

VI International Forum on Teacher Education

## Self-regulation of Cognitive States: a Conceptual Perspective

Mark G. Yusupov\* (a), Alexander O. Prokhorov (b), Albert V. Chernov (c)

(a), (b), (c) Kazan Federal University, 420008, Kazan (Russia), 18 Kremlyovskaya street,  
markyusu@gmail.com

---

### Abstract

The article is devoted to the study of self-regulation of cognitive states in the educational activities of students according to the system-functional approach. The scientific task of the research is in the intersection zone of two fundamental areas of psychology – self-regulation of human mental states and management of educational and cognitive activity of the subject. The article presents a structural-functional model of self-regulation of cognitive states. The components of the regulatory process are highlighted: learning situations, reflection, images of the present and the target state, learning styles, as well as the individual characteristics of students. The chosen research methodology corresponds to the current trends in psychology – the identification of integrative factors that ensure the success of the subject's activities. The study of self-regulation of cognitive states broadens the understanding of the role of mental states in learning, supplements them with knowledge of the mechanisms of self-regulation of cognitive states. In the applied plan, the study of self-regulation of cognitive states is useful for general and pedagogical psychology. The proposed model can be used to solve issues of cognitive activity and independence of students, as well as to organize work with the weak students.

*Keywords:* self-regulation, cognition, mental states, academic activity, system-functional approach.

© 2020 Mark G. Yusupov, Alexander O. Prokhorov, Albert V. Chernov

This is an open access article distributed under the terms of the Creative Commons Attribution License (CC BY 4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Published by Kazan federal university and peer-reviewed under responsibility of IFTE-2020 (VI International Forum on Teacher Education)

---

\* Corresponding author. E-mail: markyusu@gmail.com

## **Introduction**

The theoretical prerequisites for identifying a class of cognitive states appeared as a result of the study of human mental activity. "Intellectual feelings" arising in the course of the thought process were correlated with separate phases of logical thinking and were contrasted with the usual emotions associated with somatic processes. Since cognitive processes structurally and functionally form a relatively autonomous sphere of a person (along with emotional and regulatory), its activity comes to the fore in the analysis of the emerging "accompanying" mental states. After that, these states were considered from the point of view of the activity of the cognitive processes of the individual.

Cognitive states usually arise in problem situations, activating the cognitive processes of the individual. Thus, an adequate goal of the subject's involvement in the decision is achieved. Cognitive states affect the dimension (cognitive complexity) of mental structures, including subjective experience. Because of this, they contribute to their multidimensionality, representativeness, provide regulatory properties of mental structures (Prokhorov, Chernov, & Yusupov, 2015).

Despite the fact that cognitive states are typical for educational, research, creative and other types of activity, at the moment the composition of cognitive states has not been determined, criteria for identifying and systematizing individual cognitive states have not been developed, etc. This is because the problem of classifying mental states has not been resolved and the question of differentiating individual groups of states (volitional, emotional, etc.), as before, remains open. As a result, the cognitive states (interest, surprise, meditation, etc.) are identified with activation, motivational, volitional or emotional states (along with fear, anxiety, etc.), or the very existence of cognitive states is questioned (Prokhorov et al., 2015).

In applied terms, the study of cognitive states is of interest for research in the field of the psychology of creativity and scientific activity, in the context of which a person is faced with the need to go beyond the limits of existing knowledge, transform the prevailing ideas in the course of solving problem and creative tasks. In this case, the most important are the cognitive states associated with the processes of productive thinking and imagination (these states are focused on the production of new knowledge, going beyond the known).

Knowledge of cognitive states and the peculiarities of their regulation will make it possible to manage these states in a way that is more effective: to maintain the duration and optimal intensity, which will contribute to greater efficiency of scientific activity and the creative process (Prokhorov, Chernov, & Yusupov, 2016).

We also note that the study of cognitive states is essential for the organization of educational activities of schoolchildren and students. The activation of cognitive states in the conditions of educational activity in the process of setting and solving problems, contributes to a better understanding of the essence of the studied objects and phenomena, awakens interest in learning and cognitive activity, thereby performing the function of developing cognitive processes and intellectual abilities.

From the teachers' point of view, taking into account the cognitive states of students in the learning process will make it possible to solve the assigned tasks effectively, since the correct recognition and interpretation of the cognitive states of students by psychomotor, behavioral and other signs is a necessary condition for the effective organization of the educational process.

### **Purpose and objectives of the study**

As for the study of self-regulation of cognitive states, the main share of research is carried out in the paradigm of basic emotions in learning. Works devoted to the self-regulation of cognitive states are not enough, and individual studies within the framework of educational psychology and practical pedagogy do not provide a holistic view of the structure, mechanisms of regulation and optimization of cognitive states. Therefore, the purpose of this research is to study the components of self-regulation process, as well as the development of a theoretical model of self-regulation of cognitive states in students' learning activities.

### **Literature review**

Early studies of the regulation of mental activity were carried out within the framework of traditional approaches (mainly in line with the cybernetic approach). The subject is included in the process of self-regulation as a medium of target and operational components of self-regulation.

The result of these studies is the development of structural-functional models of regulation which reveal the most common structure (components, levels) and functions of the system of activity's mental regulation (Carver & Scheier, 1998). Based on general ideas about the structure of the system of mental regulation, private models get their development. They reveal the system's functioning in the context of various activities, for example, the situational-dynamic model of the mental regulation of professional activity (Oboznov, 2003).

Theoretically, the problem of the regulation of mental states remains less developed. Previous studies of the self-regulation of mental states revealed the similarity of its structure with the structure of self-regulation of arbitrary activity. The specificity of the self-regulation of mental states lies in the fact that it is more related

to the functional blocks of control and correction of certain characteristics of the state (qualitative originality, duration, polarity and intensity).

In modern psychology, self-regulation is considered to be an ability or skill that develops as regular exercises or naturally in the process of achieving various life goals (Vohs & Heatherton, 2000). Diverse approaches are used in research: neurocognitive, psychoanalysis, cybernetics, theory of dynamic systems, etc. (Oboznov, 2003). The main concepts in regulation are the “feedback” (feedback) and the “hierarchy of goals” of the individual. Recent studies on self-regulation tend to take into account individual differences and the social context (Berger, 2011).

From 1976 to 1986, four volumes of “Consciousness and self-regulation” were published, where various theories of self-control are presented, physiological and cognitive processes in the regulation of individual states are considered (Schwartz & Shapiro, 1976-1986).

In the last years of the 20th century, the concepts of self-regulation that were popular in world psychology were developed: the concept of control over action (Kuhl, 1987), the model of regulation of behavior and emotional states (Pulkinen, 1992); the cognitive-motivational concept of coping by R. Lazarus, based on the concept of cognitive assessment of difficult situations (Lazarus, 1999).

The “cutting edge” of self-regulation research is presented in the large manual (Vohs & Baumeister, 2016). It presents articles of the most authoritative researchers on neurological, physiological, cognitive, affective, social, cultural and other dimensions of self-regulation, issues of automatic and conscious regulation, individual psychological aspects of self-regulation, development of self-regulation in ontogenesis.

For practical purposes, various methods of self-regulation are explored: positive thinking, sleeping, volitional control, religious practices, progressive relaxation and the possibilities of its use in pedagogy, the role of hypnosis and meditation states in regulating behavior, biofeedback (Alpha Feedback Training) (Schwartz & Shapiro, 1976-1986).

## **Methodology**

The scientific task of the research is in the intersection zone of two fundamental areas of psychology - self-regulation of human mental states and management of educational and cognitive activity of the subject. The methodological basis of the concept is a system-functional approach which allows to reveal the composition, structure, mechanisms of self-regulation of cognitive states.

The components of the regulatory process are learning situations, reflection, images of the present and the target state, learning styles, as well as the individual characteristics of students. The chosen research methodology corresponds to the current trends in psychology – the identification of integrative factors that ensure the success of the subject's activities. The study of self-regulation of cognitive states broadens the understanding of the role of mental states in learning, supplements them with knowledge of the mechanisms of self-regulation of cognitive states.

We understand cognitive states as an integral functional structure (complex of states) formed through the integration of various components of the psyche (experiences, mental processes, psychological properties, socio-psychological characteristics, etc.), changing during different stages of the main activity and performing the main function - metacognitive regulation of educational activities (Prokhorov et al., 2015).

## **Results**

Self-regulation of cognitive states is aimed at maintaining a certain rhythm, duration and optimal intensity of states in the educational process increasing the involvement of students into the educational process. Self-regulation of cognitive states allows to solve the issues of students' attention management, to activate post-spontaneous attention, without requiring volitional efforts, to reduce emotional tension, to create a semantic focus on the implementation of educational and cognitive activity.

Self-regulation of cognitive states is carried out at three levels: operational (sec-min.), current (hour-day) and long-term (month.). There is a specificity of self-regulation of states in different time ranges associated with the qualitative and quantitative characteristics of the corresponding functional structures of cognitive states. Changes in the state complexes at each level are made through various regulatory actions.

The essence of these actions lies in influencing on the components of the functional structures of cognitive states that do not meet the current requirements of the activity and, as a result, reduce its effectiveness. For example, in the course of the standard seminar work of students at the first stage of activity the states of drowsiness and apathy are overcome; at the second stage communicative states of gaiety and joy are regulated, the excessive intensity of which also impedes learning (these conditions arise because learning activity is a joint activity). At the last stage cognitive states are combined with negative states of low intensity (fatigue, boredom, etc.). Thus, self-regulation is connected with the maintenance of such states as activity, interest, etc. In addition, productive cognitive states require the inclusion in the functional structures of the motivational mood state and its prolongation at all stages of learning work.

In practical terms, self-regulation of cognitive states should solve the following tasks: prevention of negative states, bringing the existing state in accordance with the requirements of the activity, prolongation of productive cognitive states, and in general, adapting students to information-rich situations of educational activity. The solution of these tasks is possible thanks to a multi-level system of regulation of cognitive states which provides coordination of the cognitive, volitional, emotional, and other components of the personality, depending on the situations of learning activity.

The specificity of self-regulation of cognitive states depends on individual psychological characteristics, skills of self-regulation and existing regulatory experience, attitude to self-regulation of one's state and ability to control oneself as a whole. In terms of learning activities, the motivation of students, the degree of students' involvement in the learning process, their learning style, features of pedagogical communication on the part of the teacher, etc., affect the regulation process (Prokhorov & Yusupov, 2017).

The process of regulation must be investigated from two perspectives. Firstly, it is the regulation of cognitive states by the teacher through the management of learning situations and students' attitudes towards them. Here, the main tools of regulation are the educational task and the teacher's personal qualities. In previous studies we have shown that the use of creative and heuristic tasks in learning leads to a "surge" of significant cognitive states (Prokhorov et al., 2016). In addition, such personal qualities of the teacher as enthusiasm for their subject, interesting presentation of educational material, etc. contribute to the involuntary updating of cognitive states of students.

Secondly, students are able to independently manage their cognitive states. In this case, the main mechanism of regulation is the feedback on the change in the psycho-physiological parameters of the experienced state. The leading components of self-regulation are the reflection of the current state and the image of the target mental state (Prokhorov, 2009).

The key component of self-regulation is the "image" of the current state. In the system of mental regulation, the image is traditionally understood as a system of signals informing the subject about changes in the state of the object or the environment. On the basis of the image, regulatory actions and control are launched. In our studies the "image of the state" is considered as a subjective representation of the experienced complex of subjective and objective characteristics of a person, arising after the actualized state (Prokhorov, 2013).

The stability of the image of states is connected with the subjective experience of a particular state (frequency, duration, intensity, etc.). The image of the state is steadily reproduced, including tense and stressful situations. The image of the state is connected with the peculiarities of the situation, individually

personal characteristics that make up consciousness (semantic structures, reflection, etc.). The most stable images are of high and low intensity states.

The states of medium intensity, which are mainly cognitive states, have a less organized image that makes their reproduction more difficult in current situations of activity. This creates certain difficulties in the study of self-regulation of cognitive states; within the framework of this investigation, we are planning to carry out extra studies of the images of cognitive states and their interaction with components of the regulatory process.

## **Discussions**

Other areas of psychology that are relevant to the issues of self-regulation are the concepts of self-regulated learning (SRL) and the theory of academic emotions (AE).

According to the *Self-regulated learning* theory learning success cannot be explained solely by students' existing skills and abilities; cognitive, motivational, emotional and social factors make a significant contribution to academic achievement (Schunk, 2005).

Various SRL models can be found in the literature (Pintrich, 2003). A review of these models is presented in Puustinen and Pulkkinen (2001). Despite the differences between these models, theorists agree that the SRL process includes several qualitatively different stages. So, many authors distinguish phases of anticipation, monitoring, control and reflection in the SRL.

According to SRL, in a real learning activity a student must control his activity in terms of goals, using for this purpose a constant reflection of his academic achievements. This enhances self-satisfaction and increases motivation to further improve teaching methods (Zimmerman, 2002). The SRL system uses various methods that increase the effectiveness of training: stimulating students to set goals, using effective meta-strategies, special homework tasks, diaries of self-observation, etc. The disadvantage of SRL theory is that mental states in this theory are not considered as a significant factor in self-regulatory learning.

The Academic Emotion Theory is based on the concept of "academic emotion" (Pekrun, Goetz, Titz, & Perry, 2002). This theoretical construct takes into account the importance of the learning situation for students, the behavior and professional level of the teacher, the degree of complexity of the tasks to be solved, the style of communication, etc. At present Control-value theory of achievement emotions is considered to be the most authoritative (Pekrun, Frenzel, Goetz, & Perry, 2007). The authors define academic emotions as emotions related to achievement-related activities and to the results of such activities themselves (Pekrun et al., 2007, p. 15).

The actualization of certain academic emotions is connected with a sense of control or lack of control over the process and the result of activities that are meaningful for students. Thus, assessments of the control and significance of learning are decisive in the occurrence of emotions.

In applied terms, research conducted today should answer the question of how different types of academic emotions affect students' motivation, self-regulation of their behavior, use of learning strategies, distribution of cognitive and physical resources, and ultimately, academic achievements (Zeidner, 2007).

A significant disadvantage of the theory of academic emotions is the limited number of measured emotions. Emotions that are significant for education are selected on the basis of their belonging to the basic emotions. For example, the AEQ questionnaire for all subsequent modifications measures eight separate emotions: pleasure, hope, pride, anger, anxiety, shame, hopelessness, and boredom (Pekrun et al., 2002). As our studies show, schoolchildren and students experience such typical cognitive states as interest, concentration, thoughtfulness, etc., but they are not academic and, therefore, are not considered as meaningful for learning (Prokhorov & Yusupov, 2017).

Thus, a review of scientific studies shows that despite a significant amount of research on various aspects of self-regulation, cognitive states, their role in learning, as well as the possibilities for their regulation, are not studied enough. The issues of regulation are solved mainly in the field of various private and controversial theories of learning through the development of external means of influence on the states of students. Systemic studies on cognitive states and their self-regulation were not performed. As a consequence, issues of self-regulation of cognitive states have been poorly investigated; there is no conceptual framework explaining and describing the mechanisms of human cognitive states regulation.

The model we are developing complements the presented theories of self-regulated learning and the theory of academic emotions. The scientific novelty of the concept lies in the study of the structural and functional organization of self-regulation of cognitive states as a holistic structure, taking into account the characteristics of consciousness, situations of learning and cognitive activity, learning style, individual psychological characteristics of students, the level structure of regulation, dynamic changes.

## **Conclusion**

The relevance of the study of self-regulation of cognitive states is due to the lack of theoretical elaboration of the problem, the lack of explanatory models that reveal the composition, structure, levels of the regulation system of cognitive states. As a consequence, issues of self-regulation of cognitive states are

poorly investigated, there is no conceptual framework explaining and describing the laws governing the regulation of human cognitive states.

The article presents a concept for the holistic study of self-regulation of cognitive states. The process of regulation as the main elements includes the relationship between mental states and characteristics of consciousness (state image, reflection, meanings), as well as the individual characteristics of the student. On the other hand, self-regulation depends on external factors: the situation, the social environment and regulatory actions carried out in a certain time range. The methodology implemented in our research is in line with the current trend in world psychology - the identification of integrative factors that ensure the success of the subject.

The study of self-regulation of cognitive states will expand the understanding of the role of mental states in learning; supplement them with knowledge of the mechanisms of self-regulation of cognitive states. From the practical point of view, the study of self-regulation of cognitive states will be useful for general and educational psychology, for example, to solve issues of cognitive activity and independence of students, as well as to organize work with poorly performing persons.

### **Acknowledgements**

The research was carried out with the financial support of the RFBR; project No.19-013-00325.

This work was funded by the subsidy allocated to Kazan Federal University for the state assignment in the sphere of scientific activities.

### **References**

- Berger, A. (2011). *Self-Regulation: Brain, Cognition, and Development (Human Brain Development Series)*. Washington: American Psychological Association.
- Carver, C. S., & Scheier, M. F. (1998). *On the self-regulation of behavior*. New York: Cambridge University Press.
- Davidson, R. J., Schwartz, G., & Shapiro, D. (Eds.). (1976-1986). *Consciousness and Self-regulation*. (Vols. 1-4). New York: Plenum.
- Kuhl, J. (1987). Action control: The maintenance of motivational states. In Halish F., & Kuhl J. (Eds.), *Motivation, intention, and volition*. (pp. 279-291). Berlin: Springer.

- Lazarus, R. S. (1999). *Stress and emotion: A new synthesis*. New York: Springer.
- Oboznov, A. A. (2003). *Psychological regulation of operator activity*. Moscow: Institute of Psychology RAS.
- Pekrun, R., Frenzel, A. C., Goetz, T., & Perry, R. P. (2007). The control-value theory of achievement emotions: An integrative approach to emotions in education. In Schutz, P. A., & Pekrun R. (Eds.), *Emotions in education*. (pp. 13-36). San Diego, CA: Academic Press.
- Pekrun, R., Goetz, T., Titz, W., & Perry, R. P. (2002). Academic emotions in students' self-regulated learning and achievement: A program of quantitative and qualitative research. *Educational Psychologist*, 37, 91-106.
- Pintrich, P. R. (2003). A motivational science perspective on the role of student motivation in learning and teaching contexts. *Journal of Educational Psychology*, 95, 667-686.
- Prokhorov, A. O. (2009). Semantic regulation of mental states. *Psychological Journal*, 4, 5-17.
- Prokhorov, A. O. (2013). The image of mental state. *Psychological Journal*, 34, 108-122.
- Prokhorov, A. O., & Yusupov, M. G. (2017). The Functional Structure of Cognitive States. *RUDN Journal of Psychology and Pedagogics*, 14, 440-450.
- Prokhorov, A. O., Chernov, A. V., & Yusupov, M. G. (2015). Cognitive States in Educational Activity of Students: Structural-Functional Aspect. *Asian Social Science*, 11, 213-218.
- Prokhorov, A. O., Chernov, A. V., & Yusupov, M. G. (2016). The Relationships of Mental States and Intellectual Processes in the Learning Activities of Student. *International Journal of Environmental and Science Education*, 11, 1031-1037.
- Pulkinen, L. (1992). Life style in personality development. *European Journal of Personality*, 6, 139-155.
- Puustinen, M., & Pulkkinen, L. (2001). Models of self-regulated learning: A review. *Scandinavian Journal of Educational Research*, 45, 269-286.
- Schunk, D. H. (2005). Self-regulated learning: The educational legacy of Paul R. Pintrich. *Educational Psychologist*, 40, 85-94.

Vohs, K. D., & Baumeister, R. F. (Eds.). (2016). *Handbook of Self-Regulation: Research, Theory, and Applications*. New York: Guilford Publications.

Vohs, K. D., & Heatherton, T. F. (2000). Self-regulatory failure: a resource-depletion approach. *Psychological Science, 11*, 243-254.

Zeidner, M. (2007). Test anxiety in educational contexts: Concepts, findings, and future directions. In Schutz, P. A., & Pekrun R. (Eds.), *Emotions in education*. (pp. 165-184). San Diego, CA: Academic Press.

Zimmerman, B. J. (2002). Becoming a self-regulated learner: An overview. *Theory into Practice, 41*, 64-72.