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Psychological basics for arrangement of stepwise physics module

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Abstract

Psychological basics for arrangement of stepwise physics module A method of forming a module of physics is proposed in the article. The steps of the module correspond with the theory of Stepwise Forming of Mental Actions (SFMA) suggested by Russian psychologists P.Ya. Galperin, N.F. Talyzina. The SFMA theory was worked out for pre-school children. When comparing the steps of the SFMA theory with stages of the theory of social learning worked out by Canadian psychologist A. Bandura, which focuses the older age, the correspondence of the two theories was found out, and the deduction was drawn about the SFMA theory has no contradictions with principles of teaching in schools and universities. The structure of module of physics developed by author is presented in the article, containing the elements need for implementation of the SFMA theory steps in the process of teaching physics. It was demonstrated that the content of the physics module suggested doesn't contradict with psychological factors of efficiency of teaching process

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1. Introduction

Lately, more emphasis is put on psychological issues in the research dealing with teaching process organization. This tendency is very natural as two subjects take part in the teaching process: the teacher and the student. Pedagogics evaluates the teaching from the teacher's viewpoint and psychology, from the student's viewpoint. Pedagogical research is concerned with search for the answer to the question, how students can be taught; psychological research is intended to solve the task, how students can be helped to study. Obviously, the teaching process organized in accordance with optimal combination of those mutually antithetical research's results can be very efficient which is especially important in teaching natural sciences, particularly, physics.

In the middle of the last century, prominent Russian psychologists V. V. Repkin and P. I. Zinchenko [1, 2] performed research dealing with finding psychological factors of the learning process' efficiency. The degree in

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which the present-day teaching physics corresponds with the said factors can objectively characterize its efficiency level. The first factor reflects the knowledge acquisition: the knowledge can be acquired well when the student masters the goal-oriented skills revealing the knowledge's contents. The second efficiency factor corresponds to the dependency found in the above-mentioned research between the strength of memorizing the knowledge which was remembered involuntarily and the degree of including the goal-oriented actions leading one to such memorizing into the system of other actions. The disadvantage of the teaching practice is that the students' goal-oriented actions necessary for realizing and understanding the knowledge cannot be organized intentionally. Therefore, the problem consists in absence of recommendations on issues of building the process of teaching physics with high efficiency.

2. Study

This article deals with the issue of building a technology of teaching physics in accordance with the first psychological factor of teaching process efficiency only. The discussion of the mechanism providing for the second psychological factor in the teaching process was performed in connection with the intrasubject connections information model, see article [12].

2.1. Learning Module Structure's Psychological Foundation

In order to build the process of teaching physics in accordance with the first efficiency factor, the students' goal-oriented activity is supposed to be organized in connection with module teaching which is possible if we contemplate the module as a pedagogical system's unit [3] constituting an open dynamic system affected by the social environment. In such case, the system elements' function is subject to attaining the study objectives: the general ones (for the module) and operative ones (attained during the study of a module's separate topic). The students' goal-oriented activity is also provided for by the modules' systematic organization.

A module's structure is well-known (it repeats the structure of the pedagogical system and includes all its invariable components including the following: students; study and education objectives and contents; teachers; didactic processes; organization forms of study), whereas the stages of the module's topic study supporting the students' goal-oriented and the sequence thereof require additional research.

The module's topic study stages are arranged so as to connect them with stages of multidimensional psychological changes evoked due to the human performing new actions, building new images and ideas which is appropriate to the development reflecting the study objectives attaining. The stages mentioned were investigated in details by P. Ya. Galperin [4, 5] who promoted L. S. Vygotsky's opinion regarding the issue of interrelation of study and development. The theory of stepwise intellectual action formation (SIAFT) drafted based on his ideas considers the psychic processes as a special type of investigatory activity and the knowledge as derivatives of the actions and acquisition thereof. The unit of analyzing any human activity, according to P. Ya. Galperin's opinion, is the action which can be divided into three components: the approximate component, the execution component and the controlling component. The above-mentioned components comprise the activity's structure including the learning activity. Therefore, taking into account the three elements mentioned and the aggregate of stable links between them, the sequence of the module's topic study stages can be determined and appropriate form and method choice for the module study technology be made.

Based on the above-mentioned reflection, we suggest arranging the module topic's stage sequence in accordance with the intellectual actions' formation stages [8]. Let us arrange them at the example of studying the topic of a physics module for university college students where the study is organized with the means of the following study forms: students' self-guided work, colloquium, lab, solving tasks, computer modeling, seminar, lecture.

Thus, the zero stage (motivation stage) of the SIAFT is supposed to be organized as accomplishing an experience, reviewing a complicated problem, making notes for the question plan. The next (1st) stage suggests

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