DEVELOPING STUDENTS' HIGHER-ORDER COGNITIVE COMPETENCIES THROUGH PROBLEM-BASED LEARNING

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Abstract: This research aims at exploring the use of problem-based learning approach to enhance students' higher order thinking skills in higher education. The research was carried out on 59 students in the undergraduate level of Samarkand State Institute of Foreign Languages in mixed-method quasi-experimental design. The participants were divided into control and experimental group, with the experimental group given problem-based learning activities and the control group was given conventional instructions. Data gathering techniques included pre-test, post-test, classroom observation and reflective analysis. The results showed that the students who learned using problem-based learning showed significant improvement in analytical thinking, critical evaluation, independent thinking, problem solving and collaborative interaction when compared to students who were taught using conventional teaching methods. The study also revealed that the students were more motivated and participated intellectually in the learning process in situations where they were actively involved in real learning problems. This result has verified that the problem-based learning helps to foster higher order thinking skills and helps modern higher education to move towards more student-centered and competency-based learning.

This is a problem-based learning course that emphasizes higher order thinking skills and problem solving abilities in the context of student-centered learning and collaborative learning.

Introduction

The twenty first century is a changing time, and education is not just judged as the information that students can regurgitate at the end of an exam. In today's societies, people are needed who are able to think independently, process information critically, respond to new circumstances and find solutions to complex problems. The role of education has been changing from the mere transfer of information to the creation of higher order thinking skills as technology advances and information is readily available. These skills encompass analytical thinking, evaluation and interpretation skills, creativity, and problem solving skills, which are all thought to be important for achieving success in the academic, work and social world in today's society [1].

In higher education, this shift has gained particular importance, as universities are not just expected to impart facts, figures and theory but also to equip students with the ability to face the challenges of the real world in a flexible and intellectually independent way. Nevertheless, in spite of the increased focus on competency-based education, many educational settings continue to use traditional instruction models that are centered on lecture, listening, and rote learning. These approaches can lead to satisfactory student achievement in academic learning but are not likely to foster genuine learning or the use of learning in practical situations. Consequently, there is still a significant difference between educational attainment and cognitive readiness for professional activity [2].

To address these issues, educators and researchers are now more interested in adopting active learning approaches that involve learners more in learning. Of these, problem-based learning (PBL) has received much attention for its student-centeredness and its potential to foster higher-order thinking. PBL differs from conventional teaching methods by having students face real-world

problems where they must conduct research, work with others, critique information, and offer logical explanations for how to address the problem. The process enables learning to be more interactive and meaningful, resulting in the learner in the process of creating knowledge actively rather than passively [3].

In terms of theoretical basis for problem-based learning, there is a close relationship between problem-based learning with constructivist and sociocultural theories of learning. Constructivist approaches focus on active experience and reflection in the formation of knowledge, and the sociocultural approaches emphasize that cognitive development is necessary through interaction and collaboration. These strategies all indicate that active, open discussion of ideas and meaningful tasks will lead to learning. This type of environment drives the development of higher order thinking skills as students are encouraged to challenge their own and others' views, to assess the competing explanations, and to make connections between information from a variety of sources [4].

Studies in a range of learning environments have shown that PBL has a positive impact on students' cognition, learning motivation, and learning engagement. Students taught with this approach often develop better critical thinking skills, self- learning skills, communication skills than the traditional approach [5]. In parallel, the effectiveness of problem-based learning can be influenced by classroom organization, problem based learning facilitation, and the quality of problem based learning tasks. In this sense, additional studies are needed to understand the functioning of this approach in specific educational contexts and its contribution to the acquisition of cognitive skills of university students [6].

Methods

The present research employed a mixed-method quasi-experimental design to investigate the impact of problem-based learning on the development of students' higher-order cognitive competencies. The choice of this methodological framework was influenced by the understanding that cognitive growth is a multidimensional phenomenon that cannot be explained only through numerical indicators. Quantitative methods allowed the study to identify measurable changes in students' analytical thinking and problem-solving abilities, while qualitative approaches made it possible to observe behavioral changes, classroom interaction, collaborative engagement, and reflective learning processes. The integration of these two approaches provided a broader and more reliable understanding of how students' cognitive competencies evolved during the intervention period [7].

The research was conducted at Samarkand State Institute of Foreign Languages during the spring semester of the 2025–2026 academic year. A total of 59 undergraduate students from groups 2204, 2205, and 2206 participated in the study. These academic groups were selected intentionally because they demonstrated relatively similar educational backgrounds, language proficiency levels, and classroom performance before the beginning of the experiment. Since the research was implemented within an authentic educational setting, complete random assignment was not feasible; therefore, a quasi-experimental structure was considered the most suitable approach for maintaining ecological validity within natural classroom conditions [8].

The participants were divided into two separate categories: a control group and an experimental group. The control group continued learning through traditional instructional methods that included lectures, teacher explanations, note-taking activities, and individual written assignments. In contrast, the experimental group participated in lessons organized according to the

principles of problem-based learning. Students in this group worked collaboratively in teams, analyzed educational problems, searched for information independently, exchanged viewpoints, and attempted to construct solutions through collective reasoning. The learning process intentionally emphasized active inquiry, reflection, communication, and independent decision-making [9].

At the beginning of the research process, all participants completed a diagnostic pre-test designed to evaluate the existing level of their higher-order cognitive competencies. Unlike traditional achievement tests focused on factual recall, this assessment concentrated on analytical reasoning, interpretation, evaluation, and problem-solving skills. Students were required to examine educational situations, compare ideas, justify conclusions logically, and propose possible solutions to open-ended tasks. The purpose of this stage was to establish a reliable baseline for comparing the cognitive development of both groups during the intervention process [10].

The intervention phase lasted for eight weeks, from February to March 2026. During this period, the experimental group participated in structured problem-based learning sessions integrated into their regular coursework. Each session started with the presentation of a realistic and intellectually challenging problem situation connected to the lesson topic. Students were intentionally not provided with immediate explanations or ready-made answers. Instead, they were encouraged to identify the nature of the problem independently, discuss possible interpretations, and determine what additional information was necessary to understand the issue more deeply. This process created a learning environment characterized by inquiry and intellectual exploration rather than passive reception of information [11].

After identifying the problem, students worked collaboratively in groups consisting of four or five participants. During these discussions, learners exchanged perspectives, questioned assumptions, analyzed alternative explanations, and refined their ideas through interaction. Such collaborative engagement played an important role in stimulating higher-order cognitive processes because students were required not only to express opinions but also to defend them logically and critically evaluate the viewpoints of others. Throughout this process, the teacher acted primarily as a facilitator who guided discussion through reflective questions and supportive feedback while avoiding direct instruction whenever possible [12].

Another important stage of the intervention involved self-directed inquiry and information analysis. Students searched for academic materials, online educational resources, and theoretical explanations relevant to the problems under discussion. They were expected to evaluate the reliability, relevance, and applicability of the information before integrating it into their solutions. This stage contributed significantly to the development of independent learning abilities and critical information evaluation skills, which are considered essential elements of higher-order cognitive competence in modern education [13].

Meanwhile, the control group continued studying identical academic content through conventional instructional approaches. The lesson duration, curriculum content, and assessment procedures remained consistent in both groups to maintain methodological reliability. The primary difference between the groups was therefore limited to the instructional strategy itself. Maintaining such consistency was essential for ensuring that any observed differences in outcomes could reasonably be attributed to the implementation of problem-based learning rather than external educational variables [14].

At the end of the intervention period, both groups completed a post-test structurally similar to the initial diagnostic assessment. The post-test aimed to identify changes in analytical thinking, reasoning ability, interpretation, and problem-solving competence. In addition to quantitative assessment data, classroom observations and reflective notes were collected throughout the research process. These qualitative materials documented patterns of engagement, collaboration, participation, and independent inquiry demonstrated by students during learning activities. The integration of quantitative and qualitative findings provided a more comprehensive understanding of how problem-based learning influenced students' cognitive development over time [15].

Results and Discussion

The findings obtained during the experimental phase of the study demonstrated noticeable differences between the control and experimental groups in relation to the development of higher-order cognitive competencies. At the beginning of the research, both groups showed relatively similar levels of analytical thinking, interpretation ability, and problem-solving performance according to the diagnostic pre-test results. Most students initially relied on memorized information and demonstrated difficulty when required to evaluate unfamiliar situations critically or generate independent solutions. However, gradual changes became increasingly visible during the eight-week intervention period, particularly among students who participated in problem-based learning activities [16].

One of the most significant outcomes observed in the experimental group was the improvement in analytical reasoning. During the first weeks of the intervention, many participants struggled to identify the core elements of complex educational problems and often expected direct guidance from the teacher. Nevertheless, as collaborative discussions and inquiry-based activities continued, students became more confident in examining information independently and constructing logical interpretations. Classroom observations revealed that learners gradually shifted from passive acceptance of information toward active questioning and reflective analysis. By the end of the intervention period, students in the experimental group were more capable of identifying relationships between concepts, evaluating multiple perspectives, and defending their conclusions with clearer reasoning compared to the control group [17].

The post-test results also indicated a measurable improvement in problem-solving performance among students exposed to problem-based learning. While the control group demonstrated moderate progress primarily associated with content familiarity and repetition, the experimental group showed stronger development in tasks requiring interpretation, evaluation, and decision-making. Many participants became more comfortable dealing with open-ended questions and ambiguous learning situations where there was no single correct answer. This suggests that repeated engagement with authentic educational problems contributed to the strengthening of higher-order cognitive processes and encouraged students to rely on deeper intellectual strategies rather than memorization alone [18].

A particularly important observation concerned student interaction and collaborative learning behavior. In the experimental group, classroom discussions became increasingly dynamic as students gained experience working in teams. At the beginning of the research, communication within groups was often limited, and several participants hesitated to express their viewpoints openly. Over time, however, students demonstrated greater willingness to participate in discussions, challenge assumptions, and respond critically to the ideas presented by their peers. Such collaborative engagement created an environment where learners were continuously exposed

to alternative perspectives, which stimulated cognitive flexibility and reflective thinking. Research on active learning environments similarly emphasizes that interaction and dialogue are essential conditions for the development of critical reasoning and intellectual independence [19].

The motivational dimension of learning also changed considerably throughout the intervention period. Questionnaire responses and classroom observations suggested that students in the experimental group experienced higher levels of academic engagement and interest compared to those in the traditional learning environment. Many participants reported that problem-based tasks felt more meaningful and intellectually stimulating because they reflected realistic situations rather than isolated theoretical exercises. Students appeared to value the opportunity to participate actively in the learning process instead of functioning solely as recipients of information. This increased motivation may partly explain the stronger cognitive outcomes observed within the experimental group, as educational psychology research consistently associates active engagement with deeper learning processes [20].

Comparative Results of Cognitive Competency Development

Cognitive Competency	**Control Group Pre-test (%)**	**Control Group Post-test (%)**	**Experimental Group Pre-test (%)**	**Experimental Group Post-test (%)**
Analytical Thinking	51	61	50	82
Problem Solving	48	58	49	85
Critical Evaluation	46	57	47	80
Independent Reasoning	52	60	51	84
Collaborative Discussion	55	63	54	88

Table 1. Comparative analysis of higher-order cognitive competency development before and after the intervention period. The results indicate that both groups demonstrated some degree of academic improvement over time; however, the experimental group exposed to problem-based learning showed significantly greater progress across all measured competencies. The most visible differences were observed in problem-solving ability, collaborative discussion, and independent reasoning, suggesting that active inquiry and group interaction played an essential role in strengthening higher-order cognitive processes. Another noteworthy finding involved the development of independent reasoning skills. Initially, many students depended heavily on teacher approval before expressing conclusions or proposing solutions. As the intervention progressed, learners in the experimental group gradually became more autonomous in their thinking and demonstrated greater confidence in defending their arguments. They increasingly relied on evidence gathered through inquiry and discussion rather than repeating textbook explanations. This transition from teacher-dependence toward intellectual autonomy represents one of the central goals of student-centered education and reflects the broader objectives of higher-order cognitive development [21].

The findings also revealed that problem-based learning influenced students' attitudes toward uncertainty and complexity. In traditional classroom settings, learners often expect tasks to have clear instructions and predetermined answers. During the intervention, however, students in

the experimental group became more comfortable working with ambiguous situations that required interpretation and negotiation. Instead of perceiving uncertainty as an obstacle, many participants began to treat it as an opportunity for exploration and inquiry. This psychological shift is particularly important because higher-order thinking frequently develops through engagement with complex and non-routine problems rather than through repetitive exercises [22].

Despite these positive outcomes, several challenges were identified during the implementation process. Some students initially experienced difficulty adapting to the demands of self-directed inquiry and collaborative problem solving because they had previously been educated within highly teacher-centered environments. A small number of participants also expressed discomfort with open-ended tasks during the early stages of the intervention. However, these difficulties gradually decreased as students became more familiar with the structure of problem-based learning and developed stronger communication and inquiry skills. This adaptation process suggests that successful implementation of innovative pedagogical approaches requires both time and continuous instructional support [23].

The results of the study indicate that problem-based learning created more favorable conditions for the development of higher-order cognitive competencies than traditional instructional methods. The combination of inquiry, collaboration, independent analysis, and reflective discussion encouraged students to engage more deeply with knowledge and strengthened their ability to interpret, evaluate, and apply information in meaningful ways. These findings support contemporary educational perspectives emphasizing that cognitive development is most effective when learners actively participate in constructing understanding rather than passively receiving information.

Conclusion

The findings of this study demonstrate that problem-based learning plays a significant role in the development of students' higher-order cognitive competencies within higher education environments. Unlike traditional instructional methods that mainly emphasize memorization and passive reception of information, problem-based learning encourages active inquiry, collaboration, independent reasoning, and critical analysis. Throughout the experimental process, students exposed to problem-based learning showed stronger improvement in analytical thinking, problem-solving ability, reflective reasoning, and academic engagement compared to learners in the control group. The results also revealed that collaborative discussion and authentic educational problems created favorable conditions for deeper intellectual involvement and more meaningful learning experiences. Although several students initially experienced difficulty adapting to student-centered learning practices, most participants gradually developed greater confidence and autonomy in their thinking processes. Overall, the research confirms that problem-based learning represents an effective pedagogical approach for strengthening cognitive development and preparing students for complex academic and professional challenges in modern educational contexts.

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