through game-based learning. The main goal of the project was to prepare a course program and teaching materials for teaching algorithmic thinking skills in all areas of preschool education, as an innovative approach for students, future teachers (Mezak et.al., 2021). Following lessons that introduced students to ways in which algorithmic thinking can be integrated into all developmental areas of preschool education, our students created a written preparation as a scenario for encouraging algorithmic thinking skills through play-based activities.

The activities within the Erasmus+ GLAT project aimed to strengthen the competences of classroom teachers to apply innovative teaching approaches using information and communication technology. Emphasis was placed on the application of game-based learning combined with other approaches such as problem-based learning, project-based learning, learning through questions to encourage logical thinking, creativity and the development of problem-solving skills in students. The teachers were introduced to the concept of game-based learning, had the opportunity to try out tools for creating learning scenarios (LePlanner) and were made familiar with different tools for creating digital teaching materials. They analyzed problem-based learning that develops logical thinking through quiz examples and logical tasks using tools Kahoot, Wizer.me, Match the memory. They were introduced to the concept of inquiry-based learning and the basic concepts of programming. They have tried out all the forms of learning mentioned with the help of educational technology in their pedagogical practice with their students and have reflected on their work.

3.1. Problem-based learning activities

As examples of good practice from the GLAT project (Table1.), we list the best learning scenarios that teachers have independently created and implemented with their students in the classroom for problem-based learning and digital storytelling. To use digital tools in the problem-solving process, teachers designed learning scenarios with problem solving and knowledge acquisition in logic games.

In the activity of designing a digital story with game elements, teachers guided their students through the process of designing a story with game elements. The children described the plot and decided on the names and appearance of the characters in the story. After researching the topic and gathering the necessary information, students also designed game elements that would allow players to develop algorithmic thinking skills (e.g., sorting games, puzzles, moving through the maze, etc.). In addition to these game elements, children were involved in defining the scene, sequencing events, and establishing logical conditions for the game. Since these were teachers from practice who did not have sufficient knowledge and skills to program independently and students in lower elementary grades, students, future computer science teachers, helped by creating digital stories in the Scratch programming language according to the instructions of the teachers and their students.

Table 1. Learning scenarios from the GLAT project.

Learning scenario Title	Subject and grade	Implementation links
Addition to 5 https://glat.uniri.hr/wp-content/uploads/2019/09/Lanca_WS2_Learning_scenario_ENG.pdf	Mathematics 1st grade	Example 1 – Mathematical warming up: https://learningapps.org/display?v=p82852wi318 Example 2 – Kahoot! Quiz: http://tiny.cc/n3v2vz Example 3 - Worksheet:https://app.wizer.me/learn/55YALZ
Months of the year https://glat.uniri.hr/wp-content/uploads/2019/09/Stambulic_WS2_Learning_scenario_ENG.pdf	Science 2nd grade	Kahoot! quiz: http://tiny.cc/s3v2vz Match the Memory game: https://matchthememory.com/mjeseciugodinimelita
Spatial orientation https://glat.uniri.hr/wp-content/uploads/2019/09/KristinaUjcicCucak_WS2_Learning_scenario_ENG.pdf	Science 3rd grade	STAPLE https://matchthememory.com/orijentacijakika TREASURE HUNT https://learningapps.org/display?v=p05tz96fn18 Kahoot! http://tiny.cc/u3v2vz Wizer.me https://app.wizer.me/learn/OY2KVJ
Nutrition http://tiny.cc/x3v2vz	Science 2nd grade	https://scratch.mit.edu/projects/325739167
The fruits of the seasons http://tiny.cc/y3v2vz	Science 1st grade	https://scratch.mit.edu/projects/326888540/
Playing and calculating up to 20 http://tiny.cc/04v2vz	Mathematics 1st grade	https://scratch.mit.edu/projects/326503995/

As examples of good practice from the ALGOLITTLE project (Table 2.), we cite written preparations designed by students, only some of which have been used in work with children. In a holistic approach, unplugged activities are designed to solve problems and promote algorithmic thinking. The goal of task design is to foster children's ability to analyze, find basic actions that lead to solving problems, and learn and work according to rules or models.

Table 2. Written preparations from the ALGOLITTLE project.

Written preparation Title	Game activities
What does the aircraft need to fly? http://tiny.cc/eyu2vz	constructive games and building games (plane, helicopter, balloon) functional games ("Fly, fly" game) symbolic games (pilot and flight attendant game) games with the rules
Why is washing your hands important? http://tiny.cc/jyu2vz	"Bacteria Memory" game dance game "This is how you wash your hands" game "Let us build a bacterium". creation and performance of the play "How to expel bacteria?"
I am the wind, I raise the air! http://tiny.cc/lyu2vz	A motor skills game "The wind can raise..." A game with cards showing the weather Interactive board "Weather conditions" Car race with plastic cups

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