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DEVELOPMENT OF STUDENTS' TECHNOLOGICAL THINKING THROUGH PROJECT-BASED LEARNING

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Abstract: This article substantiates, from scientific-theoretical and methodological perspectives, the effectiveness of a project-based learning approach in developing students' technological thinking in general secondary schools within the subject of Technology. The study compares project-based learning with traditional teaching methods and identifies its advantages. The findings indicate that project-based learning is a significant factor in enhancing students' independent thinking, problem-solving abilities, and readiness for practical activities.

Keywords: technological thinking, project-based learning, educational effectiveness, methodological approach, innovative education.

Introduction

One of the main tasks of the modern education system is to develop students' independent thinking, problem-solving skills, and the ability to apply knowledge in practice. In this regard, the development of technological thinking in the process of teaching Technology is becoming a relevant pedagogical issue.

The reforms being carried out in the field of education in the Republic of Uzbekistan are of great importance in this direction. In particular, issues such as modernization of the education system, introduction of innovative methods, and development of practice-oriented teaching have been raised to the level of state policy [1; 2]. At the same time, organizing the educational process on the basis of a competency-based approach requires the development of students' technological thinking.

The aim of this study is to determine the effectiveness of project-based learning in developing students' technological thinking during Technology lessons in general secondary schools[6;7].

The object of the research is the process of developing technological thinking among secondary school students, while the subject of the research consists of pedagogical opportunities for applying project-based learning in Technology education.

The novelty of the study lies in the application of project-based learning specifically for improving technological thinking skills within Technology classes in Uzbek secondary schools[8].

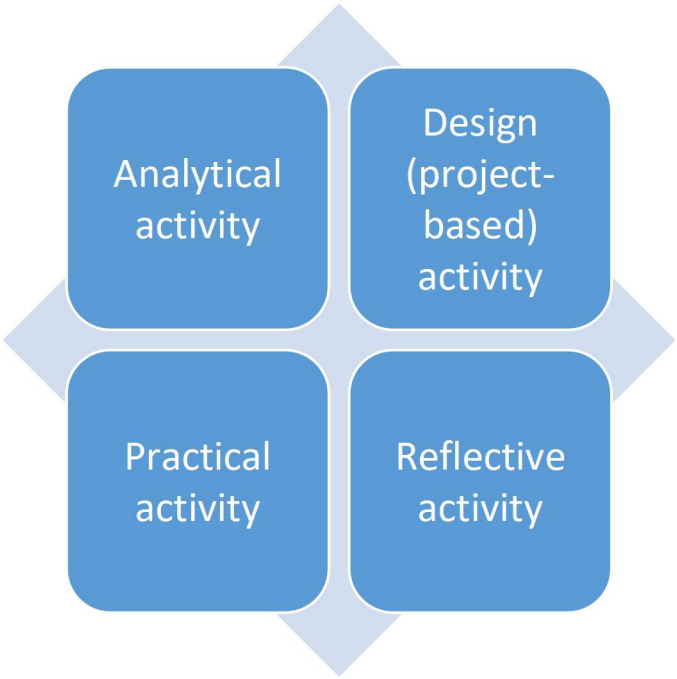
Theoretical Foundations of Technological Thinking

Technological thinking is a form of cognitive activity aimed at understanding a problem, analyzing it, developing a technical solution, and evaluating the outcome. This type of thinking contributes not only to the acquisition of knowledge but also to the formation of practical competencies in students [3; 4]. According to J. Dewey, education should be closely connected with practical activity and real-life problem solving[3]. In this regard, project-based learning creates opportunities for students to independently search for solutions, analyze technological processes, and apply theoretical knowledge in practice.

Modern pedagogical approaches also emphasize that technological thinking develops more effectively in interactive and competency-based learning environments[5;9]. Therefore,

organizing Technology lessons through project activities contributes to students' creativity, logical reasoning, and practical competence.

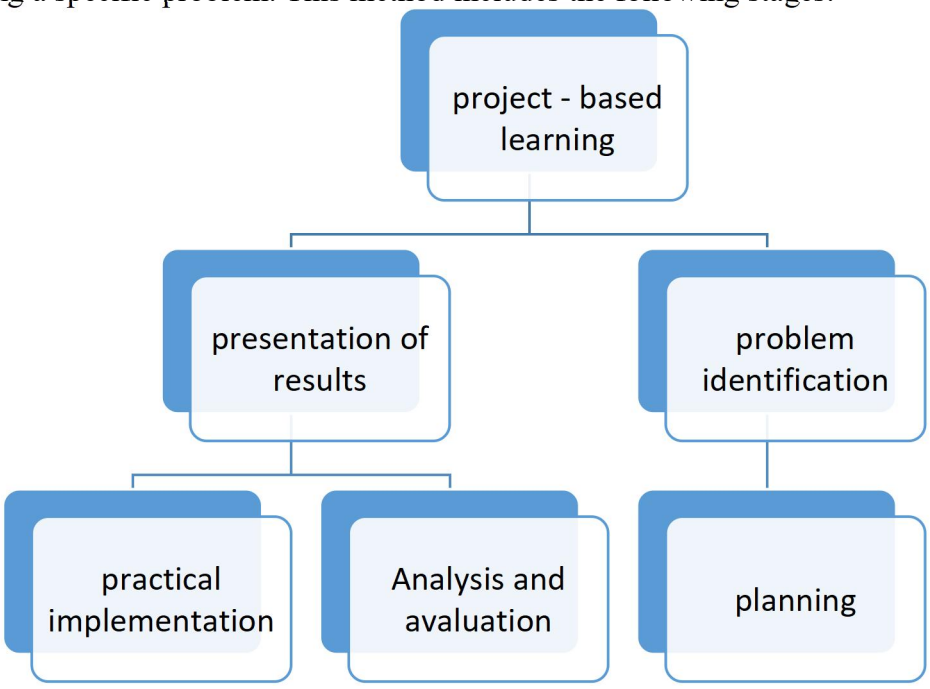
In scientific literature, technological thinking is considered to consist of the following components:



The development of these components plays a significant role in the formation of students' technological competence.

The Content of Project-Based Learning

Project-based learning is grounded in the organization of students' independent activities aimed at solving a specific problem. This method includes the following stages:



This process ensures active student engagement and contributes to the development of their technological thinking.

Research Methodology

The research was conducted at Secondary School No. 46 in Samarkand city during the 2025–2026 academic year. A total of 32 seventh-grade students participated in the study. The participants were divided into two groups: an experimental group consisting of 16 students and a control group consisting of 16 students.

In the experimental group, Technology lessons were organized using project-based learning methods, while traditional teaching methods were applied in the control group.

The study employed pedagogical observation, comparative analysis, questionnaires, and experimental research methods [5;9]. Students' technological thinking levels were evaluated according to the following criteria:

- ✓ independent thinking;
- ✓ problem-solving ability;
- ✓ practical activity;
- ✓ creative approach to technological tasks.

The experimental work was carried out over a period of two months. At the end of the study, the results of both groups were comparatively analyzed.

Comparison of teaching methods

Within the educational process, project-based learning was compared with traditional teaching methods. In traditional approaches, the teacher serves as the primary source of information, whereas in project-based learning, students function as active participants[4;5].

The results of the comparison indicate that project-based learning:

- ✓ promotes the development of independent thinking;
- ✓ fosters decision-making skills in problem situations;
- ✓ enhances practical skills [4; 5].

Results Analysis

As shown in the diagram, project-based learning demonstrates higher outcomes across all indicators. In particular, students' practical skills and level of engagement have increased significantly. This confirms the effectiveness of project-based learning in developing students' technological thinking.

The obtained results demonstrated noticeable differences between the experimental and control groups. In the experimental group, students' practical activity increased from 46% to 78%, while independent problem-solving skills improved by 31%. The assessment results were determined on the basis of observation sheets, practical assignments, and students' participation during Technology lessons.

Indicators	Experimental Group	Control Group
Independent thinking	78%	52%
Practical skills	81%	55%
Problem solving	74%	49%

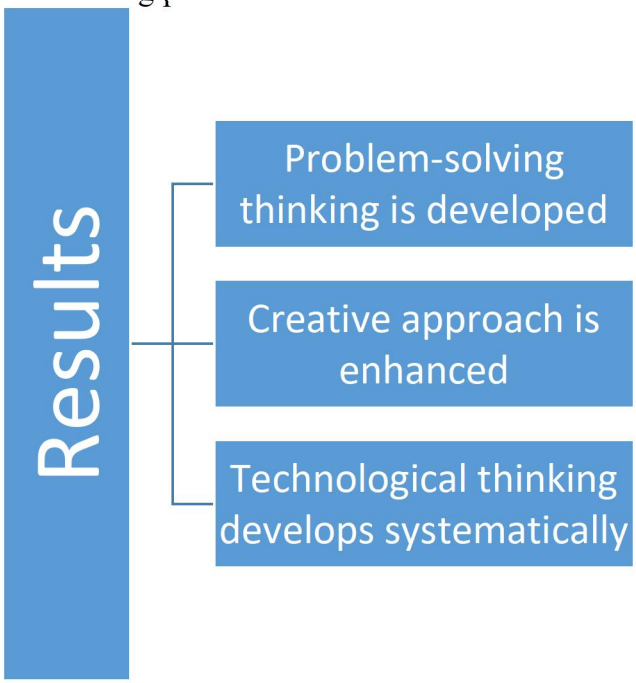
In contrast, only minor changes were observed in the control group, where traditional teaching methods were used. These findings confirm that project-based learning has a positive influence on the development of technological thinking.

Discussion

The obtained results confirm the pedagogical effectiveness of the project-based learning method. Through this approach, students do not simply acquire ready-made knowledge; rather, they gain knowledge independently and apply it in practice.

The findings of the study are consistent with modern pedagogical concepts that emphasize active and student-centered learning. Project-based learning not only improves students' technological knowledge but also develops collaboration, communication, and decision-making skills.

Moreover, the integration of practical tasks into Technology education increases students' motivation and interest in the learning process.



Conclusion

Based on the conducted study, the following conclusions were drawn:

1. Project-based learning is an effective method for developing technological thinking.
2. This method yields higher results compared to traditional teaching approaches.
3. Students' independent thinking and creative activity are enhanced.
4. The educational process is effectively integrated with practical activities.

Overall, the study proved that project-based learning can serve as an effective pedagogical tool for improving students' technological thinking in Technology education. The method creates favorable conditions for developing independent, creative, and practice-oriented learners.

Practical Recommendations

✓ It is recommended to systematically implement a project-based approach in teaching Technology.

✓ It is necessary to provide students with tasks based on real-life problem situations during the learning process.

✓ Supporting students' independent activities and encouraging their creative initiatives are essential.

✓ Particular attention should be paid to the stages of presenting and analyzing the results of activities.

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