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## Improving students' cognitive processes to enhance the quality of education

**Abstract:** This article discusses the problem of improving the quality of students' knowledge by improving their cognitive processes in the educational environment. The purpose and content of the modern educational paradigm are to focus on the free and comprehensive development of future generations, self-education, competitiveness, successful life as a business person, the education of students, their quality of education, and the education of a responsible, humane citizen. Much research is being carried out in this direction. However, the problems of improving students' cognitive processes and improving their knowledge quality require particular study. There are contradictions between the definition of pedagogical conditions for the development of cognitive processes of students and the need to determine their effective ways. The authors found that the concept of cognitive has different meanings. Improving students' cognitive processes at an early age can significantly improve the quality of knowledge. Various research methods were used, including a theoretical analysis of literature, an express questionnaire, and a question-and-answer questionnaire "designed to improve the cognitive processes of students." The studied questions in this article will be helpful for those who are engaged in the education and upbringing of students, including parents and teachers, as well as psychologists and sociologists.

**Keywords:** Cognition, education, student, learning theory, cognitive processes.

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### Introduction

The methodical basis of the theory of education was the theory of knowledge, i.e., the theory of the comprehensive and harmonic formation of the pupil's character. According to this theory, education and teaching are considered specially organized activities. One educational theory's main requirement in teaching students is cognitive activity and awareness (Amirova, 2014; Gasanova et al., 2020). Fulfillment of this requirement is reflected in the student trying to understand the teaching content, connect the past with the new, determine the main and supplementary, use the acquired knowledge through experience, and base his opinion on it. Conscious mastery of knowledge is impossible without mastering one's mental work methods, allowing one to acquire new knowledge independently (Borisova, 2013; Kassymova, 2018). Existing studies

often contrast the cognitive processes of input and output. They examine their respective roles in language acquisition. There is no opposition between inputting and outputting (Qiyi, 2009). Input is the key and prerequisite of learning, and output is the guarantee. They are inseparable and complementary. However, the input cannot be spontaneously transformed into the output, and the learners must go through a series of cognitive processes from the input to the output.

Today, individuals must have skills and abilities appropriate for their age (Hebebcı, 2023; Hebebcı & Usta, 2022). One of the most critical skills is cognitive. Developing cognitive skills is essential for lifelong learning and survival in any emergency; it is crucial to open up the full cognitive potential of every learner, as each person is unique (Casanova et al., 2021; Tiffany, 2022). Human cognition consists of several processes (Samuel et al., 2017; Tiffany, 2022), such as perception, attention, memory, working memory, pattern recognition, real-life problem-solving abilities, and academic achievement. In order to process learning and achieve an educational goal, in addition to the learning process, there are several factors such as good sleep, diet, various vitamins (iodine, iron, folate, zinc, vitamin B12, and omega-3 polyunsaturated fatty acids), physical exercise, etc., which have a positive impact on healthy cognitive development since childhood (Tiffany, 2022).

Digitally supported learning opportunities have proliferated in educational contexts, and many students rely on the Internet to continue their education for self-development and school contexts (Duman, 2023; Hebebcı et al., 2020). Research results show that newly developed online programs are built on modern digital tools but require more focused content and a different focus than traditional learning scenarios (Rohdeet al., 2023). Digital education is conducive to tapping students' implicit cognitive potential and promoting students' ability to proactively, persistently, and quickly solve problems (Chunming, 2020). The interest in students' cognitive activity is developed based on the need to understand the social meaning of education and increase the service rate to society. The most effective manifestation of activity is the student's ability to use the acquired knowledge in life and practice effectively. This arises from the requirement to form a cognitive process in the student's activity during education. If we analyze the pedagogical and psychological literature, the term "cognitive" is based on the concept of activity. Cognitive action is a very active mental action of the learner toward knowledge (Tlegenova, 2012). Cognition is an integral part of a person's mental activity and part of a research study of philosophy, sociology, pedagogy, and psychology. There are components of cognitive activity and levels of its development (Korobova et al., 2018). It consists of cognitive needs, logic, goals, and action methods. Cognition is also seen as an essential characteristic of culture (The newest philosophical dictionary, 1999). The cognitive process is a concept that a single symbol cannot represent and has many multifaceted characteristics. Korobova et al. (2018) found that cognitive activity is an intensive learning process that meets the life needs of an individual; his/her professional career is determined by cognitive activity at different levels of the training period. For example, through the cognitive activity of "coordinate" problem-solving, students can experience the cognitive process of the holistic characteristics of graphics and cultivate their mathematical literacy (Liu, 2022).

Cognition is defined as a characteristic of an individual that reflects a person's attitude to action by being ready to act independently, striving to achieve set goals, and being able to choose optimal ways. Thus, activity in education is not only the condition of the learners but also the quality of education. We mean the personality expression of the learner determined by his attitude to the content and nature of the activity, his efforts, and his desire to achieve spiritual and free cognitive goals.

Integrating cognitive processes and educational practices holds significant promise for enhancing the quality of education. Cognitive load theory, for example, emphasizes the importance of reducing the cognitive burden on learners to facilitate higher cognition processes and improve the quality of online discussions (Cook, 2006). Educators can provide students with practical strategies to improve higher cognitive processing by incorporating collaborative problem-solving and cognitive tools into online discussion environments. Some Chinese scholars put forward the three-cycle teaching model of "cognition-practice-cognition," which recognized the critical position of cognition and practice in teaching activities (Jin, 2005). Furthermore, by modeling experts' cognitive processes, educators can help students transfer problem-solving skills to new situations (Mayer, 1998). These approaches highlight the potential of integrating cognitive processes into educational settings to maximize learning outcomes and foster the development of critical cognitive skills among students.

In the Kazakhstani educational evaluation system, there is a growing emphasis on Criteria-based assessment, which encompasses both formative and summative assessments (Begimbetova et al., 2023). Formative assessment involves providing ongoing feedback and monitoring students' progress to support their

learning and development. The summative assessment evaluates students' achievement and proficiency at the end of a unit and module. "Evaluation" of the cognitive process includes checking and judging two small cognitive processes. Verification means that learners determine whether there is a problem with the internal consistency of an operation or scheme based on standards or guidelines. Evaluation means that learners determine whether an operation or program meets the requirements of external consistency based on external standards or guidelines (You, 2016). To ensure the effectiveness of these assessments, it is essential to create tasks that primarily target cognitive skills, aligning with Bloom's taxonomy.

Bloom's taxonomy (Table 1) provides a hierarchical structure for organizing cognitive processes into distinct levels. The taxonomy includes various levels, such as remembering, understanding, applying, analyzing, evaluating, and creating (Krathwohl, 2002). Each level represents a progressively higher order of cognitive engagement. By utilizing measurable verbs associated with these levels, educators can establish clear expectations for students and facilitate the practical assessment of their learning outcomes. This approach enhances instructional design by emphasizing specific actions that students must demonstrate, ultimately leading to a more focused and comprehensive educational experience.

**Table 1.** Bloom's taxonomy measurable verbs associated with each level

Level	Description	Measurable Verbs
Remembering	Recalling or retrieving information	List, Define, Identify, Recall, Recognize
Understanding	Interpreting and comprehending information	Explain, Summarize, Paraphrase, Classify, Compare, Contrast
Applying	Applying knowledge or skills in a new context	Solve, Demonstrate, Use, Apply, Illustrate
Analyzing	Breaking down information and identifying patterns or relationships	Analyze, Compare, Contrast, Differentiate, Organize, Deconstruct
Evaluating	Assessing or making judgments about information or concepts	Evaluate, Critique, Justify, Assess, Determine
Creating	Generating new ideas or products	Create, Design, Invent, Compose, Construct, Develop

**Research problems** in this study aimed to study the concept of cognition and improve the quality of education by developing students' cognitive processes.

**The research goal** of this study is to determine the level of formation of students' cognitive processes in the current educational environment.

## Method

### Research Design

This study uses research design types for both qualitative and quantitative research. Methods such as theoretical analysis of the literature on the research topic and questionnaires were used. Materials, views of teachers, and various scientists on "cognitive activity" were considered and studied. The authors also created questionnaires for identifying what factors influence the cognitive development of school students and how to enhance education quality.

### Participants

This research includes secondary school students in Chemistry subject. They were randomly chosen to collect data. The participants consisted of 12 female and 9 male students.

### Data collection tools

According to this research, different sources were reviewed to identify a research gap and to create a questionnaire. Ten survey questions and two open proposal questions "for improving students' cognitive processes" were compiled by the authors, and participants responded via online Google form.

### Data analysis

Descriptive analysis methods were used to analyze the data obtained. In this direction, values such as frequency and percentage were used. In addition, some of the data obtained from the participants were transferred as they were.

### Results and Discussions

Ancient philosophers such as Aristotle, Socrates, Democritus, Abu Nasir al-Farabi, Yusip Balasagun, etc., deeply learned about knowledge; they studied the First Cause of existence (Freeman, 1983; Baird, 2010). In many works, one can find opinions about the importance of the development of cognitive processes for human life (Bekbolganov, 2007).

Piaget proposed a four-staged level of cognition development starting from birth to the end of adolescence. He studied a sequence of thinking patterns with four key features, such as stages always happening in the same order; each is a significant transformation of the stage before it (Cognitive Development: The Theory of Jean Piaget, 2023). Siegler (1976) studied developmental differences in children's cognition as three aspects of cognitive development. Problem-solving skills by existing knowledge and information perception are underlying developmental changes as a third aspect of cognitive development. R.G. Lemberg, N.D., studied various aspects of cognitive development. Ivanova, A.E. Abylkasymova, G.K. Akhmetova, T.S. Sadykov, Sh.Sh. Karbaeva, N. D. Khmel, M.N. Skatkin, K. Zharykbaev, etc., in many pedagogical and psychological scientific works. While reviewing the scientific research, it is possible to single out the recognized innovative pedagogical direction. Yu.K. Babansky proposed a system for optimizing education. At the same time, M.A. Danilov and B.P. Esipov made a didactic classification of teaching methods that form the cognitive process in solving the students' cognitive tasks (Belyaeva, 2003).

Later, several works by Aristova (1968), Lerner (1974), Shamova (1977), etc., tried to distinguish between these concepts. B.P. Yesipov, V.A. Krutetskyy, and others considered the concept of cognition to be a broader concept (Ormanova, 2009). I.Ya. Lerner held the opposite opinion about the relationship between the concepts of cognitive activity and cognitive curiosity. He said, "You cannot be inquisitive without being active," and thus attributed activity to inquisitiveness (Mustoyapova, 2003; Tuyakov, 2009). A recent book chapter stated that such four main links are complex and dynamic:

- Curiosity, which is a children's active exploration by asking questions;
- Wonder, which is emphasized affective response, reflection, and pursuit of further knowledge;
- Creativity, which discusses capacities such as generating ideas, original transformations, and novel combinations;
- Relationship between curiosity, wonder, and creativity.

Bazhydai Westermann (2020) suggested future research to understand their interrelations as they unfold developmentally.

Students' achievement in good learning results stimulates their cognitive activity (Deryabina & Sergeichik, 2020). It is primarily a need for new information and ideas about the world. The activity reflects a certain degree of inquisitiveness in the student's mind (Ezhov et al., 2013). Cognitive activity is a desire to master new skills correctly (Abukhanova, 2007; Abuova, 2007). It is also a mental action of the learner toward new knowledge (Asaubaeva, 2010). Cognitive activity activates all higher cognitive processes of a learner from the level of their development, leading to constant search as a result of the person's attempt to reconstruct reality (Amirova, 2014). Communicative tasks are essential; teachers control students' learning development (Nazarova, 2021). Table 2 provides different definitions in detail and analyzes the concept of "cognitive activity" by various scientists.

**Table 2.** Content analysis of “cognitive activity.”

Definitions	Sources by
The teacher's responsibility is to advise students in personal development and motivate them since the joy of achieving good results stimulates their cognitive activity.	Deryabina & Sergeichik (2020).
The cognitive need is primarily a need for new information. However, new information can appear in different forms: new knowledge about a	Ezhov, Bologova, Nebolyubova (2013)

thing, new knowledge about something new, motivation for something new, and a system of new ideas about the world.	
The activity reflects a certain degree of inquisitiveness in the student's mind.	Abukhanova (2007)
Cognitive activity is not attributed to simply mobilizing the student's mind and physical strength; it is valued as the quality of the individual's actions. This quality is the content and attitude of the student's actions and the desire to master knowledge correctly. It is reflected in the mobilization of behavior.	Abuova (2007).
Cognitive action is a very active mental action of the learner towards knowledge. It consists of cognitive needs, logic, goals, and action methods.	Asaubaeva (2010)
The relationship of cognitive activity with a particular field of science, cognitive activity, participation in them, and cognitive relationship with participants are becoming essential. At the same time, cognitive activity to activate all higher cognitive processes of a person from the level of their development leads to constant search due to the person's attempt to reconstruct reality.	Amirova (2014)
One possible way to activate students' cognitive activity is to set communicative tasks in the learning process, which must be carried out with the teacher's prompting, guidance, and control and contribute to the speedy and successful achievement of the planned learning outcome.	Nazarova (2021)

The following questionnaire for improving students' cognitive processes was conducted among school learners in grade 9; the subject is chemistry. It contains five answers and two open questions where learners can suggest their ideas for effective learning styles. The results obtained based on the questionnaire for improving students' cognitive processes were as follows:

1. To understand the new material that the teacher is lecturing, is it necessary to listen attentively, read books, and conduct experiments in a laboratory on one's own to expand the given knowledge?

*47.4% of the respondents indicated that self-searching is very necessary, 36.8% indicated that it is only partially necessary, and a small number of respondents answered yes, it is necessary.*

2. How do you study, and what sources do you often use to improve your knowledge?

*The vast majority (52.6%) answered that they use the Internet. The remaining 36.8% said they use books, while a small percentage said they look at additional literature and find it difficult to answer.*

3. So that the lesson does not become an empty lesson in the life of students, it should be interesting.

*89.5% of the respondents indicated that they believed the lesson should be interesting; the remaining few said they had difficulty answering and disagreed.*

4. Is every lesson exciting and essential to you?

*47.4% of students think it is exciting, 26.3% say it is only partially interesting, 15.8% say they do not know, and 10.5% say yes.*

5. Do you find it challenging to solve tasks given in class?

*47.4% said no, it is not difficult at all, 31.6% said it is more complicated, others said it is challenging to answer, and yes.*

6. Can you solve simple problems with different tasks?

*42.1% said they could ejaculate quickly, 47.4% indicated that they could ejaculate only partially, and the remaining few answered no.*

7. Do you want to do research work in the future?

*31.6% said that they would like to do it, 31.6% said that they are not very interested, 15.8% said that they are only partially interested, and the remaining few answered that they are not interested at all; I do not know, it is difficult to answer.*

8. Will it help to improve the student's cognitive processes by organizing extracurricular, individual work, scientific works, and additional literature?

*57.9% said it helps very well, 26.3% said it partially helps, and the rest had difficulty answering.*

9. The number of tasks given to each student should be adjusted to his level so that the student has his level. Do you agree with this?

*68.4% agreed with the question, 15.8% partially agreed, and the remaining few disagreed.*

10. Is it necessary to improve cognitive activity in class?

*73.7% said yes, it is essential, and the rest of the respondents gave critical answers: partially necessary; I do not know, yes, definitely, yes necessary.*

11. What is needed to increase knowledge in education to raise the quality of education? Make your suggestions, please.

- *Students left the following suggestions and thoughts on the question:*
- *Reading books, memorizing notes;*
- *It is better to shorten the lesson with many quiz games;*
- *It is necessary to use the Internet and books;*
- *In my opinion, necessary videos and slides should be shown to improve the lesson, or it is necessary to show cartoons about exciting facts. For example, the cartoon "Smeshariki" is full of information about biochemistry;*
- *You should listen carefully to the teacher;*
- *I think it is necessary to read a book;*
- *I think an excursion or a subject-related laboratory is needed;*
- *Changing the way of conducting classes;*
- *Adding additional materials, etc.*

12. What is needed to improve the quality of education in order to increase awareness? Make your suggestions, please.

- *Respondents left the following answers:*
- *Reading books, writing notes, and memorizing;*
- *To improve the quality of education, it is necessary to understand the lesson well and be proactive;*
- *Read many books, read extra information besides the textbook;*
- *Making the lesson enjoyable;*
- *Be interested in new information and strive for knowledge;*
- *Open special classrooms and conduct various engaging lessons, etc.*

Through the results of this questionnaire, we can find out their open thoughts about the modern teaching technologies used to increase the cognitive activity of students. The questionnaire results allow us to conduct a pedagogical experiment to improve students' cognitive skills in teaching. According to the questionnaire results obtained while improving students' cognitive processes in this study, most students showed the need for independent research on "Mastering new material." According to "improving knowledge," students' most frequently used sources are Internet sources and books in the second place. Regarding how important it is to make the lesson enjoyable, the students said it should be exciting.

"What is needed to raise awareness and raise the quality of education?" - Various excursions, additional materials, quiz questions, games, etc., gave many exciting ideas. "Making simple calculations" was easy for a few respondents and difficult for most respondents. "Doing scientific work in the future" is attractive to a small part of the respondents, while the majority said that they are not very interested.

"Literature helps to improve the student's cognitive processes" - most indicated that it helps very well. "What is needed to increase knowledge in education, to improve the quality of education?" - said that it is essential to make the lesson enjoyable, to open special classrooms, to conduct various exciting lessons, and to increase the necessary information. In the "Determining the student's level" question, most said that assigning tasks to each student at their level was correct, while a small number disagreed. "Cognitive activity" - to the question of how much improvement is necessary, the majority said it is essential. In contrast, a few respondents said they do not know or that it is partially necessary.

## **Conclusions**

To sum up, cognitive development depends on education and several external factors such as healthy nutrition, physical activities, sleeping, etc., starting from childbirth. Integrating cognitive processes into educational practice and aligning assessments with Bloom's taxonomy suggests a prospective way to maximize learning outcomes, develop critical thinking skills, and create an enriched learning environment for students. This integration can significantly contribute to improving the quality of education and student learning outcomes.

For students' cognitive development, questionnaire results showed that academic tasks should be assigned according to a student's abilities and skills. Solving cognitive problems increases the ability to think and develops students' intellectual skills. The development of cognitive processes depends on the activity of students. This task is critical to correctly forming active behavior in the future. Cognitive problem-solving is a cognitively active process. These tasks contribute to the formation of cognitive motives of students; that is, they use their existing knowledge and achieve insufficient information through creative search.

## **Recommendations and limitations**

Over the past several decades, research in education psychology has provided many principles for developing instructions to mediate human cognitive processes (Clark & Harrelson, 2002). This study is limited to a literature review and an online survey, so the authors recommend that teachers use teaching methods without stress in the classroom that generate human learning processes, including attention, perception, emotional management, and short-term and long-term memories.

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