

## COGNITIVE ACTIVITY IN MODELING PHYSICAL EXPERIMENTS AS THE BASIS OF EFFECTIVE LEARNING

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### Abstract

This article investigates the nature of cognitive activity in the educational process and explores effective strategies for its organization. Two foundational learning theories - the associative-reflex model and the activity-based approach - are subjected to comparative analysis, with particular attention to the pedagogical advantages of activity-based instruction. The study examines how motivation, cognitive interest, reflective practice, and peer communication contribute to the quality of learning. The findings suggest that purposefully organizing students' cognitive activity produces measurable improvements in knowledge acquisition, critical thinking, and personal development, making it a cornerstone of modern pedagogical design.

**Keywords:** Cognitive activity, activity theory, learning motivation, reflection, cognitive interest, educational communication, student-centered learning.

### Introduction

A person develops as an individual within a specific cultural environment. The acquisition of cultural experience occurs through a specialized form of activity - learning. The speed of this acquisition and the ability to apply it across various situations are largely determined by the manner in which learning activity is organized.

According to V.V.Davydov, two major theories of learning have historically developed in European and American education. The first is grounded in the concepts of association, reflex, and stimulus-response (the associative-reflex theory). The second is based on the concepts of action and task (the activity theory). Understanding the distinctions between these two frameworks is essential for designing pedagogically sound instructional approaches.

## Literature Review

Under the associative-reflex theory, the teacher's role consists of presenting learning material for perception and comprehension, guiding students in developing skills through model-based practice, and ensuring creative application of previously acquired knowledge. Learning thus proceeds from organized perception of material to its model-based application, with competencies formed through instructive-reproductive methods.

This theory served as the dominant framework for knowledge acquisition over a long period, yet it began to show limitations when students increasingly required a qualitatively different kind of thinking - theoretical cognition. This need could only be addressed within the framework of activity theory applied to the learning process.

V. V. Davydov defines activity theory as a framework grounded in the concepts of "action" and "task." An action implies the transformation of a given object by the subject. A task contains a goal presented under specific conditions for its achievement. Solving a task means finding an action that allows the subject to transform those conditions in order to reach the desired goal.

Within this framework, learning is characterized not by passive reception, but by the transformation of material within a task context. As Davydov notes, this theory "allows knowledge and skills to be acquired not reproductively, but through active inquiry, by constructing the process of creatively mastering their genetic origins through the performance of motivationally and purposefully oriented tasks associated with problem situations". In this mode, the student independently adopts and internalizes general methods of action.

A.N. Leontiev understands motive as an objectified need and therefore considers it an internal element - an integral part of the activity structure itself. L. I. Bozhovich, one of the prominent scholars who studied the problem of motivation, argues that "objects of the external world, images, ideas, feelings and experiences can all function as motives - in short, anything in which a need has become embodied" [6, p. 53].

## Research Methodology

The research draws on a comparative analysis of theoretical frameworks in educational psychology and pedagogy. Primary sources include the works of V.V. Davydov, A.N. Leontiev, L.I. Bozhovich, S.M. Bondarenko, N.F. Talyzina,

Yu.A.Saurov, P.G.Shchedrovitsky, I.A.Zimnyaya, and S.L.Vygotsky. The study also incorporates observational data from classroom practice, allowing theoretical propositions to be evaluated against real pedagogical conditions.

The research hierarchy of learning motives distinguishes between internal motives - those directly connected to the activity and its execution - and broader social motives related to the child's need to occupy a particular position within social relationships. Teachers must account for the full spectrum of motives in order to elevate internal motivation to primacy. This need has intensified in recent years, as today's students are considerably more socially active than their counterparts of two decades ago.

Creating conditions in the classroom that generate cognitive interest is of critical importance. Interest is the emotional expression of cognitive need. S.M. Bondarenko argues that the necessary condition for arousing interest in instructional content and the learning activity itself is providing students with the opportunity to demonstrate intellectual independence and initiative in their learning. The primary instrument for achieving this is the use of tasks whose solutions require active inquiry and genuine intellectual effort.

### **Analysis and Results**

As Yu.A.Saurov observes, learning activity is not simply any kind of activity (such as working with a book), but purposeful activity in which the educational and developmental goals of instruction become the student's own personal goals. Within this activity, it is possible to distinguish goal-setting, planning, execution, monitoring, and evaluative actions - each corresponding to a specific phase of the learning process.

P.G. Shchedrovitsky contends that developing structures of understanding and thinking - which enable self-determination and participation in complex social activities - is essential. Everything else, including the transfer of knowledge, must be regarded as a prerequisite for such development. This position is confirmed by N.F.Talyzina's activity-based learning theory (grounded in the ideas of P.Ya.Galperin and A.N. Leontiev), which demonstrates that knowledge cannot be assimilated or retained outside of the learner's own actions.

Reflection constitutes a key component of the process of acquiring and internalizing knowledge and methods of cognition organized on an activity basis. Reflection is not merely recalling the main points of a lesson or

formulating conclusions; it is the awareness of activity methods, the identification of their meaningful characteristics, and the determination of the rate of educational growth for both student and teacher. Through reflection, students evaluate various dimensions of their learning progress, comparing their initial understandings with the knowledge attained.

The organization of student communication is another vital dimension of learning activity. S.L. Rubinstein observes that the human personality develops within a specific society, as “a contemporary of a particular era, a peer of a particular generation” [6]. When planning lessons, the teacher must focus not on how much information to transmit, but on how to organize joint activity with students that enables them to understand the methods of acquiring and internalizing knowledge. Through this collaborative process, students themselves propose the methods of assimilation and the volume of material to be mastered - in other words, they begin constructing their own learning activity.

### Conclusion

The analysis demonstrates that organizing cognitive activity in the learning process is one of the fundamental conditions for the development of the student as an individual. The transition from the associative-reflex model to activity-based theory fundamentally redefines the educational process: the student shifts from a passive recipient of knowledge to an active constructor of meaning.

Effective organization of cognitive activity requires: first, cultivating internal cognitive motives in students; second, stimulating cognitive interest through problem-based tasks; third, embedding reflective mechanisms into the lesson structure; and fourth, employing collaborative and group activity formats. This approach develops not only knowledge acquisition, but also the student’s capacity for independent reasoning, self-regulation, and creative problem-solving - qualities indispensable in contemporary education.

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