INFORMATION TECHNOLOGIES AND PROJECT-BASED LEARNING

Zornitza Kaneva
Paisii Hilendarski University of Plovdiv, Faculty of Mathematics and Informatics, Department of Mathematics, Informatics and Information Technology Education, Plovdiv, Bulgaria;
zory_kaneva@abv.bg
ORCID ID: 0009-0009-5022-4321

Abstract: This report examines the role of information technologies within the context of Project-Based Learning (PBL) as a contemporary pedagogical approach aimed at developing twenty-first-century skills. The analysis focuses on the integration of digital tools into the teaching and learning process and their impact on active learning, critical and creative thinking, collaboration, and student autonomy. It also explores the principles of blended learning, in which technology does not replace traditional instruction but complements it by shifting the focus from the passive acquisition of knowledge to constructive learning.
To analyse the impact of information technologies on students' learning activities, two key indicators were examined: digital engagement and motivation and sense of belonging. Digital engagement is defined as the extent and quality of students' use of technological tools for creating, editing, and organizing learning content. Motivation and sense of belonging were assessed through a questionnaire survey and systematic pedagogical observation, with particular emphasis on students' attitudes toward school and on the role of the project in strengthening their identification with the school community.
The findings indicate that the integration of information technologies within the framework of Project-Based Learning (PBL) significantly enhances student engagement, supports effective teamwork, and contributes to the development of higher levels of intrinsic motivation. It transforms the role of the student from a passive recipient of knowledge into an active participant in the learning process, while the teacher assumes the role of a mentor who guides and oversees the appropriate use of project-based resources in accordance with established procedures and guidelines.
Furthermore, an increased sense of belonging was observed, resulting from students' opportunities to actively present and interpret their own school environment. The study confirms that combining Project-Based Learning with information technologies creates favourable conditions for deeper learning, the development of digital competencies, and the cultivation of positive attitudes toward school. Particular importance is attached to authentic assessment, which enables the monitoring of individual progress and the application of knowledge in real-world contexts.
In conclusion, it can be stated that the integration of information technologies and the development of transferable skills constitute a sustainable model for modernising the educational system and preparing students for active participation in a dynamic, technology-driven society.
Keywords: Project-Based Learning (PBL), information technologies, digital engagement, sense of belonging, student engagement.

1. INTRODUCTION

Dynamic social, economic, and technological changes in recent decades place new demands on education regarding the preparation of learners for a knowledge- and high-technology-based society. The traditional model of instruction, based on the reproduction of facts outside the context of real-world problems, is increasingly proving insufficient for developing key competencies such as critical thinking, collaboration, and digital literacy (Nikolaeva, 2008).
In this sense, project-based learning (PBL) is establishing itself as an alternative pedagogical approach that integrates knowledge, skills, and attitudes through work on authentic tasks that are meaningful to students. Despite its widespread application, discussions persist in the scientific literature regarding the degree of effectiveness of PBL and the role of technology as a mediator of the learning process (Kirilova, 2023).
This report presents an analysis of the impact of information technology applied in project-based learning (PBL), examining how it contributes to the development of 21st-century skills and enhances the quality of education (Dulyarova, 2013).
Educational technology encompasses any digital tool that facilitates the learning process, supports communication between teacher and students, enables the creation of learning materials, and develops digital competencies (Mitova, 2011).

2. MATERIALS AND METHODS

The most frequently used Microsoft products in education include Microsoft Teams for Education, which is utilized for virtual classrooms, sharing assignments and files, video conferencing, and enabling students to submit projects and homework. Other notable products include OneNote and Class Notebook, which serve as

digital notebooks and dedicated spaces for projects, notes, and graphics. Applications from the Office suite, such as Microsoft Word, PowerPoint, Excel, and Paint 3D, are also studied and utilized; these serve as classic tools for text creation, presentations, spreadsheets, drawing, modeling, and collaboration (Ministry of Education and Science, 2020).
The digital skills that fifth-grade students can develop are closely associated with various Microsoft products. These include skills for working with digital information, creating digital content, communicating in a digital environment, and collaborating with others. Furthermore, they encompass the foundations of digital literacy and safety, work organization and file management, basics of digital creativity, introductory data processing, and skills for independent learning through technology (Pecheva, 2020).

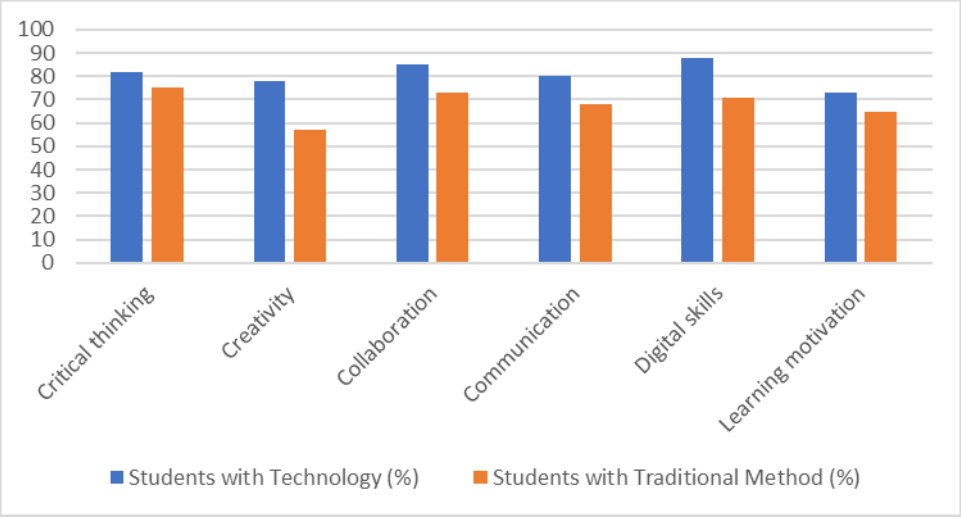
3. RESULTS

The study was conducted through a qualitative and quantitative analysis of educational practices and pedagogical models related to project-based learning (PBL) and the integration of educational technologies. Data were collected through document analysis and literature reviews, observation of instructional activities within a PBL environment, and a survey distributed to students and teachers. Informed consent was obtained from parents for all participating students (Ministry of Education and Science, 2016).
The results are presented as mean values. Statistical analysis was performed to determine the relationships between the use of information technology and student achievement (Ganev, 2026).
The study involved sixty fifth-grade students and twenty subject-area teachers. The survey questions focused on the application of technology during the implementation of PBL and its overall impact. The questions addressed key areas such as: "How does the use of technology in project-based learning support the development of critical thinking?"; "Do technology-driven projects stimulate creativity and original ideas?"; "Does project work improve collaboration skills?"; "Do educational technologies facilitate communication and the presentation of ideas?"; "Does PBL contribute to the development of digital competencies?"; and "Does project work involving technology increase learning motivation?" (Tsokov et al., 2023).

4. DISCUSSIONS

The final section of an IMRAD paper is the discussion. Its purpose is to fit the results from the current study into the preexisting fabric of knowledge. The important points will be expressed as conclusions. This should explore the significance of the results of the work, not repeat them. A combined Results and Discussion section is often appropriate. Avoid extensive citations and discussion of published literature.
Many papers are rejected by journal editors because of a fault Discussion.

Figure 1. Relationships Between the Use of Technology and Student Achievement



The depicted figure illustrates the percentage distribution of student evaluations across key indicators related to 21st-century skills and instructional quality. A comparison was drawn between the metrics of the two student groups. Across all indicators, the technology-integrated group exhibited higher values.

5. CONCLUSIONS

Analysis of the survey results demonstrates a pronounced positive attitude toward the integration of information technology within project-based learning (PBL), as reported by teachers regarding student engagement. Both

groups acknowledged a positive impact on the development of digital skills, confirming that information technology serves as an effective medium for fostering essential 21st-century competencies.

The elevated values observed across the indicators of "collaboration," "learning motivation," and "digital technologies" demonstrate that PBL creates a favorable environment for active participation, teamwork, and personal student engagement. The observed alignment between student and teacher evaluations suggests a consistent perception of enhanced instructional quality and a stronger connection between academic content and real-world experience.

The results demonstrated an increase in performance outcomes for students taught through project-based learning (PBL) with active integration of information technology. Performance indicators across two distinct student groups were observed and compared. One group received instruction incorporating technology throughout all stages of the learning process and project implementation—specifically for communication, information retrieval, project planning, digital product creation, and the presentation and evaluation of outcomes (Ilieva, 2025). The second group was taught using traditional methods, relying on books and textbooks, face-to-face meetings with oral communication, handwritten notes on paper, project presentations using physical posters, and verbal feedback.

The technology-integrated group exhibited reduced absenteeism, increased engagement and motivation, enhanced teamwork skills, and superior performance on tasks requiring information analysis and synthesis.

Authentic assessment facilitated comprehensive tracking of individual progress and provided deeper insight into student needs.

The findings of this study demonstrate that the integration of information technology into project-based learning (PBL) has a significant positive effect on the instructional process. PBL shifts the student's role from a passive recipient of knowledge to an active participant in the learning process, while the teacher is established as a mentor who oversees the rules and procedures for utilizing project-based resources.

These conclusions support modern pedagogical models oriented toward lifelong learning. Future research could focus on the long-term impact of PBL and technology on students' professional realization, as well as on the development of standardized instruments for evaluating 21st-century skills.

REFERENCES

Aleksieva, M., & Dimitrova, Z. (2025). EDUCATION IN THE CONDITIONS OF DIGITAL TRANSFORMATION AND ADAPTATION TO THE STANDARDS OF THE UNIVERSITY OF THE FUTURE. SCIENCE International Journal, 3(2), 33-37. https://doi.org/10.35120/

Dulyarova, P. (2013). Proektno bazirano obuchenie – v tŭrsene na formula za uspeh [Project-based learning – in search of a formula for success]. Pedagogika, (5), 682–689.

Ganev, K. (2026). Prilozhna statistika s R [Applied statistics with R]. Sofia University Press. https://www.uni-sofia.bg/index.php/bul/content/download/349381/2244922/version/1/file/R_book_KG_bg_final.pdf

Ilieva, S. (2025). Problemno i proektno bazirano obuchenie v ramkite na izvŭnklasna deynost "Svetlinata, bez koyato ne mozhem – problemi i resheniya" [Problem- and project-based learning within the framework of the extracurricular activity "The light we cannot do without – problems and solutions"]. Pedagogika, 97(1), 45–56.

Kirilova, B. (2023). Proektno bazirano obuchenie – adaptatsiya kŭm sŭvremennata realnost [Project-based learning – adaptation to contemporary reality]. Sofia University Press.

Ministry of Education and Science. (2015). Uchebna programa po kompyutarno modelirane i informatsionni tehnologii za V, VI i VII klas [Curriculum for computer modeling and information technologies for grades 5, 6, and 7]. https://www.mon.bg

Ministry of Education and Science. (2016). Naredba № 10 ot 1 septemvri 2016 g. za otsenyavane na rezultatite ot obuchenieto na uchenitsite [Ordinance No. 10 of September 1, 2016 on assessment of student learning outcomes]. State Gazette, (79). https://www.mon.bg

Mitova, D. (2011). Proektno orientirano tehnologichno obuchenie: teoriya i metodika [Project-oriented technological education: Theory and methodology]. Neofit Rilski University Press.

Nikolaeva, S. (2008). Teoretichni osnovi na proektno-baziranite modeli v obrazovanieto [Theoretical foundations of project-based models in education]. Annual of Sofia University "St. Kliment Ohridski".

Pecheva, I. (2020). Proektno-bazirano obuchenie i myastoto mu v uchebniya protses [Project-based learning and its place in the educational process] [Conference presentation]. National Scientific Conference, Bulgaria.

Tsokov, G., Angelov, A., Mincheva, Y., Dimova, R., & Tsakova, M. (2023). Proektno bazirano obuchenie za sotsialno-emotsionalni i tehnologichni umeniya chrez programata "Umeniya za inovatsii" [Project-based learning for social-emotional and technological skills through the "Skills for Innovation" program]. Az-buki National Publishing House.