

QUALIMETRIC ASSESSMENT OF STUDENTS' LOGICAL THINKING BASED ON AN INTEGRATIVE APPROACH

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Abstract: This article analyzes modern approaches to developing and evaluating students' logical thinking from scientific-theoretical and practical perspectives. In particular, the possibilities of forming students' logical thinking skills are highlighted by ensuring various interdisciplinary connections based on an integrative approach. The study developed criteria, indicators, and assessment indicators to determine the level of students' logical thinking based on the qualimetric assessment methodology. Additionally, the effectiveness of integrative methods, interactive technologies, and diagnostic tools used in the educational process is substantiated through experimental analysis.

Keywords: logical thinking, integrative approach, qualimetry, qualimetric assessment, pedagogical diagnostics, indicators, interactive methods, quality of education

Introduction

The modern education system defines the formation of independent, critical, and logical thinking skills in students as a priority task as a key factor in the development of human capital. In the context of globalization, digital transformation, and the sharp increase in information flow, the acquisition of knowledge in a simple reproductive way is not enough; the ability to analyze, generalize, and apply it in practical situations is becoming increasingly important. Therefore, the development of students' logical thinking in higher educational institutions, its assessment on a scientific basis, and its monitoring are emerging as an urgent pedagogical problem.

Traditional assessment systems are often focused on the volume of knowledge and cannot fully reflect the student's thinking process, analytical approach, and decision-making competence in problem situations. This strengthens the elements of subjectivity in determining the quality of education. An integrative approach is of particular importance in solving this problem. This is because integration serves to assimilate knowledge as an integrated system by strengthening interdisciplinary connections and, as a result, creates an opportunity for the comprehensive development of the student's logical thinking process.

At the same time, the need to evaluate educational outcomes on a clear, objective, and scientific basis requires a qualimetric approach. Qualimetric assessment is an effective methodology that allows for the quantitative and qualitative determination of pedagogical process results and their measurement through criteria and indicators. Especially in the assessment of complex intellectual competencies such as logical thinking, the qualimetric approach ensures the accuracy, reliability, and validity of the assessment.

This article covers the theoretical and methodological foundations of developing students' logical thinking based on an integrative approach and its qualimetric assessment. Issues regarding the development of criteria, indicators, and assessment indicators to determine the level of students' logical thinking and their implementation into practice will also be discussed. This

approach serves the systematic organization of the educational process, the improvement of assessment mechanisms, and the development of students' intellectual potential.

Based on an integrative approach, qualimetric assessment is a system for evaluating students' knowledge, skills, competencies, and thinking activities not only within a single discipline but also in harmony with interdisciplinary connections, practical situations, independent analysis, and the ability to draw logical conclusions. In such an assessment, an important criterion is considered not only the extent to which the student remembers theoretical knowledge but also their ability to apply it in various contexts, compare evidence, identify cause-and-effect relationships, logically solve the problem, and justify their opinion.

The integrative approach provides systematicity to the assessment process. For example, if a student's logical thinking is evaluated in connection with philosophy, mathematics, pedagogy, psychology, social work, information technology, or professional disciplines, their level of thinking will be much deeper. Because real-life problems are usually not solved within the boundaries of a single discipline. If a student combines knowledge gained from various disciplines, analyzes the situation, identifies the causes of the problem, and proposes an optimal solution, it indicates that their level of integrative thinking has been formed.

Qualimetric assessment allows for the measurement of this process based on specific criteria, indicators, and scores. Qualimetry serves to evaluate educational outcomes qualitatively and quantitatively. In this case, each competence or skill is divided into specific indicators. For example, when assessing logical thinking, indicators such as "analysis," "comparison," "generalization," "argumentation," "conclusion," and "problem solving" are identified. According to each indicator, the student's performance can be assessed as low, medium, good, or high.

The main advantage of qualimetric assessment based on an integrative approach is that it reduces subjectivity in assessment. In traditional assessment, the teacher often places a grade based on the overall impression or final answer. In qualimetric assessment, the assessment is based on pre-developed criteria. For example, a student receives a special score for correctly identifying a problem, a special score for providing evidence, a special score for demonstrating interdisciplinary connections, and a special score for drawing conclusions. As a result, the assessment becomes transparent, fair, and analytical.

Criteria play an important role in this evaluation system. When assessing students' logical thinking, it is advisable to use the following criteria: cognitive criterion, analytical criterion, integrative criterion, practical-activity criterion, and reflexive criterion. The cognitive criterion indicates the student's level of knowledge of theoretical concepts and their comprehension. The analytical criterion evaluates the student's ability to analyze events and processes, identify important features, and determine cause-and-effect relationships. The integrative criterion represents the ability to see the connection between various disciplines, concepts, and life situations. The practical-activity criterion determines the ability to apply knowledge in problem situations. The reflexive criterion determines the student's ability to evaluate their own thinking process, realize their mistakes, and revise their conclusions.

When implementing qualimetric assessment into practice, it is necessary to clearly develop evaluation indicators. For example, on the "analysis" indicator, a student receives a high score if they can distinguish the main parts of the problem, identify their causes, and provide a logical

explanation. According to the “Comparison” indicator, he must be able to compare two or more events based on their similarities and differences. The "Argumentation" indicator indicates the student's level of ability to substantiate their opinion with facts, scientific concepts, or practical examples. The “Integration” indicator assesses the ability to combine knowledge from various disciplines into a single conclusion.

In such an approach, assessment acts not only as a means of final control but also as a developing pedagogical mechanism. That is, through the results of the assessment, the student sees which aspects of themselves are strong and which are weak. On this basis, the teacher has the opportunity to correct the further educational process, provide individual assignments, and determine the trajectory of the student's intellectual development.

Based on the integrative approach, qualimetric assessment can be organized in the following stages. First, the purpose of the assessment is determined. Next, the components of logical thinking competence are defined. Subsequently, criteria and indicators are developed for each component. At the next stage, an assessment scale is established, for example, from 0 to 5 points or from 0 to 100 points. Subsequently, diagnostic tasks, tests, case studies, essays, project work, problem-based questions, and practical situations are prepared. At the end, the results are analyzed and the level of logical thinking of the student is determined.

Case studies are of particular importance in this assessment system. This is because case studies force the student to apply their theoretical knowledge in a practical situation. For example, a social problem, a pedagogical situation, or a professional dilemma is presented. The student analyzes this situation, identifies the problem, explains its causes, proposes solution options, and justifies the most optimal solution. Such tasks allow for the simultaneous assessment of logical thinking, decision-making, argumentation, and integrative analysis skills.

The use of rating maps, assessment sheets, and rubrics is also effective in qualimetric assessment. The rubric serves to evaluate the student's work based on specific criteria. It specifies the level of requirements for each criterion. For example, “high level” - a student deeply analyzes a problem, substantiates interdisciplinary connections, and draws independent conclusions; “medium level” - the student understands the main idea, but makes some shortcomings in argumentation; "low level" - the student explains the problem superficially and cannot fully reveal the logical connection.

Based on an integrative approach, qualimetric assessment develops not only logical thinking but also independent learning, critical analysis, communicative culture, a creative approach, and reflexive competencies. This is because in such an assessment, the student does not repeat a ready-made answer, but reflects on the problem, searches for evidence, compares, draws conclusions, and defends their position. As a result, the educational process transforms from reproductive learning into constructive, research-oriented activity. Based on this approach, qualimetric assessment is an effective, objective, and developmental mechanism for assessing students' logical thinking in modern higher education. It strengthens interdisciplinary connections, clarifies evaluation criteria, allows for a comprehensive analysis of a student's intellectual activity, and serves to improve the quality of education.

Discussion

The issue of qualimetric assessment of students' logical thinking based on an integrative approach is one of the most pressing areas in today's higher education process, possessing not

only theoretical but also practical and methodological significance. This is because in modern education, there is a growing need to assess a student's level of knowledge not through simple memorization or repetition, but through the ability to analyze, generalize, explain, justify, and apply knowledge in problem situations. From this perspective, the combination of an integrative approach and qualimetric assessment allows for the comprehensive determination of a student's intellectual potential.

In traditional assessment systems, the student's final answer is often considered the primary criterion. In this case, the internal mechanisms of the thinking process - that is, how the student analyzed, what evidence they relied on, and what logical connections they were able to see - are not sufficiently evaluated. Qualimetric assessment eliminates this shortcoming and allows for the measurement of logical thinking by dividing it into components. For example, when indicators such as analysis, comparison, identification of cause-and-effect relationships, argumentation, generalization, and inference are defined as separate indicators, the evaluation process becomes more precise and transparent.

An important aspect of the integrative approach is that it directs the student's knowledge toward viewing it as an integrated system rather than within the framework of individual disciplines. Logical thinking is inherently interdisciplinary in nature. This is because in solving a problem, a student relies not only on a single theory but also on the knowledge, concepts, and experience gained from various disciplines. For example, when analyzing a pedagogical situation, the student must take into account psychological patterns, social factors, didactic principles, and ethical criteria. Thus, the integrative approach brings logical thinking closer to real-life and professional situations.

Another important aspect of the topic under discussion is ensuring the objectivity of the assessment. In qualimetric assessment, each criterion is expressed through specific indicators. This reduces the influence of the teacher's subjective views. For example, instead of the general assessment "the student answered well," the assessment is carried out based on specific indicators such as "the student correctly identified the problem," "justified the cause-and-effect relationship," "showed interdisciplinary connections," and "made an independent conclusion." As a result, the student also understands which aspect of himself is superior and which aspect needs to be developed.

The interconnection of cognitive, analytical, integrative, practical-activity, and reflexive criteria is of great importance in assessing students' logical thinking. While the cognitive criterion expresses the student's level of mastery of theoretical concepts, the analytical criterion indicates their ability to process these knowledge through mental operations. The integrative criterion demonstrates the student's level of use of various knowledge sources and interdisciplinary connections. The practical-activity criterion determines the ability to apply knowledge in real or simulated situations. The reflexive criterion is related to the student's ability to control, evaluate, and improve their own thinking process.

In particular, the importance of the reflexive criterion deserves special attention. This is because logical thinking is not only the execution of an external task, but also the process of internal control over one's own thoughts, the ability to see mistakes, evaluate the adequacy of evidence, and revise conclusions. If a student is able to understand the strengths and weaknesses of their opinion, they will be ready for independent learning, self-development, and a critical

approach. Therefore, in the qualimetric assessment system, it is advisable to use tools such as reflection tasks, self-assessment sheets, portfolios, and analytical essays.

In qualimetric assessment based on an integrative approach, case studies, problem-based questions, project work, analytical essays, conceptual maps, and interactive tests serve as effective tools. Such tasks reveal not only the student's knowledge but also their way of thinking. For example, in a case study, a student identifies a given problem, analyzes its causes, proposes several solution options, compares them, and substantiates the most optimal option with evidence. Almost all components of logical thinking are actively involved in this process.

During the discussion, it should also be noted that evaluation indicators must be clear, measurable, and substantiated in content. If the indicators are too generic, the assessment may become subjective again. For example, the indicator "the student thinks well" is not sufficient for scientific assessment. Instead, indicators such as "a student can distinguish between primary and secondary causes of a problem," "substantiates their opinion with at least two arguments," and "combines knowledge from various disciplines into a single conclusion" are more accurate and easy to evaluate.

The effectiveness of this approach lies in the fact that it combines diagnostic, developmental, and control functions within the educational process. The diagnostic function determines the student's current level of logical thinking. Based on the assessment results through the developmental function, methodological work aimed at strengthening the student's weaknesses is determined. The control function verifies the compliance of educational results with the established criteria. Consequently, qualimetric assessment serves not only as a means of evaluation but also as a mechanism for managing the quality of education.

However, there are certain problems with the practical implementation of qualimetric assessment based on an integrative approach. First, teachers are required to have methodological training in developing criteria and indicators. Secondly, to ensure interdisciplinary integration, curricula, topics, and assignments must be harmonized. Third, it is important to avoid excessive formality in the evaluation process. Because the goal of qualimetric assessment is not to fill out many documents, but to accurately and fairly assess the intellectual development of the student.

The possibilities of using digital technologies in the evaluation process are also of great importance. Electronic rubrics, online tests, automated monitoring systems on educational platforms, electronic portfolios, and analytical programs allow for the systematic recording, comparison, and analysis of student results. This increases the speed, accuracy, and transparency of the assessment. Digital monitoring tools are particularly effective for the step-by-step monitoring of logical thinking dynamics.

Qualimetric assessment based on an integrative approach is also significant because it is aimed at developing the student's personality. In this case, the student is viewed not as an object of evaluation, but as an active participant. They familiarize themselves with the evaluation criteria in advance, verify their work based on these criteria, and participate in the evaluation of themselves and their groupmates. This process fosters a culture of responsibility, independence, critical thinking, and self-development in students.

This approach is directly linked to the competency-based approach in education. This is because competence is not just a set of knowledge, but an integrated expression of knowledge, skills, experience, attitudes, and practical actions. Logical thinking also has a similarly complex

character, which cannot be fully assessed through test questions alone. Therefore, the qualimetric assessment system requires the harmonious use of various assessment tools. Qualimetric assessment based on an integrative approach creates a qualitatively new stage in assessing students' logical thinking. It focuses assessment on the process rather than the result; it analyzes the thinking strategy rather than the student's response; and it evaluates interdisciplinary knowledge as an integrated system rather than an individual unit. Therefore, this approach can be recognized as an effective pedagogical mechanism for improving the quality of education in higher education, strengthening the intellectual independence of students, and preparing them for modern professional activities.

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