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Influence of Training Situations on Structure and Function of Cognitive States

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Abstract

The article is devoted to the study of students' cognitive states organization in three different training situations (lecture, seminar, examination) depending on information intensity. The research aims are to reveal the phenomenological features of students' states depending on the form of educational activity, reveal the composition of states, the structure leading components, the functions realized in training process. The study procedure included: diagnosis of students personality traits and cognitive abilities, measurement of cognitive states characteristics during lecture, seminar and examination. The statistical processing of study results was carried out by the factor analysis method. From situational and systemic approach positions it is established that, depending on learning situations, the cognitive states perform the functions of activating the intrapsychic orientation (lecture), activating cognitive activity and mobilizing intellectual resources (seminar), self-regulation of educational activities and its emotional states (exam). It is shown that the degree of cognitive states integration increases with the intensifying of situation, the role of self-regulation indicators and the value-semantic sphere in the integral structure of the state grows. The results of the study may be of interest to teachers and practical psychologists in education, as well as to researchers of human mental states.

Keywords: academic activity; situation; cognitive mental states; structure and function.

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Introduction

The initial theoretical prerequisites for a class of cognitive states appeared as a result of human mental activity of studying. "Intellectual feelings" arising during thinking process were correlated with separate phases of logical thinking and were opposed to ordinary emotions connected with somatic processes. Since cognitive processes structurally and functionally form a relatively autonomous sphere of the subject (along with emotional and regulative), its activity comes to the fore when analyzing the emerging "accompanying" mental states. Later, these states were considered from the subject's cognitive processes activity point of view.

Modern studies of cognitive states are conducted mainly in three directions. The first one includes general psychological studies of various aspects of human cognition which has practical importance for psychology of learning, cognitive psychology, self-regulation of states, etc. (Oatley, Parrott, Smith, & Watts, 2011). The second group consists of studies about cognitive processes and states while teaching pupils and students (Blanchette & Richards, 2010). The third direction is the study about metacognitive aspect of cognitive states during the process of studying mathematics and other natural sciences (Grant, 2001; Ng, Lay, Areepattamannil, Treagust, & Chandrasegaran, 2012).

The conducted studies do not adequately cover the issue of states situational conditionality, the dependence of states organization from emotional tension and informational saturation of learning process. Our previous studies of states structure and functions relied on a situational approach of learning (Brown, Collins, & Duguid, 1989). From these positions, the mediating role of self-reflective awareness and personal meaning of training situation in the relationship between mental states and cognitive processes was revealed; on the example of interest, reflection and other states meta-cognitive entity of cognitive mental states were shown; the leading role of metacognitive induction procedures by analogy and productive imagination in the structure of intellectual states is established (Prokhorov, Chernov, & Yusupov, 2016).

Purpose and objectives of the study

The purpose of this article is to reveal the features of structural and functional organization of the subject's sign-on states, depending on the intensity of the learning activity situation (lecture, seminar and exam).

Literature review

Cognitive states are actualized in a problem situation, stimulating intrapsychic (cognitive) activity, activating a wide spectrum of intellectual manifestations integrated in functional structure of the states. Thus, the inclusion of the subject to problem solution or problem situation, which is determined by the cognitive regulation of activity, is adequate for the purposes of activity. Cognitive states affect the dimensionality (cognitive complexity) of mental structures, thereby contributing to the development of their multidimensionality, representativeness, providing regulator properties of these structures. Due to the developing function of cognitive states, the corresponding "process-substantial" complexes are fixed and preserved in the structure of subject's mental experience.

Cognitive mental states are actualized in the process of interaction between the subject and the object of cognition. The result is the cognitive transformation of the object and the deepening on this basis of cognition. Therefore, its methodological study based on the principles and provisions of situational and system-functional approaches. From the system approach point of view, the cognitive state is viewed as a

functional system that integrates those processes and properties that are necessary for the effective performance of activities (Prokhorov, 1998).

Situational analysis is traditional for psychology of states, because the situation as a subjective image of objective reality is considered as a central determinant of mental state. The subjective situation is always represented in the structure of mental state as a system-forming factor and acts as a metasystem level in the integral organization of the state. The accessibility of this level for consciousness is realized through reflection. In accordance with the process of self-reflection, it becomes possible to manage the situation and the actual mental state, for example, based on the well-known processes of "assessment" and "reassessment" of the subjective situation by Lazarus (1991).

Thus, the subjective situation of life-activity fulfills the role of a meta-level in the structural and functional organization of mental state; thanks to it "mental self-management" is realized by the state, which mechanism is conscious (or unconscious) regulation by an individual representation of situation. It should be noted that it is in the unity of the "external" (the situation as a metasystem in relation to a person) and the "internal" (state as a reflection of the situation - psychological syndrome) where the fundamental functions of mental states, - reflection and regulation, are being realized.

Methodology

The sample of the study was made up of students of various specialties (mathematics, physics, biologic, psychology, etc.), totally 143 people. Respondents' average age is 19.7 years.

States' structural and functional organization was considered in three different contexts of educational activity – lecture, seminar and exam conditions. In each of them, the typical cognitive states and its characteristics were measured according to personality mental state questionnaire (Prokhorov, 1998).

During study period, the personality traits and cognitive abilities of respondents were studied using the following methods:

- the method for measuring various aspects of reflection, including socio and auto reflection (Grant, 2001);
- the method for diagnosing the general level of reflection development, as well as communicative reflection and reflection of activity (retrospective, relevant, perspective) (Karpov & Skityaeva, 2005);
- the method for diagnosing metacognitive inclusion to activity (MAI) (Schraw & Dennison, 1994);
- the method for studying teaching styles (Litzinger, Sang, Wise, & Felder, 2007);
- the method that diagnoses of self-control development level (Nikiforov, 1989);
- the method for assessing the style of behavior self-regulation (Morosanova, 1995);
- the personal questionnaire (16 PF) (Cattell & Mead, 2008);
- the method for values structure studying (Alishev, 2002);
- standardized methods for diagnosing and measuring the level of development of operational, semantic and mechanical memory, concentration and switching of attention, thinking processes (analysis and classification of concepts, the process of comparison and generalization, logical thinking, induction by analogy, the cognitive style is "analytic - synthetic" (Anastasi & Urbina, 1997).

Processing of empirical data was carried out by using the procedure of factor analysis (Principal

Component Analysis, method of rotation - promax) in the statistical program SPSS 16.0

Results

Phenomenological analysis of students' self-reports showed that cognitive activity of students is accompanied by rather complex combinations of states. In situation of lecture, the triad "calmness - interest - drowsiness" (57%) is typical, in conditions of seminar - "cheerfulness - interest-calmness" (53%) and in situation of exam - "mental stress - concentration - excitement "(69%). Thus, depending on situation, the cognitive process is combined with functional states of low intensity (lecture), positive (seminar) or negative (exam) emotional states of high intensity. At the same time, states of interest (lecture, seminar) and mental stress (exam) are the core states in the marked triads: comparison with other states their share exceeds 60%.

Let us further consider the structural and functional organization of cognitive states typical for each learning situation. In the situation of lecture classes, the central axis of the structure of interrelations is a group of indicators representing different characteristics of reflection, self-regulation and self-control, personality traits, integral cognitive processes, value characteristics, learning styles and cognitive processes.

The constituent component is the factor of reflection (the general level of reflection, the reflection of the past and the present), integrating the characteristics of metacognitive inclusion in activity, self-control, self-control, intelligence, thinking and personality traits (emotional instability, high self-control, expressiveness, dominance, conservatism, diplomacy, normative behavior, sociability).

Personality traits occupy dependent position, forming the "outer contour" of the nuclear grouping of variables and thereby showing that the metacognitive regulation of activity is related to a certain set of personality traits. At the same time, it should be noted that the average value of the correlations between the spells is rather weak (0.126), and this testifies to the discreteness of the structure, the relative independence of the allocated subsystems, and their weak coordination. The intensity of mental states indicators occupy a peripheral position in the structure and associated with a complex including variables of personal values (kindness, love), an integral cognitive process "planning" and a personality trait "developed imagination" (M factor by R. Kettel).

Based on the structural organization of cognitive states during lecture period, it can be assumed that their main function is related not only to the receipt and memorization of new information, but also to active space of mental experience orientation, including the juxtaposition of new information and available knowledge, critical attitude to the presented theories and facts. The intensity of these states is determined, apparently, by subjective representations of students about importance and usefulness of the information provided for future personal well-being.

In the situation of seminar, key position in the structure of interrelations is occupied by a complex of variables; including parameters of general intelligence, conceptual thinking, and general level of self-control. These indicators have the closest interrelationships with a set of characteristics represented by values (self-giving, beauty, power, justice, kindness), integral cognitive process "planning", cognitive processes (attention switching, different thinking productivity, abstraction and generalization), learning styles (synthetic, rational).

Attention is drawn to the direct inclusion of the intensity indicators of psychic states in interaction with the central factor. At the same time, the characteristics of self-control of activity and the regulatory-personal trait "flexibility" are integrated into the factor of states. On the other hand, the intensity indicators of states are closely related to psychological values (development of morality and culture, well-being of

close people).

Thus, unlike the situation of a lecture, this structure of cognitive states is largely determinedby psychological values. From psychological and pedagogical point of view, one can speak of an inseparable unity among students in intellectual and personal spheres, about the unity of the learning processes and individual-personal development in conditions of active interaction during seminars. In addition, during the seminar, the average value of intercorrelations (0.298) more than twice increases, which indicates increase in level of cognitive states structure organization, coordinated various state subsystems participation in solution of cognitive and educational problems.

On the basis ofdata obtained, it can be assumed that the main function of cognitive states in conditions of seminars is to activate cognitive activity, mobilize intellectual abilities to understand and assimilate the content of the subjects taught by means of solving learning problems. At the same time, it is necessary to note the essential dependence of these cognitive states on the features of the value-semantic sphere of the subject of educational activity. In this case, their intensity can be determined by the success of intellectual activity and by the correspondence of the form and content of the seminar sessions to the students' value preferences.

In the conditions of the examination, there is a significant complication in the structure of relationships. In quantitative terms, this is reflected in decrease of factors number (up to 18) and increase in the average value of correlations (0.313) compared with previous educational situations. Qualitative changes consist in formation of structure-forming subsystem, consisting of two interrelated factors.

The most significant indicators in the central galaxy are behavior self-control, the overall level of self-control behavior, self-control of emotions, resulting in a shift in the structure of relationships emphasis on the processes of arbitrary activity self-regulation and associated emotional states. Proceeding from peculiarities of cognitive states structural organization in situation of exam, one can assume that their main function is the self-regulation of cognitive and educational activities in general.

Central groupings are associated with indicators of values (well-being of close people, life and safety of a person, material well-being, usefulness, dedication, power, activity), personality traits (sensitivity (factor I), developed imagination (factor M), tension (Factor Q4), cognitive styles (analyticity, synthetics), metacognitive processes (general reflexivity, communicative reflection), integral processes (modeling), cognitive processes (logical thinking, abstraction and generalization, mechanical memory, attention concentration, switching attention, general productivity of attention, memory, spatial generalization, analysis and classification of concepts).

Of these, the key variables (having the maximum factor load) are mental states intensity (behavior, mental processes), cognitive style "synthetics", values (well-being of close people, life and human security), concentration and overall attention productivity, developed imagination (factor M), sensitivity (factor I).

It is interesting to note the direct interrelation between the mental states intensity factor and the central complex of self-regulation and self-control of behavior. At the same time, in the organization of the subsystem of mental states intensity, there is the greatest correlation with the indicators of memory, figurative and conceptual thinking. In this case, it can be argued that cognitive states intensity and productivity of cognitive processes during exam process are largely determined by the general capacity for self-regulation.

The statistical data presented in Table 1, demonstrate the role of the leading factors in cognitive states organization with continuum "the usual - tense situation of learning activity". The relative frequency

of these indicators correspond occurrence to its number in the structures of the leading factors. According to the calculations, the key indicators differ depending on the learning situation: a) personality traits and metacognitive processes (lecture situation); B) intellectual abilities and psychological values (seminar situation); C) self-regulation and psychological values of person (the situation of exam).

Table 1. *Relative frequency of cognitive states indicators occurrence that are part of the structure-forming subsystems (depending on the situations of learning activity), %*

Psychologicalcharacteristics	Numberofindicators		
	Lecture	Seminar	Exam
Value-semanticsphere	8	25	33
Personality traits (byR. Kettel)	33	0	17
Indicators of self-control and self-regulation	8	12.5	50
Intensityofmentalstates	0	0	0
Metacognitiveprocesses	33	0	0
Integralcognitiveprocesses	8	12.5	0
Cognitiveprocesses and intelligence	8	50	0
Cognitivestyles	0	0	0
Learningstyles	0	0	0

Discussions

In this study, the state was examined in three different content conditions for learning activities - lectures, seminars and exams. Analysis of students' self-reports showed that cognitive activity of students is accompanied by rather complex states combinations. In conditions of lecture, the triad "calmness - interest - drowsiness" is typical, in conditions of seminar - "cheerfulness - interest - tranquility - reverie" and in the situation of exam - "mental tension - concentration - excitement". Thus, depending on the situation, the cognitive process is combined with functional states of low intensity (lecture), positive (seminar) or negative (exam) emotional states of high intensity. At the same time, states of interest (lectures, seminars) and mental stress (exams) act as pivotal states in these triads: in comparison with other states their share exceeds.

The obtained data indicate that cognitive states arising in the process of solving intellectual problems form a dynamic complex, integrating emotions into their structure (which are an indicator of direct relationship of the subjects to the proposed tasks and the situation of the research as a whole), cognitive activity (which characterizes intellectual activity with Point of view of the complexity of the tasks to be solved and mental difficulties in the implementation of activities), as well as social feelings (feelings of duty, And so on). Therefore, in future, cognitive states need to be examined as a holistic functional structure, formed through the integration of various emotional manifestations, aspirations,

relationships, and changing throughout the various stages of main activity.

The notion of dynamic complexes began to develop in the context of studying basic emotions (Izard, 1991). Interrelations between basic emotions, including intellectual (interest and surprise) were examined, dyads and triads of interaction were singled out, "cognitive-affective complexes" were analyzed, which are the result of interaction of emotions, cognitive processes and the available knowledge (experience) of a person. A similar concept of "ideological organization" was considered by Tomkins (1962). Similar structures within the framework of social cognition were investigated by Katz and Stotland (1959), denoting them by the term "installation". The latter includes in its composition affective, cognitive and behavioral components, thereby being a complex mental state.

Based on these studies, it can be assumed that the states arising in the course of educational and cognitive activity represent a multi-level structure integrating into its composition a set of diverse mental phenomena (mental processes, properties, socio-psychological manifestations and etc.), necessary for the effective activities implementation. The cognitive complex provides coordination of cognitive, volitional, emotional, and other personal components depending on situations of vital activity. The study of interaction specifics of these psychic subsystems will make it possible to approach the understanding of the essence of states as an integral phenomenon. The components of the complex are in continuous interaction with each other, thanks to which the subject is adapted to the information-intensive situations of educational activities.

Conclusion

The data obtained in the course of the study allow us to state that interest (lecture, seminar) and mental stress (exam) are typical cognitive states in the course of students' academic activity. Depending on educational situation, these cognitive states interact, respectively, with low-intensity states (lecture), positive (seminar) or negative (exam) emotional states of high intensity.

In the situation of lecture classes, the structure-forming component of cognitive states is the factors of reflection and meta-cognitive regulation of activity. The main function of these states is connected with the orientation in the space of mental experience (activation of intrapsychic orientation), allowing to compare new information with available knowledge, and also to evaluate the usefulness of the information offered for personal well-being in future.

In the situation of seminar the leading role in the structure of cognitive states is performed by intellectual abilities. We can assume that the most important function of cognitive states in the conditions of seminars is to activate cognitive activity, mobilize intellectual resources to solve learning problems.

In the situation of the exam, the organization of cognitive states determines the parameters of educational activity self-regulation. The main function of cognitive states in this case is the self-control of behavior and emotional states, as well as the activation of effective metastrategies of solving problems that ensure the most complete reproduction of previously acquired knowledge.

In the range of "ordinary - tense situation of educational activity", the structural and functional organization of the recognition states is complicated, the level of integration of various subsystems is increased, the role of value-semantic characteristics in the integral structure of states increases.

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