

# Factors And Mechanisms For Developing Logical Thinking Abilities In Future Specialists

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**Received:** 30 March 2026; **Accepted:** 25 April 2026; **Published:** 18 May 2026

**Abstract:** This article highlights the main factors and pedagogical mechanisms for developing logical thinking abilities in future specialists based on the analysis of scientific literature. During the research process, local and foreign sources related to pedagogy, psychology, and modern educational technologies were analyzed, and the importance of logical thinking in the intellectual development of individuals and the formation of professional competencies was revealed. Based on scientific sources, the factors influencing the development of logical thinking, including the educational environment, interactive methods, problem-based learning, information and communication technologies, and the role of independent learning, were analyzed. Furthermore, the mechanisms for developing analytical and critical thinking in students, integrating them with practical activities, and the effectiveness of innovative pedagogical approaches were substantiated on the basis of scientific views. The article also develops pedagogical conditions and methodological recommendations aimed at improving the logical thinking abilities of future specialists.

**Keywords:** Logical thinking, future specialist, pedagogical mechanism, educational factors, critical thinking, interactive methods, problem-based learning, pedagogical technologies, professional competence.

**Introduction:** At present, the issue of consistently implementing the most effective methods, tools, approaches, and strategies for teaching in order to develop logical thinking abilities in future specialists has become especially relevant. By its nature and essence, logical thinking is considered an integrative intellectual quality that embodies all other aspects of a specialist's thinking. One of the most important modern requirements placed on specialists in today's education system is not only to provide learners with knowledge, but also to stimulate their thinking activities and teach them to make independent decisions in problematic situations.

In traditional educational processes, the teacher mainly performed the function of delivering and demonstrating information. However, under the conditions of the rapid and dynamic changes of the 21st

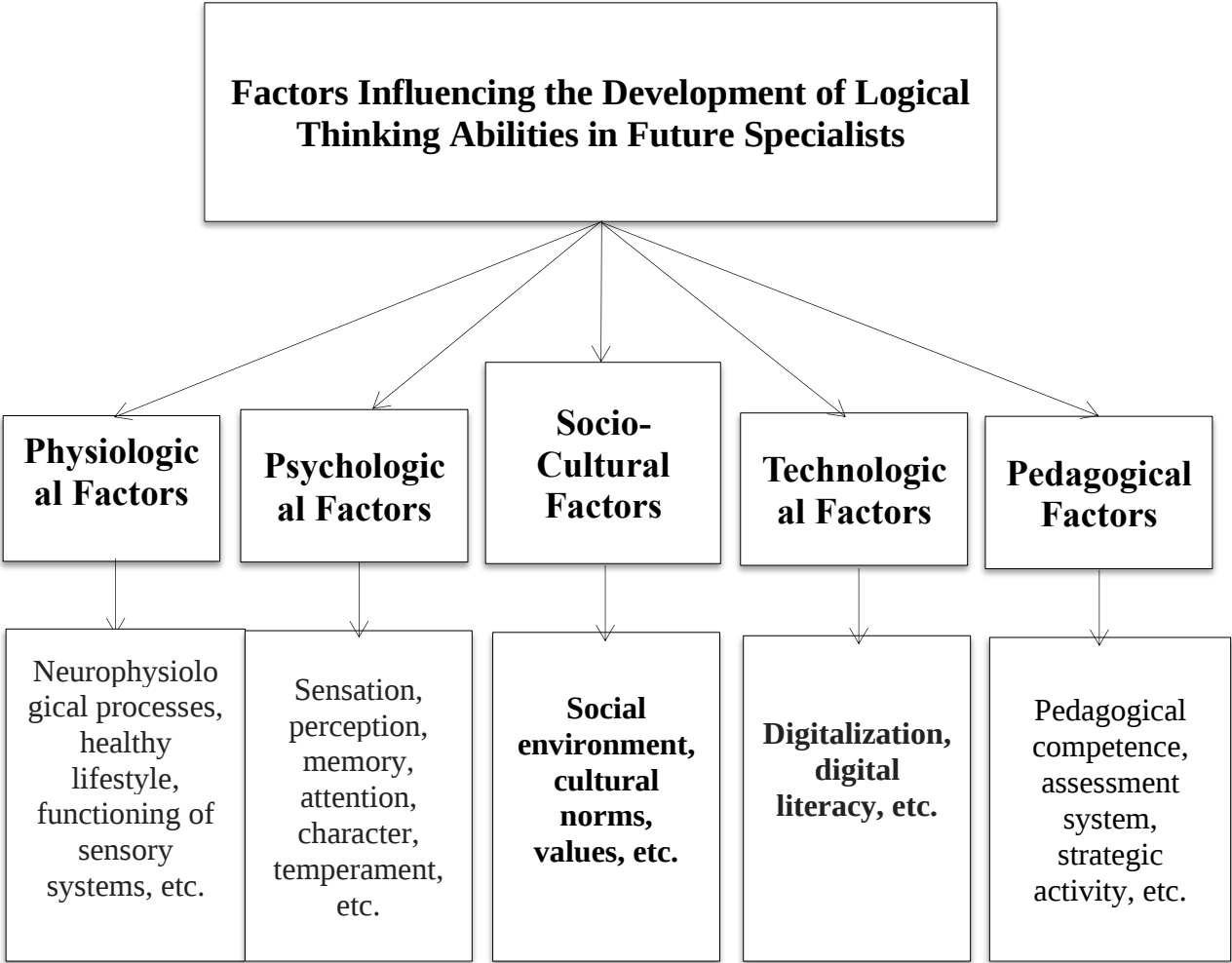
century, the main task in the field of education is directed toward developing future specialists' ability for independent learning. In this process, the primary goal should be to engage each future specialist in education according to a specific direction so that they can realize their identity, form their life position, demonstrate their creative potential, and develop the ability to logically evaluate their own activities and views.

This task becomes even more significant in the process of teaching physics. Physics is not only a theoretical science but also an experimental science. This requires future specialists to correctly understand the logical relationships between theory and experiment. Therefore, logical thinking appears as a central and decisive factor in the effective implementation of these processes.

There are several factors influencing the development

of logical thinking abilities in future specialists, and the structure and elements of these factors are presented in the following diagram (Figure 1.1).

particularly sleep quality, nutritional habits, and physical activity—play an important role in the development of logical thinking abilities in future specialists. These factors directly influence cognitive (mental) abilities required for consciously approaching



**Figure 1.1. System and elements of factors influencing the development of logical thinking abilities in future specialists.**

The above-mentioned factors influencing the development of logical thinking abilities in future specialists are of great importance in achieving the intended goal when studied in a systematic and interrelated manner. This is because these factors manifest in the life and professional activity of every future specialist as a mutually complementary, interdependent, and unified holistic system. Below, we provide a detailed analysis of the impact of these factors on the development of logical thinking abilities in future specialists.

**Physiological Factors**

A range of closely interrelated physiological factors—

complex problems and making well-founded decisions. Despite the significance of physiological factors in developing logical thinking abilities among future specialists, the lack of sufficient specialized research focused on the interrelationship of these factors indicates the existence of an empirical gap. This situation is considered one of the priority and promising directions for future scientific research. Therefore, in addressing the development of logical thinking abilities in future specialists, physiological factors should also be taken into account in a comprehensive and systematic manner.

**Psychological Factors**

The development of logical thinking abilities in future specialists is closely connected with various psychological factors. In particular, although understanding the mechanisms of interaction between attention and logical thinking may be complex, the ability to concentrate plays a key role in deeply understanding problems, thoroughly analyzing information, and evaluating it objectively and rationally. Insufficient development of attention may lead to the weakening of logical thinking processes and the formation of superficial conclusions. The ability of future specialists to maintain sustained attention strengthens the connection with learning content, enhances their analytical thinking when facing complex problems, and facilitates correct decision-making.

Memory, as one of the psychological factors, also facilitates the effective storage and manipulation of information in complex cognitive tasks, enabling the integration of multiple knowledge elements required for solving important problems.

Taking into account the psychological qualities necessary for the development of logical thinking abilities in future specialists is essential for achieving the research objectives. Based on the analysis of numerous studies in this field, the psychological qualities required for developing logical thinking abilities in future specialists, along with their brief descriptions, roles in logical thinking, and manifestations, are presented in the following table (Table 1).

**Table 1.**

**Psychological trait | Brief description | Main role in logical thinking | Manifestation**

| <b>Psychological trait</b>      | <b>Brief description</b>                                                                                          | <b>Main role in logical thinking</b>                                                                                          | <b>Manifestation</b>                                                                               |
|---------------------------------|-------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|
| <b>Metacognitive regulation</b> | An individual's ability to plan, monitor, control, and evaluate their own thinking process.                       | It ensures that thinking proceeds in the right direction and helps to identify errors and revise conclusions.                 | Checks one's own thinking, identifies errors, and is able to change the problem-solving approach.  |
| <b>Analytical ability</b>       | The ability to break down a problem or phenomenon into parts and identify the logical relationships between them. | It forms the basis of analysis, comparison, identifying cause-and-effect relationships, and drawing well-founded conclusions. | Distinguishes facts, differentiates between primary and secondary features, and analyzes evidence. |
| <b>Working memory</b>           | The ability to hold and manipulate multiple pieces of information and relationships in the mind simultaneously.   | It enables thinking while maintaining complex judgments, arguments, and logical chains in mind.                               | Retains multiple conditions in mind, integrates evidence, and maintains the continuity of thought. |
| <b>Cognitive flexibility</b>    | The ability to view a problem from different perspectives and adjust one's thinking based on new evidence.        | It enables seeing alternative solutions, overcoming one-sided thinking, and ensuring logical adaptability.                    | Reconsiders ideas, adopts new approaches, and compares multiple alternatives.                      |

|                           |                                                                     |                                                                                                  |                                                                                       |
|---------------------------|---------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| <b>Inhibitory control</b> | The ability to restrain hasty, impulsive, or stereotyped responses. | It helps to stop initial incorrect assumptions and arrive at a reasoned and verified conclusion. | Does not rush to respond, verifies evidence, and regulates emotional decision-making. |
|---------------------------|---------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|

Considering the aspects presented in this table is of significant importance in the development of logical thinking abilities in future specialists.

### Socio-Cultural Factors

Socio-cultural factors, particularly the social environment and cultural influences, have a significant impact on the development of logical thinking abilities in future specialists. First and foremost, the family is considered the first school of logical thinking. Young people raised in families where there is a culture of exchanging ideas and discussion tend to observe life events more deeply and form an independent position regarding various situations. In contrast, authoritarian family upbringing based on unquestioning obedience limits logical reasoning and hinders the development of personal reflection within the context of social opinions.

A future specialist is formed as an individual within a broader social space. Social institutions such as the neighborhood, school, mass culture, and peer groups directly influence their worldview and thinking style. A society in which young people's opinions are respected, where a culture of debate and discussion exists, and where pluralistic views are welcomed creates a favorable environment for the development of logical thinking. Otherwise, in environments where young people are criticized for expressing their opinions or where social pressure is strong, conformity rather than sound logical reasoning tends to prevail.

### Technological Factors

Technological factors, particularly digital technologies, play an important role in expanding opportunities for effectively using various information sources and establishing interactions in new formats, thereby developing future specialists' analytical and reflective abilities. At the same time, while technological tools broaden access to reliable knowledge and strengthen certain cognitive skills, they may also create a dynamic of information dependency that weakens future specialists' ability for independent analysis.

Moreover, the form and intensity of interaction with digital technologies can transform thinking processes, either enhancing or limiting the development of critical thinking. Therefore, the process of digitalization in education should not be interpreted merely as a positive step forward, but rather as a complex pedagogical phenomenon that reshapes the logical thinking abilities of future specialists.

Consequently, there is an objective need today to develop pedagogical strategies that ensure a balance between future specialists' metacognitive skills and their level of digital technology use. While the purposeful and methodologically grounded use of digital tools can enhance analytical and evaluative skills, their application without sufficient pedagogical mechanisms may lead to technological dependency and a decline in logical thinking capacity.

### Pedagogical Factors

The influence of pedagogical factors in developing logical thinking abilities in future specialists manifests as an integrated system. This is because the knowledge and guidance aimed at shaping the positive impact of the factors discussed above are themselves essential components of the pedagogical process. However, a distinctive feature of pedagogical factors in developing logical thinking abilities lies in the creation of a creative learning environment based on innovative pedagogical strategies that enable students to face complex situations and find optimal solutions.

Such pedagogical strategies encourage active participation of future specialists in the learning process and provide essential conditions for logical thinking, such as "self-questioning," "free expression of one's own point of view," and "constructing solutions to problems."

In the development of logical thinking abilities of future specialists, "collaborative activity" is an important pedagogical factor, turning the classroom into a space for discussion and reflection. It enables students to

analyze, compare, and justify different perspectives on the same topic, thereby contributing to the gradual improvement of their thinking abilities. The use of paradoxes in classroom activities plays an important role in stimulating problem-solving skills and conscious decision-making in future specialists.

In addition, the use of digital technologies in classroom processes is another factor that positively influences the development of logical thinking. The integration of interactive tools and digital platforms ensures more flexible and dynamic learning, enabling future specialists to access information, reflect on it, and make decisions based on logical analysis.

The factors influencing the development of logical thinking abilities in future specialists do not operate separately, but rather function as an integral and interrelated system. In particular, physiological preparedness ensures psychological stability; socio-cultural openness contributes to the formation of a free-thinking environment in the pedagogical process; and technological opportunities further enhance the effective integration of these factors. The integrative-cognitive approach precisely considers these factors as a unified whole, taking into account the role and functional significance of each in the process of developing logical thinking.

In order to increase the influence and effectiveness of pedagogical factors in the development of logical thinking abilities in future specialists, it is important to apply specific and purpose-oriented pedagogical approaches focused on logical thinking within the current curricula of higher education institutions. This, in turn, not only improves students' academic performance but also strengthens their cognitive abilities and logical inclinations, creating a foundation for the development of fundamental competencies that enable them to solve complex problems across various fields of knowledge.

A systematic analysis of physiological, psychological, socio-cultural, technological, and pedagogical factors influencing the development of logical thinking abilities in future specialists from different perspectives leads to the conclusion that, in practice, these factors should be approached as a single, integrated system. At the same time, among these factors, the pedagogical factor—and the proper organization of the pedagogical process

directly associated with it—represents the main research problem addressed in this dissertation. The effective implementation of this process requires the development of a clearly defined, comprehensive, and goal-oriented system of pedagogical mechanisms. In this regard, it is first necessary to clarify the concept of “mechanism.”

A “mechanism” is a scientific concept that refers to the factors and structural components ensuring the effective functioning of a certain process or system, representing the interconnected system of causes, means, stages, and conditions that produce results. Thus, a mechanism is an internal “operating scheme” that explains the principles of functioning of any phenomenon, process, or system.

“Pedagogical mechanisms are practical methods used by teachers and educators for studying and developing learners' competencies.” However, a pedagogical mechanism is not merely a method or a tool; rather, it is a complex of factors that drives the pedagogical process.

Based on the above, it can be stated that pedagogical mechanisms constitute the internal driving system of pedagogical activity. They ensure the achievement of pedagogical goals through the coordinated functioning of pedagogical principles, educational tools, technologies and methods, conditions, and assessment criteria between the teacher and the learner. They play a central role in enriching the learning process, directing activity, and activating logical thinking. A future specialist with developed logical thinking is capable of analyzing ideas, providing arguments, logically evaluating information, comparing opposing viewpoints, solving problems, and drawing conclusions.

Based on the above aspects of general pedagogical mechanisms, it is necessary to clarify what constitutes the system of pedagogical mechanisms for developing logical thinking abilities in future specialists.

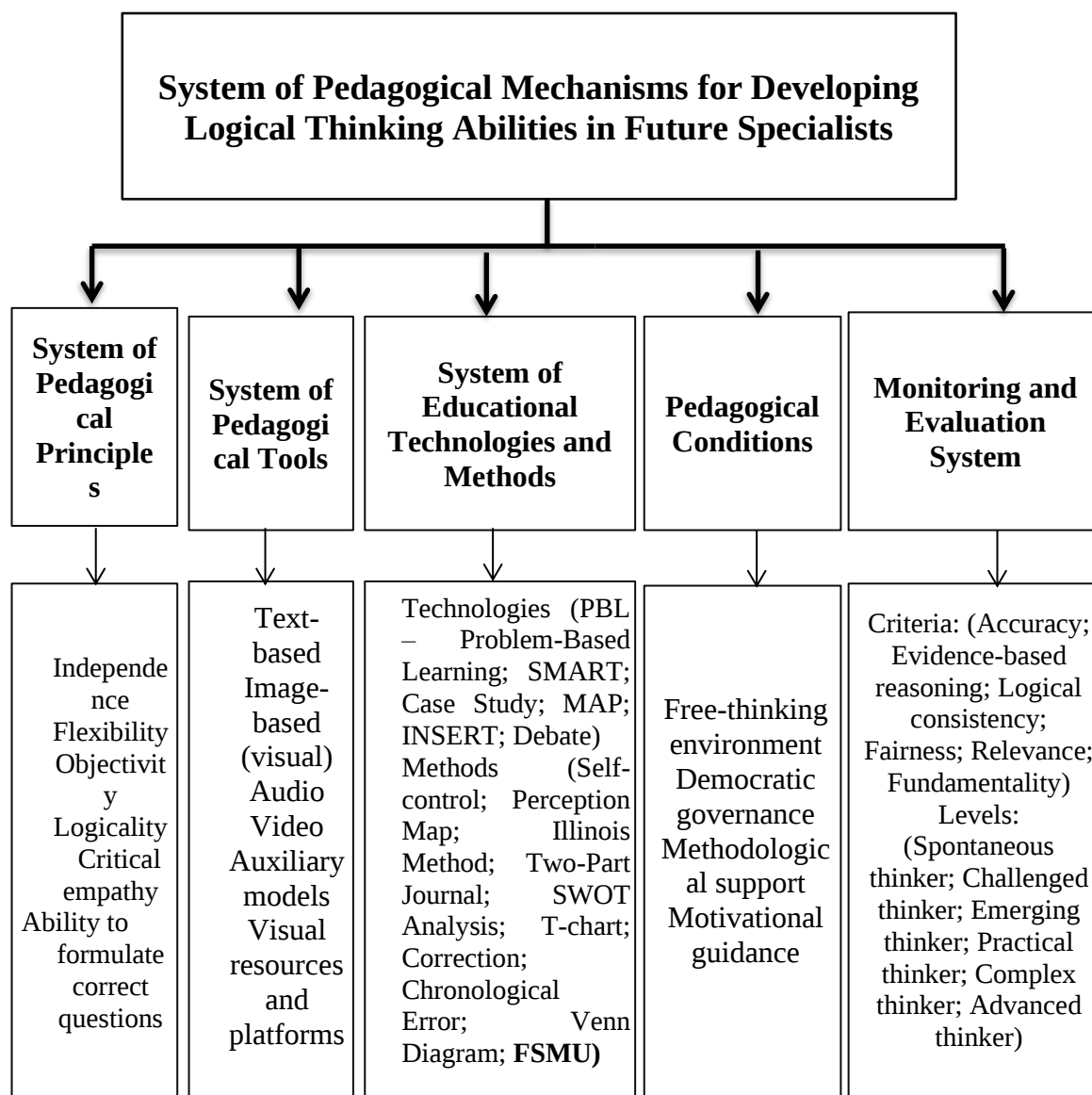
A number of studies have been conducted on pedagogical mechanisms for developing logical thinking, in which various important ideas and approaches aimed at improving pedagogical mechanisms have been proposed. In particular, T. Kh. Ismailov emphasizes that “successful mechanisms for developing creative and logical thinking are directly related to cognitive approaches, interactive

methodologies, reflective activity, and digital pedagogy, where these mechanisms must function in harmony within a modern pedagogical model.”

In addition, S. Rubinstein, F. Minkina, V. Popkov, I. Morochenkova, N. Merzlikina, Y. Kukushkina, N. Plotnikova, I. Berdnikova, O. Semenova, V. Bednenko, A.

Koroleva, T. Klimova, and Y. Koreshnikova have proposed important concepts related to pedagogical principles, tools, educational technologies, methods, pedagogical conditions, and various assessment approaches that constitute the pedagogical mechanisms for developing logical thinking in future specialists.

Based on the study of existing approaches and technologies, the system of pedagogical mechanisms for developing logical thinking abilities in future specialists can be presented as follows (Figure 3):



**Figure 3. System of pedagogical mechanisms for developing logical thinking abilities in future specialists and its elements**

The pedagogical mechanisms for developing logical thinking abilities presented above are integrated with their own distinctive features. Since the process becomes effective only when all mechanisms complement each other, this system should be

regarded as a complex structure whose components cannot fully replace one another. Each mechanism has its own specific function, and when they operate in a coordinated and algorithmic sequence, they ensure maximum effectiveness. Therefore, their balanced and

purposeful application in the pedagogical process plays a key role in developing logical thinking abilities in future specialists. The importance of pedagogical mechanisms lies in ensuring the internal organization and functioning of the educational process, as well as in monitoring and effectively managing it. As a result, this contributes to training specialists with logical thinking abilities that ensure the quality and independence of education and guarantee high outcomes.

The components of the pedagogical mechanisms system for developing logical thinking abilities in future specialists, as presented above, along with the methodological possibilities for their direct implementation in the educational process, will be discussed in detail in the next chapter of the dissertation.

## CONCLUSION

In conclusion, logical thinking is not merely a set of knowledge, but a culture. It is formed as a result of the harmonious integration of the social environment, family, national values, and the educational process. Therefore, for the development of logical thinking, openness, respect for diversity of opinions, and readiness for discussion and analysis at every socio-cultural level should be considered key criteria. Only under such conditions is it possible to train specialists who possess logical thinking abilities, demonstrate an active civic position, and express their opinions in a reasoned and culturally appropriate manner.

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