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METHODOLOGICAL AND CONTENT FOUNDATIONS OF EXPERIMENTAL TRIALS FOR SHAPING INDUCTIVE AND DEDUCTIVE THINKING THROUGH A CLUSTER-BASED APPROACH IN HIGHER EDUCATION

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ABSTRACT

This article presents the theoretical, content-related, and methodological foundations for developing students' inductive and deductive thinking in higher education through the use of a cluster-based approach. The scientific–didactic essence of the cluster approach, its place in the educational process, and its effectiveness in shaping types of thinking are substantiated scientifically. The stages of experimental trials, methodological tools, and mechanisms for organizing learning tasks on a cluster basis are also described. Based on the research results, it is proven that the cluster approach develops students' analytical, reflective, and logical thinking skills.

KEYWORDS

Cluster-based approach, inductive thinking, deductive thinking, higher education, methodology, reflection, analytical thinking, innovative teaching, pedagogical experiment, intellectual development.

INTRODUCTION

In the present era, higher education is aimed at enhancing human intellectual potential, fostering independent and reflective thinking, and developing skills for analytical and logical decision-making. Processes of globalization and digital transformation are bringing fundamental changes to the content and forms of education, requiring it to be organized not merely as a mechanism for transmitting knowledge, but as a complex system that cultivates higher levels of thinking. Therefore, developing inductive and deductive thinking on the basis of a cluster approach in higher education practice is regarded as one of the modern methodological directions of personalized, competency-based instruction. This approach creates an effective pedagogical foundation for activating students' thinking, teaching them to reason logically, and to think in a consistent, analytical manner.

The cluster-based approach is a concept for organizing the educational process on the basis of content, logical, and systemic units. In the didactic process, the notion of a "cluster" is interpreted as an integrative model that combines interrelated knowledge, skills, and abilities. This approach ensures the logical structure of the learning material, guides the learner's active cognitive process, and strengthens interdisciplinary connections.

Scholarly sources (J. Bruner, D. Kolb, R. Marzano, J. Hattie, L. Vygotsky) emphasize that cluster teaching is grounded in the theory of cognitive constructivism. According to this theory, knowledge is not simply taught; it is mastered through personal experience, analysis, and reflection. Such an approach shapes the learner not as a passive recipient of knowledge, but as

an active knowing subject. Thus, the cluster approach transforms the educational process from hierarchical structures into an interactive and reflective networked system.

The main functions of the cluster model are as follows:

- to present educational content in a block-structured manner;
- to systematize and generalize the knowledge being studied;
- to develop students' thinking processes in logical sequence;
- to create a reflective learning environment.

Such an approach increases educational effectiveness, as it activates learners' cognitive activity and supports the consistent development of stages of thinking.

Inductive thinking is the process by which a person arrives at general regularities through observation, comparison, analysis, and generalization. This type of thinking teaches the student to draw independent conclusions and to analyze the essence of phenomena. Through an inductive approach, the student forms personal intellectual experience and develops a logically grounded system of knowledge.

Deductive thinking, by contrast, is directed toward finding practical solutions to specific situations on the basis of general theoretical rules. It develops skills of logical justification, deriving conclusions from regularities, and making decisions based on analysis. In deductive thinking, the student tests general theoretical knowledge in specific cases and applies it to real-life situations.

From a scientific-pedagogical standpoint, inductive and deductive thinking are dialectically interrelated. Induction ensures analysis and generalization in thinking, while deduction enables synthesis and practical application. Therefore, integrating these two types of thinking in higher education creates opportunities for the comprehensive formation of students' logical, analytical, and creative thinking.

The experimental trials were conducted in a higher education institution as a scientific-pedagogical experiment and implemented in three stages:

1. Preparatory stage — the aims and tasks of the study were identified, and experimental and control groups were formed. At this stage, the instructional material was reorganized on a cluster basis and methodological tools were developed.
2. Practical stage — a system of tasks that develop inductive and deductive thinking based on a cluster approach was introduced into instruction. A reflective environment was formed for students, and tasks aimed at collaborative learning and independent analysis were applied.
3. Analysis and evaluation stage — the dynamics of students' thinking development were assessed on the basis of measurement criteria, and the results were analyzed statistically.

Methodologically, the content of learning activities was modeled as follows:

- Inductive tasks — observation, comparison, analysis of a problem situation, identification of general regularities;
- Deductive tasks — application of general theoretical knowledge to specific practical situations;
- Integrative tasks — finding comprehensive solutions in problem situations by combining both types of thinking.

Such an integrated methodology activates the learners' cognitive process and directs them toward independent analysis and reflection.

During the experimental trials, the content of academic subjects was reorganized on the basis of three types of clusters:

1. Theoretical cluster — a logical block of knowledge that includes core concepts, regularities, ideas, and principles within the discipline.
2. Practical cluster — a type of activity aimed at developing deductive thinking through laboratory work, seminars, and projects.
3. Reflective cluster — independent learning activities aimed at reanalyzing acquired knowledge, evaluating results, and substantiating one's opinions.

Experimental analysis results showed that:

- students' levels of analytical thinking increased;
- deductive inference skills were strengthened;
- skills of reflective analysis and logically substantiating opinions developed significantly;
- students formed as active subjects in the learning process who seek to substantiate their views, draw well-founded conclusions, and conduct independent analysis.

These results scientifically confirm the effectiveness of an educational process organized on the basis of a cluster approach.

Developing inductive and deductive thinking through a cluster approach is an innovative methodological model that influences personal cognitive development in higher education. This approach activates students' cognitive activity and ensures the harmony of theoretical and practical thinking. Thinking formed on the basis of inductive analysis, deductive synthesis, and reflective evaluation serves to deepen students' professional competencies. As a result, an instructional process organized on the basis of a cluster approach increases students' intellectual activity and directs them to logically substantiate, provide evidence for, and creatively articulate their ideas. Therefore, this methodology can be recognized as an effective scientific–methodological model for introducing modern educational technologies in higher education institutions.

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