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Gnostic Emotions of Students in Solving of Thinking Tasks

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Abstract: The paper presents the results of an empirical study of the emotional characteristics of students when solving thinking problems. The study used an experiment that simulates a students' collaborative solution to the puzzle-doing problem. To study emotional variables, we used the method of B.I. Dodonov for determination of the general emotional orientation. To investigate feelings experienced by students, we used the method of K. Isard. According to the authors, the following types of general emotional orientation (with decrease) are dominated among students: altruistic, communicative, and mixed types. All students showed the dominance of emotions of interest, joy and surprise under the decision processes, regardless of the emotional type of personal-ty. It was revealed that under the processes of solving thinking problems, students with the dominance of various types of emotional orientation showed a different ratio of emotions. Four strategies of solving thinking problems were identified, which are characterized by the representation of various emotions.

Keywords: emotion, gnostic emotions, emotional orientation, thinking, strategies for solving thinking problems.

Introduction

In modern studies, emotions are understood as short-term, intense phenomena that have a clear cognitive content and a substantial reason available to a person experiencing emotion (Clore at al., 1994; Isen, at al., 1987; Michael, 2011; Oatley, at al., 1987; Scherer, 2000; Schwarz, 2000; Zinck at al., 2008).

Studies of the role of emotions in solving problems have shown that various emotional states and emotions can differentially influence the effectiveness of solving problems (Fiedler, 2001; Isen, at al., 1987). When studying the solution of complex problems (Spering et al., 2005) showed that the form of emotions, positive and negative emotions do not influence the solution of complex problems.

In Russian psychology, one of the first who came to the understanding that various people have preferences in the most desirable experiences was B. I. Dodonov. The person's experiences of his attitude to the world expressed in the dominant emotional states to which the person aspires lead to the formation of a general emotional orientation of personality. An important component of this orientation is the attitude to emotional experiences that are valuable for a person. As a result, B. I. Dodonov identified ten types of emotional orientation that make up some emotional-personal complexes that form a certain type of personality: altruistic, communicative, praxical, gnostic, gloric, aesthetic, pugnic, romantic, hedonic, acquisitive (Dodonov, 1978).

In psychology, quite a long time ago there were ideas about the unity of emotional and thinking activity (Tikhomirov, 2008; Vasiliev at al., 1980). In the psychology of thinking in the papers of V. E. Klochko (Klochko at al., 2000), it was shown that emotions participate in reflecting the systemic, psychological characteristics of objects in the form of "experiencing" the emphasis or value of a phenomenon that falls within consciousness. These studies follow the investigations of the role of emotions in mental activity. Within their framework, in the school of O. K. Tikhomirova, it was found that the solution to a thinking problem originates at an emotional, unconscious level; thanks to emotions, a search zone and work area are fixed, the volume of research activity changes (Tikhomirov, 2008). V. E. Klochko showed the role of emotional and verbal estimates in thinking activity (Klochko at al., 2000). Thus, it was found that emotions perform a regulatory function in the person who decides the problem (Tikhomirov, 2008). In studies of joint thinking, the emotional characteristics of preschool children (Belousova and Pavlova, 2013) and students (Belousova and Belousova, 2016) were shown in the processes of cooperation with peers in solving problems.

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K. Isard identifies fundamental emotions, which include: joy, surprise, sadness, anger, disgust, contempt, grief-suffering, shame, interest-excitement, guilt, embarrassment (Isard, 1991). P. Ekman suggested that six emotional states (joy, sadness, anger, disgust, fear, and surprise) are universal in all cultures (Ekman, 1992). In modern foreign studies, it has been shown that emotions differentially affect strategies and the quality of solving thinking problems. Positive emotions lead to flexible and creative thinking (Fiedler, 2001; Isen et al., 1987). People in a positive emotional state tend to use downward (top-down) processing strategies (heuristics), while negative emotional states facilitate upward processing (bottom-up) (Bless and Fiedler, 1995; Hertel et al., 2000; Schwarz 2000).

In a modern study, conducted on chess players, the authors showed the dynamics of changes in emotional states when solving complex problems. The authors explain this phenomenon as an involuntary manifestation of emotions that are associated with a change in perception and understanding of the situation (Guntz et al., 2018). The results are consistent with the studies of O. K. Tikhmirov, who showed that the role of emotions is changing at different stages of solving the problem (Tikhmirov, 2008). J. P. Forgas suggested (Forgas, 2008) that positive emotions contribute to inductive, upward thinking, and negative emotions - to deductive, downward thinking. R. Pekrun & E. J. Stephens emphasize that positive emotions influence creative problem solving, and negative emotions influence reproductive problem solving (Pekrun and Stephens, 2010).

In the studies of J. Michael (Michael, 2011), the possibilities of the coordinating function of emotions in the context of joint actions were analyzed.

M. S. Hannula identified three different social functions of emotions in joint problem solving: those related to the needs and goals of interpersonal relationships, those related to individual learning goals, and those related to the social coordination of individual goals (Hannula, 2015).

We asked ourselves how basic emotions affect problem solving, which is carried out in an interactive environment, when students solve problems together. We believe that: 1) gnostic emotional experiences reflecting the importance of cognitive moments of activity will act as one of the regulators of human mental activity; 2) a general emotional orientation reflecting the significance of certain emotional experiences for a person, their value and semantic representation, can act as a factor affecting the strategies for solving problems.

Materials and methods

In our study, emphasis was laid on studying the effect of emotional variables on the problem solving strategies. The emotional variables included the type of the general emotional orientation of the personality in accordance with the classification of B. I. Dodonov (Dodonov, 1978) and the characteristics of the experienced emotional states of the study participants according to K. Isard (Isard, 1991); taken together, they constitute a characteristic of the individual emotional experiences.

Eighty four students from Rostov-On-Don drew the sample. As one of the methods, an experiment based on the situation of a joint decision of mental tasks by a group of 3-4 students (they were to do puzzle) was used. The subjects were asked to put together a jigsaw puzzle within 7 minutes.

In the diagnostic part of the study, B. I. Dodonov's technique and K. Isard's questionnaire were used, which were presented to the subjects immediately after the experiment.

The method of B. I. Dodonov is designed to study the General emotional orientation of the individual, it is a questionnaire with a description of various emotional experiences, grouped into ten types. The task of the Respondent is to select the characteristic emotional experiences (Dermanova, 2002). Questionnaire K. Isard includes scales characterizing the experiences of basic emotions. K Isard calls ten basic emotions: anger, contempt, disgust, grief, fear, guilt, interest, joy, shame, surprise (Eliseev, 2003).

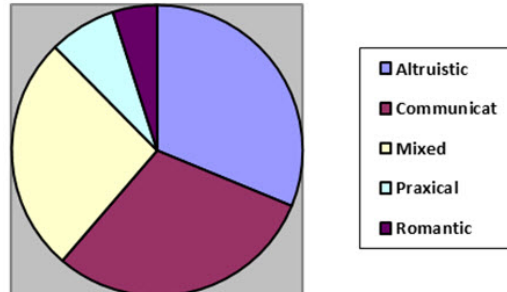
The data obtained were processed using methods of mathematical statistics: The Mann-Whitney test, Spearman correlation study (Nasledov, 2007).

Results

First of all, the analysis of the types of general emotional orientation among respondents was carried out.

Figure 1.

Types of general emotional orientation among respondents



The study has found that the primary types of general emotional orientation are altruistic (29.7%) (n = 25), communicative (28.6%) (n = 24) and mixed types. The type in the absence of pronounced dominance of certain emotional experiences (25%) (n = 21) was called mixed. Praxic (7.1%) (n = 6) and romantic (4.7%) (n = 4) types were less pronounced, but were represented in a few groups.

An output analysis of the decision process observation made it possible to identify four types of strategies for solving mental problems by students: a mosaic solution, a space restriction strategy, a strategy of successive steps, and a chaotic solution.

The mosaic solution strategy (61%) suggested that the subjects preferred to put together individual fragments from which they further tried to form a logical design and structure of the puzzle picture. We can talk about the upward heuristic that underlies this strategy: the movement from data to the goal is seen as a movement from bottom to top, from particular ideas to general ones.

The space restriction strategy (24%) suggested that the subjects first laid out the border of the picture, and then started to fill it. In this case, it can be argued that the basis is a descending heuristic suggesting a movement from the end (goal) to the beginning (data); this is a movement from above, as a movement from a functional value, a general idea to particular hypotheses. The strategy of successive steps took place when the subjects collected the figure sequentially (5%). This is also an option to use downward heuristics. The strategy is a chaotic solution assumed that the subjects had no preferences and orientation in collecting puzzles, they used various options (10%).

The analysis of strategies for solving mental problems by the subjects with different types of general emotional orientation showed the following (Table 1): for the altruistic type, mosaic decision strategies (72%) and space restrictions (28%) are typical; for the communicative type – mosaic solutions (54%), space restrictions (29%), successive steps (4%) and chaotic solutions (12%); for the mixed type – mosaic solution (71%) and a chaotic solution (29%); for the praxic type – space limitations (100%), for the romantic type – mosaic solution (100%).

Table 1.

Strategies for solving thinking problems by students with various types of emotional orientation

General emotional orientation	Strategies for solving thinking problems			
	The mosaic solution (%)	The space restriction (%)	The strategy of successive steps (%)	Chaotic solution (%)
Altruistic	72	28		
Hedonic			100	
Gnostic		100		
Communicative	54	29	4	12
Praxical		100		
Pugnic	100			
Romantic	100			
Mixed	71			29
Aesthetic			100	

According to K. Isard's method, all the types presented (Table 2) showed dominant emotions of interest, joy and surprise, which indicates the role of gnostic emotions in decision processes.

Table 2.
Emotional characteristics of students with various types of emotional orientation

Emotions	Type of general emotional orientation				
	Altruistic (%)	Communicative (%)	Mixed (%)	Praxical (%)	Romantic (%)
Interest	16	18	17	19	17
Joy	16	18	17	19	16
Surprise	12	13	12	13	11
Grief	11	10	11	7	7
Anger	7	7	7	5	7
Disgust	7	6	7	5	8
Contempt	7	7	9	9	10
Fear	8	7	6	6	8
Shame	8	8	7	8	11
Guilt	7	6	7	9	5

Less pronounced, but quite often arising in comparison with other emotions, was the emotion of grief. We interpreted it, in the context of a problem-solving situation, as chagrin about disability to cope with a task. Other emotions (fear, guilt, shame, contempt, disgust, anger) were expressed approximately the same.

Significant distinctions in emotional states between types with different emotional orientations were observed in the expression of negative emotions of fear, guilt, contempt, grief, and anger. There were no significant differences in the emotions of interest, joy, surprise.

Thus, we can say that gnostic emotions are dominant for the subjects, regardless of personality type or emotional orientation. Activities of solving mental problems induce the emergence of gnostic emotions (surprise, interest, joy), and these are common emotions for all participants and a common characteristic for all personality types. The results obtained indicate, firstly, the formation of common, shared among all participants, gnostic emotions of surprise, interest, joy; secondly, that the very situation of joint activities on solving mental problems leads to the generation of cognitive emotions common to all participants that are not related to their personality types.

At the same time, there are significant differences in the negative emotions associated with the problem solving situation (Table 3). The use of the Mann-Whitney criterion made it possible to detect differences in the intensity and frequency of the manifestation of emotions in students with various types of general emotional orientation.

Table 3.
The significance of differences in emotions in students with different types of emotional orientation

Groups of respondents	Types of emotions									
	Grief (F)	Grief (I)	Anger (I)	Anger (I)	Disgust (I)	Disgust (F)	Fear (F)	Shame (I)	Guilt (F)	Guilt (I)
Altruistic - Communicative	U=181,000 p = ,017	U= 91,00 p = ,028	U=204,00 p = ,045		U=191,00 p = ,026					
Altruistic - Mixed			U=155,00 p = ,014		U=174,00 p = ,045		U=171,00 p = ,031	U=161,500 p = ,023		U=148,000 p = ,009
Altruistic - Praxical	U=21,000 p = ,005	U=27,000 p = ,015	U=28,500 p = ,017	U=34,000 p = ,041	U=36,500 p = ,053	U=26,500 p = ,012				
Altruistic - Romantic		U=13,000 p = ,016								
Communicative - Mixed							U=166,000 p = ,039		U=164,000 p = ,041	U=138,500 p = ,008
Mixed - Praxical	U=22,000 p = ,015									

F* - Emotional Frequency

I* - Emotion expression intensity

Significant differences in the emotional states of respondents with different types of emotional orientation were observed in the manifestations of negative emotions of fear, guilt, disgust, grief, and anger. There are no significant differences in the emotions of interest, joy, surprise.

An analysis of the correlation relationships made it possible to detect inversely proportional correlation relationships between the effectiveness of solving problems and the intensity of emotions of grief and fear (Table 4). An analysis of the correlation relationships made it possible to detect inversely proportional correlation relationships between the effectiveness of solving problems and the intensity of emotions of grief and fear (Table 4). Among the general correlations, one can find that emotions of interest have direct correlations with emotions of joy. But these positive emotions exist independently and do not find any connections with other emotions.

Table 4.
The relationship of emotions and the effectiveness of problem solving

Types of emotions	Effectiveness	Joy (intensity)	Joy (frequency)
Grief (intensity)	-0,227*		
Fear (intensity)	-0,267*		
Interest (intensity)		0,256*	0,397**
Interest (frequency)			0,224*

A much greater interest is caused by the relationship of negative emotional experiences with the emotion of surprise (Table 5). The emotion of surprise (intensity and frequency of occurrence) is associated with direct positive relationships with emotions of grief, anger, disgust, contempt, fear, shame, guilt, each of which also has close mutual connections with each other.

Table 5.
Relationships of Emotion of Surprise with Other Emotions

Types of emotions	Grief (I)	Grief (F)	Disgust (I)	Disgust (F)	Contempt (F)	Anger (I)	Anger (F)	Fear (I)	Fear (F)	Shame (I)	Shame (F)	Guilt (I)	Guilt (F)
Surprise (I)	,509**	,424**	,394**	,234*		,330**	,249*	,354**	,273*	,354**	,258*	,452**	,298**
Surprise (F)	,442**	,661**	,283*	,387**	,260*	,241*	454**	,289**	,417**	,276*	,391**	,314**	,426**

F* - Emotional Frequency

I* - Emotion expression intensity

Discussions

Thus, it can be said that the mosaic solution strategy dominates among subjects with altruistic (72%), communicative (54%), mixed (71%) and romantic (100%) types of emotional orientation. The second in representativity is the space restriction strategy, which is subdominant in the altruistic and communicative types, and dominates in the praxic type.

The mosaic solution strategy allows us to talk about ascending heuristics: the movement from data to the goal is seen as a movement from the bottom up, from particular ideas to general ones. The space restriction strategy, in our opinion, speaks of a downward heuristic suggesting a movement from the end (goal) to the beginning (data), this is a movement from above, as a movement from a functional value, a general idea to particular hypotheses. Successive Steps Strategy - also demonstrates the use of a downward heuristic.

Thus, the ascending heuristic is predominant for respondents of all types of emotional orientation.

Analysis of the effectiveness of solving mental problems provided ranking the strategies for solving them in terms of their success: a mosaic solution strategy (48%), a space restriction strategy (35%), a successive steps strategy (31%), and a chaotic solution (27%).

In the process of solving problems, respondents of all types of emotional orientation were dominated by emotions of interest, joy, and surprise, which shows the role of gnostic emotions in decision processes (Vasiliev, et al., 1980; Izard, 1991). We see that solving problems evokes emotions that are related to cognition. The results obtained confirm the position that the emergence of emotions is associated with a specific situation of human life (Klochko and Galazhinsky, 2000; Izard, 1991).

The study showed that gnostic emotions are dominant for respondents, regardless of the type of emotional orientation. Activities to solve mental problems induce the emergence of gnostic emotions (surprise, interest, joy) - and these are common emotions for all participants and a common characteristic for all types of emotional orientation of a person. We speak general emotions based on the ideas of J. Michael (Michael, 2011). The results are consistent with the studies of R. Pekrun (Pekrun and Stephens, 2010), which distinguishes: negative activating emotions (anger, disappointment, fear, anxiety, shame) and deactivating negative emotions (boredom, hopelessness, sadness and disappointment); as well as activating positive emotions (pleasure, hope, anticipating joy, joy, pride and gratitude) and positive deactivating emotions (relaxation, anticipating relief, satisfaction and relief).

Our research has something in common with the results of M. S. Hannula (Hannula 2015), which refers to Ekman's assumptions about six basic emotions (anger, sadness, fear, disgust, happiness and surprise) (Ekman, 1992). and emphasizes that these emotions occur more often among participants when solving problems together.

We believe that the results obtained, firstly, indicate the formation of common, shared among all participants of the Gnostic emotions of surprise, interest, joy; secondly, that the very situation of cooperative interaction in solving mental problems leads to the generation of gnostic emotions common to all participants that are not related to their personality types. In this connection, we consider it advisable to talk about the regulatory function of gnostic or intellectual emotions in a cooperative, joint solution of problems. In modern studies, it has been shown that, with a joint solution, general estimates are formed (Belousova, 2002; Belousova, 2010; Salmela and Nagatsu, 2016), that perform a regulatory function. The obtained results confirm the provisions on the regulation of emotions in thinking (Goldin, 2004; Klochko and Galazhinsky, 2000; Tikhomirov, 2008) and in joint activities (Belousova and Pavlova, 2013; Hannula, 2015; Michael, 2011).

An analysis of the correlation relationships showed (Table 4) that emotions of interest have direct correlation with emotions of joy, thereby proving that the emotion of interest causes the joy of cognition. The correlation relationship analysis revealed the following features. Inverse proportional correlations were found between the effectiveness of solving problems and the intensity of emotions of grief and fear. Among the general correlations, one could find out that emotions of interest have direct correlations with emotions of joy. But these positive emotions exist independently and do not have any connections with other emotions. Thus, the study shows that the emotion of interest causes the joy of cognition, which, in principle, is characteristic of interest.

The data presented in table 5 show the relationship of emotions of surprise with emotions of grief, anger, disgust, contempt, fear, shame, guilt, each of which also has close mutual relations with each other. In our opinion, negative emotions have an activating effect on puzzle solving processes, which partially correlates with the position of R. Pekrun (Pekrun and Stephens, 2010), who identified activating and deactivating negative emotions. We believe that negative emotional experiences form an emotional complex, which, associated with surprise, contribute to problem solving, the formation of certain decision strategies. The results are consistent with ideas about emotional regulation presented in I. A. Vasiliev (Vasiliev et al., 1980), V. E. Klochko (Klochko and Galazhinsky, 2000), O. K. Tikhomirov (Tikhomirov, 2008). At the same time, this complex of emotions can act as universal for people with various types of emotional orientation, which serves as an evidence of the regulatory role of emotions in human mental activity.

Conclusions

Thus, the study enables to state that:

- gnostic emotional experiences can dominate in the situation of mental activity among participants with any type of general emotional orientation, which confirms the statement on the regulatory function of gnostic emotional states in human mental activity;
- negative emotional experiences associated with surprise contribute to the development of mental activity, the formation of certain decision strategies. At the same time, this complex of emotions can act as universal for people with various types of emotional orientation, as an evidence of the regulatory role of emotions in human mental activity;

- there are distinctions in strategies for solving mental problems among participants with a different type of general emotional orientation, which, however, requires confirmation and additional research on a more representative sample.

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Conflict of interests

The authors declare no conflict of interest.

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