LOOK ACADEMIC PUBLISHERS
OPEN ACCESS

IEJME — MATHEMATICS EDUCATION
2016, VOL. 11, NO. 4, 569-581
DOI: Article number: mathedu.2016.054

On the Mechanism of Interaction between Mental States and Cognitive Processes in Academic Activity of Students

Alexander O. Prokhorov[a], Albert V. Chernov[a] and Mark G. Yusupov[a]

[a]Kazan (Volga region) Federal University, Kazan, RUSSIA.

ABSTRACT

Experimental investigations of interrelation between mental states and cognitive processes are especially, important in the sphere of learning activity. Employment of their interaction mechanisms in an educational process facilitates advancement of the learning activity efficiency of the school children and students gives an opportunity for establishment of well-grounded methods of the cognitive processes activation and the mental states self-regulation during learning sessions. The study is aimed at investigation of reflexive, conceptual and dynamic properties of interaction of the mental states and the cognitive processes in the course of real learning activity of students. A dynamic system approach and an "interaction" concept were taken as major methods for investigation of the stated problem allowing to identify the psychological mechanisms of interaction between states and cognitive processes. The article shows that reflexivity and personal meaning of an educational situation mediate interrelation of the mental states and the cognitive processes of a person. There were determined psychological measurements favoring effective interaction between the mental states and the cognitive processes. They include sufficiently high level of reflexivity and personal meaning focused on the learning activity realization and solution of its tasks (process-related personal meaning). The obtained results may be of interest for the investigators studying the problem of interrelation between emotion and cognition as well as for teachers and students concerning themselves with psychological technologies in order to enhance the learning activity efficiency.

KEYWORDS
Learning activity; mental states; cognitive processes; interaction; reflexivity.

ARTICLE HISTORY
Received 11 January 2017
Revised 17 March 2016
Accepted 26 March 2016

Introduction

Study of interrelations between the mental states and the cognitive processes is necessary for understanding of the mental activity integrity and according to Vygotsky (1987) is a question of vital importance. The mentioned

CORRESPONDENCE Alexander O. Prokhorov ✉ alprokhor1011@gmail.com

interrelations are the most typical for educational conditions and situations where the "basic load" falls at the cognitive processes development of which (along with socialization) is the principal goal of education and training in the system of education.

Consideration of a problem of specifically psychological content of the concepts “mental state” and “cognitive process” allows to make the nature of interrelations between them more precise and to select an empirical study method which adequately fits the problem of concern. Analysis of theoretical literature approves that the cognitive processes and the mental states differ by duration and functions, specific quality-related characteristics, degree of awareness, self-regulation capabilities, neurophysiologic bases etc. (Prokhorov Chernov & Yusupov, 2015; Oatley et al., 2011; Storbeck and Clore, 2007). At the same time many investigators emphasize their unity which is expressed in dynamic interrelation and interdependence of these mental aspects at every level of mental functioning (Manfrinati et al., 2013; Gyurak et al., 2012; Blanchette & Richards, 2010). Strong interrelation of the cognitive processes and the emotional states shows personal prejudice manifested through emotional tinge of the cognitive processes as well as attentional selectivity (Yiend, 2010; Leontyev, 2004).

The existing perceptions suggest that a theoretical model of interaction is an effective instrument of study of relations between the mental states and the cognitive processes (Mano and Brown, 2013; Angie et al., 2011; Lewis, 2005).

Currently notwithstanding intensive study of the cognitive processes and the mental states, interrelations between the same were investigated insufficiently. This established the independent task expressed in necessity to search and define the most important aspects of interrelations between the mental states and the cognitive processes with the aim of their further empirical treatment. The analysis of theoretical and experimental literature allows determining at least three relatively independent aspects of investigations: reflexive, conceptual and dynamic.

The reference to the reflexive aspect is conditioned by the fact that the mental states by a degree of emotional stress are determined by the processes of self-reflection (Izard, 2009; Koole, 2009). On the other hand reflection is a metacognitive process performing the function of the cognitive processes regulation (Thomas, 2012; Flavell, 2000). Therefore, reflection acts as an interlink assisting a person to understand his/her mental processes and states and correlate them with his/her activity.

A theory of conceptual regulation of the mental states being developed by us is the most general basis for emphasizing the conceptual aspect of interrelations between the mental states and the cognitive processes (Prokhorov, 2009; Prokhorov & Yusupov, 2012). Within the framework of the mentioned theory we give detailed consideration to the statement of Vygotsky (1987) saying that a conceptual arrangement of consciousness is one of the factors of interrelation between a cognitive reflection and a mental state being actualized. On the basis of the above we can suggest that a conceptual context of activity has significant influence on quantitative and qualitative properties of the mental states (quality, polarity, intensiveness) and the cognitive processes (efficiency).

The dynamic aspect of interrelations between the mental states and the cognitive processes is associated with consistent nature of their interaction

(Pessoa, 2008). Due to this a time factor is included to the number of examined system parameters as an independent variable determining dynamics of interaction.

In terms of the above approaches we have conducted an experimental investigation of interrelations between the mental states and the cognitive processes in learning activity of students.

Methodological Framework

Purpose and research question

The investigation 1s aimed at discovering of a functional role of reflexivity and conceptual orientation of a person in interaction between the mental states and the cognitive processes. In order to achieve the set purpose, it is necessary to find an answer to a question how personal meaning, reflexivity and the time factor influence on dynamics of interrelation between the mental states and the cognitive processes in the course of learning activity of students.

Participants

For the purposes of the investigation two sampling populations with the equivalent content were formed. The both panels consisted of 48 persons (35 young women and 13 young men) studying liberal arts in the university and aged between 19-20 years.

Procedures

The investigation was performed in the conditions of real learning activity. The students carried out their learning activity in the usual course under the guidance of a teacher. At the beginning in the middle and at the end of a learning session there were taken measurements of the indices of the mental states intensity and the cognitive processes productivity (learning activity was interrupted for the period of 25-30 min). Total duration of the learning session inclusive of the time occupied by testing corresponded to the duration of a paired learning session (180 min).

In order to study the influence of personal meaning on interaction between the mental states and the cognitive processes there was introduced the following pattern of empirical investigations. Each of the two panels was offered the equivalent test assignments under the same learning activity conditions (the learning session contents, classroom and time at which the learning session took place). Differences consisted in the content of the given instructions and behavior of an experimenter in the course of investigations. Two personal meanings of the investigated situation were actualized in the subjects: "process-related" (the first panel) and "self-assertiveness" (the second panel). In order to form the process-related (operational) orientation of personal meaning the instruction was targeted to the process of assignments execution as opposed to importance of the investigation to a respondent or an investigator. The subjects were informed that data being obtained was necessary for verification of the current statistical standards. In this way performance of the offered test assignments was presented as a method of cooperation with the investigator which had no "checking" meaning for the students. Behavior of the investigator was characterized as "business-like" and "relaxed".

In order to activate personal meaning of self-assertiveness the instruction was oriented to forming of individual and social importance of the investigation being carried out. The subjects were informed on significance of the investigation for improvement of a study process organization, besides a testing significance (to demonstrate a limit of intellectual capabilities) of the investigation for each individual was emphasized. The investigator's behavior in this case was targeted at formation of a "failure stress" in the students (disapproving comments addressed to the students, creation "nervousness" and hurry, reporting misleading results in the course of accomplishment of the test assignments).

The corresponding created situations were classified as "usual" and "difficult". In the "usual" situation the content of activity purpose and motivation are in agreement or have close relationships (for example, purpose to fulfill an assignment, motivation to find correct variants of answers). In the "difficult" situation the activity purpose and motivation differ from each other, objective significance of the activity and its personal meaning for the subjects are different (purpose to fulfill an assignment, motivation to prove oneself at his/her best) (Leontyev, 2004).

This pattern of empirical investigations complies with the requirements of situational approach in psychodiagnostics according to which a subject responds not only to test assignments but also to a situation as a whole in line with his/her motivation and attitude to an investigator (Anastasi and Urbina, 1997).

A key role in realization of the investigation pattern concerned is being played by the issue of differential characteristics of personal meaning of self-assertiveness and process-related personal meaning in the course of empirical investigations. Here below you can find some qualitative criteria which can be taken as a basis for determining dominance of one or another conceptual orientation. Particular behavioral characteristics of subjects and their personal assessment of a situation.

Analysis of the subjects' self-reports demonstrated that the "difficult" situation was more often associated with such comments as "I am disappointed by my intellectual abilities", "I feel myself stupid", "I had more high opinion of my intelligence", etc. For the "usual" situation observations of quite another nature were encountered: "my eyes got tired", "my hand is aching", "the shoulder is aching due to rapid movements", "I am exhausted", "my head is aching" etc. These comments are indicative of two different (as to their nature) types of conceptual orientation: self-assertiveness ("toward the self") and process-related ("toward the activity").

Higher level of positive emotional states in case of the process-related orientation of personal meaning. The comparative analysis demonstrates that in the "usual" situation the more high level of positive states is being observed at every stage of the study session (the state of amusement, gaiety, excitement and other). In the "difficult" situation the subjects almost do not feel any positive states.

Instruments

The methods of diagnostics of perception, attention and memory were selected for realization of the investigation. Combined study of the stated parameters complies with the cognitive approach to the mental processes within

the framework of which various processes are being considered as components of an integrated information processing mechanism.

Among the parameters of attention the following features were explored: attention concentration and span with use of the B. Bourdon-test (1995), attention switch under subtest 8 (Coding-Digit Symbol) of the test of D. Wechsler (1997), attention capacity and allocation according to Schulte's tables, attention selectiveness according to E.L. Thorndike (1949) Method. Memory efficiency was evaluated by recent memory indices (carrying out mental arithmetical operations with retention of intermediate outcomes), memorizing numeral (10 two-digit numbers) and verbal (10 words with no contextual links) information (Anastasi and Urbina, 1997). Efficiency of mediated memorizing was measured by means of the methods of L.S. Vygotsky (1987) and T.P. Zinchenko (2002). Besides there were evaluated time perception parameters (assessment of duration of time intervals) and perception of special attributes (determination of time with the help of 10 dials without numerals put in unusual locations). Success in fulfillment of the assignments was taken as the principal index of the cognitive processes productiveness. The index of success is a complex integral characteristic which includes quantitative (speed) and qualitative (accuracy) parameters of a cognitive process. Success is also an index of information processing efficiency since it includes the indices of correctness and accuracy of finding out the only possible (standard) answer in compliance with the requirements of the given situation.

Equivalent forms of the test assignments for each method of diagnostics of cognitive processes were developed by means of intermixing, rearrangement of the assignments order, division of stimulus material into three equal parts (such technique is used also in order to reduce the effect of exercisability in the course of carrying out the offered test assignments). The mentioned methods have no influence on the results of the cognitive processes measurements, since in the used standardized methods a correct answer to any assignment is evaluated equally (receives the same grade). By virtue of the fact that all test assignments are interchangeable their rearrangement and mixing have no effect on the final indices of cognitive processes productivity.

For measurement of the mental states "Mental state pattern" method was used (Prokhorov, 1998). The method is based on the principle of semantic differential and is used for measurement of 40 indices describing feelings, behavior, physiological reactions and cognitive processes of a person. Medium intensity of the mental states in the students was taken as a principal characteristic for this investigation.

The reflexivity level indices were measured by means of "Psychodiagnostic method for determining individual degree of reflexivity" (Karpov, 2004). Totally three levels of reflexivity were distinguished: low, medium and high. In accordance with the conceptual representation of the researchers of the method reflexivity determines all of the information processing processes, since there are considerable differences in the structure of intellectual sphere in individuals with different levels of its development (Karpov, 2004).

Date analysis

Standardization of the indices defined by the methods of the cognitive processes diagnostics was carried out by the way of percentile normalization

based on the 10-point Cattel scale (M=5.5, σ=2). Standardization sampling population consisted of 102 persons studying various areas of specialization aged between 19-20 years, 61 female and 41 male among them.

In order to determine an index of structural arrangement of the mental states, the cognitive processes and intercorrelation relationships the statistical weight method was used. The relations having the level of statistical significance of $p \leq 0.05$ were assigned 1 point, $p \leq 0.01$ – 2 points and $p \leq 0.001$ – 3 points. The sum of points for all statistically significant relations was considered as the index of arrangement of the corresponding structures.

In agreement with the investigation algorithm interaction of the mental states and the cognitive processes was examined with the aid of variance analysis technique (ANOVA 2x3x3x3). The average indices of the mental states and the cognitive processes were alternatively assessed as dependent/independent variables. Besides the following parameters were taken as independent variables: personal meaning of the investigation situation (two ranking levels: process related orientation and orientation toward self-assertiveness), reflexivity (low, medium and high levels), time (beginning, medium and end of the study session). Efficiency of the cognitive processes and medium intensity of the mental states had three graduation levels (low, average and high).

Results

The results of phenomenological analysis of the mental states of the students demonstrated that at each stage of the study session three groups of typical mental states could be observed: of medium intensity at the beginning of high intensity in the middle of low intensity at the end of the study session. The three groups were characterized by the following predominating states correspondingly: tranquility and interest; intellectual intensiveness and excitement; fatigue. Subsequently, only those empirical data which related to the mentioned typical states were subject to processing.

In the course of analysis of the cognitive processes as a dependent variable it was established that the model of variance analysis was statistically significant ($F=1.525$, $df=53$, $p \leq 0.026$) and explained 34% of variance of their average characteristics. An unexplained part of variance may be referred to the influence of the cognitive processes which were not taken in consideration in the investigation, most likely brainwork acting as a significant integrator of the cognitive processes, the basis of their arrangement.

There were discovered statistically significant influence of the following parameters on the cognitive processes productivity: personal meaning variables ($F=4.018$, $df=1$, $p \leq 0.047$), levels of the mental states intensity ($F=3.933$, $df=2$, $p \leq 0.022$), interaction of time and the mental states variables ($F=2.931$, $df=4$, $p \leq 0.023$), interaction of reflexivity and the mental states variables ($F=2.631$, $df=4$, $p \leq 0.037$).

The investigation discovered that personal meaning of self-assertiveness reduced the cognitive processes productivity. In its turn, within the range of states from low to high intensity the cognitive processes productivity is becoming higher. Influence of the time variable on interrelation of the mental states and the cognitive processes lies in the following: at the beginning of the investigation the highest efficiency of the cognitive processes is demonstrated by

those subjects who experience medium intensity, on the second and the third stages those who experience high intensity. Regardless of the time factor the subjects experiencing the states of decreased mental activity demonstrate comparatively low results.

Subsequently, the influence of reflexivity, personal meaning, time and the cognitive processes productivity on the mental states intensity as a dependent variable was examined. The results of analysis of variance allowed to establish that with relation to the states of medium intensity the panel means had statistically valid difference in variables of: personal meaning ($F=4.668$, $df=1$, $p\leq0.032$), time ($F=3.133$, $df=2$, $p\leq0.045$), the cognitive processes ($F=8.088$, $df=2$, $p\leq0.000$), reflexivity ($F=3.829$, $df=2$, $p\leq0.023$) as well as in interaction of reflexivity variables and the cognitive processes productivity ($F=3.027$, $df=4$, $p\leq0.018$).

The analyzed factor model explains 27% of variance of the mental states with medium intensity and is characterized by high level of statistical significance ($F=1.615$, $df=53$, $p\leq0.009$). It will be logical to suggest that the non-explained part of variance is associated with the influence of personal factors. Indeed, as compared to the cognitive processes personal attributes are "included" into the functional structure of the mental states to significantly higher degree, at that the major amount of relationships falls at character traits. These results evidence that the mental states to a large extent are a reflection of character traits as an aggregate of substantial individual characteristics of a personality (Prokhorov, 1994).

The procedure of analysis of variance did not allow establishing the role of personal meaning in the interrelation between the mental states and the cognitive processes. In order to investigate this aspect there was performed a comparative analysis of correlation relationships between the mental states and the cognitive processes in the cases of dominance of process-related orientation and orientation toward self-assertiveness. The basic difference of the situations under consideration consisted in structure of arranging relations (Table 1). In case of process-related orientation of personal meaning interrelation of the cognitive processes with the mental states of medium and low intensity gets stronger and with the mental states of high intensity gets weaker. These regularities allow suggesting that process-related meaning function consists in regulation of a degree of self-dependence and integration ability of the structures of two mental phenomena depending on the degree of intensity of the mental states. In a quantitative sense, process-related personal meaning favors decrease of intensity of the mental states and growth of the cognitive processes productivity thereby promoting optimal interaction.

Discussions

It is seen from Fig. 1 that influence of the mental states on the cognitive processes is being mediated by reflexivity. The highest cognitive processes productivity is demonstrated by the students having medium and high indices of the level of reflexivity. At that the highest efficiency in the high intensity mental states 1s demonstrated by the subjects with medium level of reflexivity. Thereby, the statement on interrelation between mental activity success and sufficiently high level of reflection development is being ascertained (Karpov, 2004). The following regularities are of interest in the state of depressed mental

activity regardless of the level of reflexivity the subjects demonstrate low cognitive productivity. In case of low level of reflexivity regardless of the level of the mental state intensity the cognitive processes also appear to be low productive.

Table 1. Interrelation of the mental states and the cognitive processes with account of conceptual peculiarities of a situation.

Sign.	Study session start				Study session middle				Study session end			
	A		B		A		B		A		B	
	PMS	PPM	PMS	PPM	PMS	PPM	PMS	PPM	PMS	PPM	PMS	PPM
p< .05	3	3	5	20	1	1	22	19	5	4	5	14
p< .01	2	1	1	3	1	0	10	4	4	3	0	3
p< .001	0	0	0	0	0	0	4	5	2	1	0	2
Coef. of organization	7	5	7	26	3	1	54	42	19	13	5	26

Symbol legend: PMS: Personal Meaning of "self-assertiveness"; PPM: "Process-related" Personal Meaning; A: number of relations in the structure of the cognitive processes; B: number of relations between the structures of the mental states and the cognitive processes.

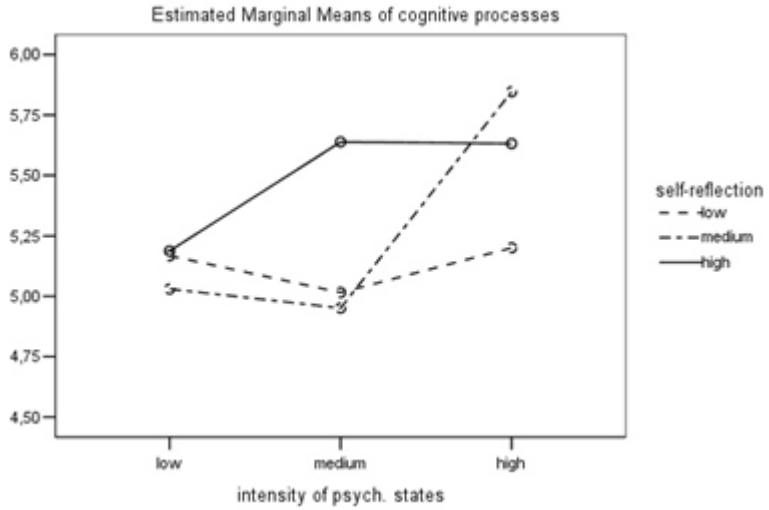

Figure 1. Influence of the mental states intensity on the cognitive processes productivity depending on the level indices of reflexivity.

These results evidence that relationship between the characteristics of the mental states and the cognitive processes is of complex and mediated type. High level of reflexivity does not always mean successful mental activity as it can be seen from the presented results reflexivity depends on intensity of the mental states being experienced. On the other hand high cognitive processes productivity in the state of medium-intensive mental activity is connected with high level of reflexivity. Therefore, the investigation results demonstrate a mediating role of reflexivity in interrelationship of the mental states and the cognitive processes.

According to the results of the analysis of variance it was established that the influence of personal meaning on interrelation of the mental states and the cognitive processes is being manifested through reduction of the cognitive processes productivity in the "difficult" situation. It can be suggested that decrease of the cognitive processes productivity in case of dominance of orientation towards self-assertiveness is associated with the psychological mechanism of self-attitude which causes the subject to "stick together" himself/herself and the results of his/her activity in consequence of which he/she becomes too dependent on his/her achievements. In case of misfortune and failures self-attitude is getting down, self-confidence is being lost which results in actualization of destructive mental states. In this situation, the mental states function as mediators in influence of self-attitude on mental activity productiveness. This statement was experimentally validated in the investigations which involved teen-agers as a sample population (Nosenko, 1998).

Besides the results of the performed analysis of variance demonstrate that influence of the mental states intensity consists in increase of the cognitive processes productivity within the range from low to high intensity states. In general this confirms regularities of emotional states influence on cognitive activity: favorability of sthenic and infavorability of asthenic states (Izard, 2009).

Let's examine the "reverse" influence of the cognitive processes on the mental states intensity. The investigation results demonstrate that in the "difficult" situation intensity of the mental states is higher than in the "usual" one. The time factor action consists in lowering of medium intensity of the mental states from the first to the last stage of the study session. Influence of the cognitive processes is manifested through increase of the mental states intensity in the subjects with high level of the cognitive processes productivity as compared to the medium and the low levels. The effect of reflexivity is expressed in increase of the mental states intensity in the subjects who has medium or high reflexivity.

The influence of the cognitive processes on intensity of the mental states is being mediated by reflexivity. In case of low productivity more intense mental states are being experienced by the subjects with high level of reflexivity in case of medium productivity the subjects with medium level of reflexivity experience more intensive mental states. High level of cognitive processes productivity is connected with the highest indices of the mental states intensity in the subjects with medium and high level of reflexivity. The subjects with low level of reflexivity experience less intensive mental states regardless of the level of the cognitive processes productivity.

In accordance with the investigation results the subjects with high level of reflexivity demonstrate high cognitive processes productivity both in the states of medium and high intensity, at that the states being experienced are less intensive. Therefore, from the point of view of correlation between energy consumption and the cognitive processes productivity high-level reflexivity is an optimal variant.

It is interesting that there is no statistically valid interaction between the variables of reflexivity, personal meaning and time. It seems that interaction between the mental states and the cognitive processes of the students is being independently regulated both on the part of personal factors (personal meaning and reflexivity) and on the part of learning activity dynamics (time factor).

The obtained results confirmed the introduced suggestion on influence of reflexivity, personal meaning and time on interrelation of the mental states and the cognitive processes. In addition, there was demonstrated the mediating role of reflexivity in interrelations between the mental states and the cognitive processes in the course of the students' learning activity.

Moreover, the analysis of correlations between the mental states and the cognitive processes is indicative of regulation of interrelations between them by personal meaning of an investigation situation. In this case conceptual regulation may be treated as a system of psychological mechanisms ensuring conformity of the course of activity with intentional sphere of its actor (Leontyev, 2007). Conceptual regulation plays the leading role in the system of internal regulation of a certain activity and consists among other things in coordination of activity purposes and motivation. This form of regulation establishes determination of interrelations between the mental states and the cognitive processes on the part of a subject of the learning activity. Conceptual regulation of relationships between the mental states and the cognitive processes is connected with volitional regulation. Manifestation of a subject's will is expressed in switching over of consciousness and volitional control from experiencing an unfavorable state (orientation toward the self) to regulation of

activity, maintenance of its quality (process-related orientation) (Kuhl *et al.,* 2006).

Conclusion

Reflexivity, personal meaning and time factor have a joint influence on interaction of the mental states and the cognitive processes.

The level indices of reflexivity mediate interaction of the mental states and the cognitive processes in the course of the students' learning activity. The regulatory function of reflexivity is associated with its level characteristics: high reflexivity level promotes high cognitive processes productivity with less energy consumption; medium reflexivity level ensures achievement of the maximum cognitive processes productivity provided that highly intensive mental states are being active; low reflexivity level is characterized by the minimum cognitive processes productivity over the whole range of the mental states intensity change.

Personal meaning has a regulatory effect on interaction of the cognitive processes and the mental states in the students' learning activity. Dominance of process-related orientation of personal meaning (by contrast with orientation toward self-assertiveness) in the situations of the learning activity makes interrelation between the cognitive processes and the medium and low-intensity mental states stronger. At the same time the level of integration of the cognitive processes with the high-intensity mental states is being reduced. In a quantitative sense, this is expressed in increase of the cognitive processes productivity at the less intense mental states.

It was established that influence of the mental states on the cognitive processes is mediated by time characteristic. At the beginning of study sessions the cognitive processes productivity is connected with the medium-intensity mental states, whereas during the consecutive stages (the medium and the end of a study session) productivity is associated with the high-intensity mental states.

Recommendations

Materials of the paper are of interest to psychologists working in education, teachers, and a wide range of specialists-teachers.

Acknowledgements

1. The research was conducted with the support of the Russian Humanitarian Scientific Fund and the Government of the Republic of Tatarstan, project No. 15-16-16002.

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

Disclosure statement

No potential conflict of interest was reported by the authors.

Notes on contributors

Alexander O. Prokhorov is Doctor of Psychology, Professor, Head of the General Psychology Department of the Institute of Psychology and Education, Kazan (Volga region) Federal University, Kazan, Russia.

Albert V. Chernov is PhD, Associate professor, senior lecturer in the General Psychology Department of the Institute of Psychology and Education, Kazan (Volga region) Federal University, Kazan, Russia.

Mark G. Yusupov is PhD, Associate professor of the General Psychology Department of the Institute of Psychology and Education, Kazan (Volga region) Federal

References

Anastasi, A & Urbina, S. (1997). *Psychological Testing*. NJ: Prentice Hall, Upper Saddle River. 377p.

Angie, A. D., Connelly, S., Waples, E. P., Kligyte, V. (2011). The influence of discrete emotions on judgement and decision-making. *Cognition and Emotion*, *25*, 1393-1422.

Blanchette, I. & Richards, A. (2010). The influence of affect on higher level cognition: A review of research on interpretation, judgement, decision making and reasoning. *Cognition and Emotion*, *24*, 561-595.

Bourdon, B. (1995). Observations on memory, discrimination and association. *Revue Philosophique*, *40*, 153-185.

Flavell, J. (2000). Metacognition and cognitive monitoring: A new area of cognitive developmental inquiry. *American Psychologist*, *34*, 906-911.

Gyurak, A., Goodkind, M. S., Kramer, J. H., Miller, B. L., Levenson, R. W. (2012). Executive functions and the down-regulation and up-regulation of emotion. *Cognition and Emotion*, *26*, 103-118.

Izard, C. E. (2009) Emotion Theory and Research: Highlights, Unanswered Questions and Emerging Issues. *Annual Review of Psychology*, *60*, 1-25.

Karpov, A. V. (2004). *Psychology of Reflexive Mechanisms of Activity*. Moscow: Academy of Sciences. 293p.

Koole, S. L. (2009) The psychology of emotion regulation: An integrative review. *Cognition and Emotion*, *23*, 4-41.

Kuhl, J., Kazen, M., Koole, S. L. (2006). Putting self-regulation theory into practice: A user's manual. *Applied Psychology*, *55*, 408-418.

Leontyev, A. N. (2004). *Activity, Consciousness and Personality*. Moscow: Akademia. 277p.

Leontyev, D. A. (2007). Psychology of Meaning: Nature, Composition and Dynamics of Conceptual Reality. Moscow: Smysl. 314p.

Lewis, M. D. (2005). Bridging emotion theory and neurobiology through dynamic systems modeling. *Behavioral and Brain Science*, *28*, 169-194.

Manfrinati, A., Lotto, L., Sarlo, M., Palomba, D., Rumiati, R. (2013). Moral dilemmas and moral principles: When emotion and cognition unite. *Cognition and Emotion*, *27*, 1276-1291.

Mano, Q. R. & Brown, G. G. (2013). Cognition-emotion interactions in schizophrenia: Emerging evidence on working memory load and implicit facial-affective processing. *Cognition and Emotion*, *27*, 875-899.

Nosenko, E. L. (1998). Emotional state as a mediating factor of influence of self-appraisal on efficiency of intellectual activity of a teenager. *Psikhologicheskii Zhurnal*, *19*, 16-25.

Oatley, K, Parrott, W. G., Smith, C., Watts, F. (2011). Cognition and emotion over twenty-five years. *Cognition and Emotion*, *25*: 1341-1348.

Pessoa, L. (2008). On the relationship between emotion and cognition. *Nature Reviews Neuroscience*, *9*, 148-158.

Prokhorov, A. O. & Yusupov, M. G. (2012). Everyday trance state: Phenomenology and regularities. *Psikhologicheskii Zhurnal*, *33(1)*, 88-100.

Prokhorov, A. O. (1994). *Mental States and their Functions*. Kazan: Teacher's Training Institute. 122p.

Prokhorov, A. O. (1998). *Psychology of Non-Equilibrium States*. Moscow: Academy of Sciences. 174p.

Prokhorov, A. O. (2009). *Conceptual Regulation of Mental States*. Moscow: Academy of Sciences, 114p.

Prokhorov, A. O., Chernov, A. V., Yusupov, M. G. (2015). Cognitive states in educational activity of students: Structural–functional aspect. *Asian Social Science*, *11(1)*, 213-218.

Storbeck, J., Clore, G. L. (2007). On the interdependence of cognition and emotion. *Cognition and Emotion*, *21*, 1212-1237.

Thomas, G. P. (2012) Metacognition in Science Education: Past, Present and Future Considerations. *Second International Handbook of Science Education*, 131-144.

Thorndike, E. L. (1949). *Selected Writings from a Connectionist's Psychology.* New York: Appleton-Century-Crofts, 205p.

Vygotsky, L. S. (1987). Thinking and Speech. In R.W. Rieber, & A.S. Carton (Eds.), *The Collected Works of L.S. Vygotsky*, 37-285. New York, London: Springer.

Wechsler, D. (1997). *WAIS-III, Wechsler Adult Intelligence Scale*. San Antonio: Psychological Corporation, 173p.

Yiend, J. (2010). The effects of emotion on attention: A review of attentional processing of emotional information. *Cognition and Emotion*, *24*, 3-47.

Zinchenko, T. P. (2002). *Memory in Experimental and Cognitive Psychology.* Saint-Petersburg: Piter, 166p.