



Cognitive preconditions and interaction styles between university students in the information environment

Liudmila V. Shukshina ^{1*}, Bogdan S. Vasyakin ¹, Elena L. Pozharskaya ¹,
Tatyana L. Khudyakova ², Olga V. Mizonova ³, Natalia G. Eniashina ⁴,
Rina S. Khammatova ⁵

¹ Plekhanov Russian University of Economics (Moscow University), Moscow, RUSSIA

² Voronezh State Pedagogical University, Voronezh, RUSSIA

³ Ogarev Mordovia State University, Saransk, RUSSIA

⁴ Ulyanovsk State University, Ulyanovsk, Ulyanovsk, RUSSIA

⁵ Sechenov First Moscow State Medical University, Moscow, RUSSIA

*Corresponding author: liudmila.shukshina@yandex.ru

Abstract

The question of what cognitive characteristics of a subject can be considered as cognitive strategies of interaction in the information environment is discussed in the article. Three groups of indicators related to the assessment of potential characteristics of the subject's cognitive strategies were involved in the conducted empirical study: structural characteristics of intelligence (offered by R. Amthauer and R. Cattell, styles of thinking and assessment of the personality's self-regulation style. As a result of the factor analysis, five main components were identified that determine the cognitive characteristics of the subject of information interaction. The first factor includes variables correlated with "mathematical" and "spatial" intelligence, that is, they are professionally significant for specialists working in the field of technology. The second factor includes the load on the variables "modeling conditions", "programming actions" and "the result assessment". The third factor comprises assessments on scales that are related to verbal abilities: "word exclusion" and "analogies", as well as an assessment of general (non-verbal or "cultural-free") intelligence. The fourth and fifth factors differ from the previous ones that they, to a greater extent, unite stylistic cognitive characteristics. The fourth factor includes "analytical", "realistic" styles of thinking and the flexibility of self-regulation. In addition, two factors have been presented that determine cognitive interaction strategies in the information environment: a strategy with a flexible approach to searching, selecting and testing the data, and a strategy for work with information, taking account of the target and practical components.

Keywords: information environment, styles of thinking, cognitive strategies, intellectual potential, university students

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INTRODUCTION

In current publications, the "information environment" is defined as a component of the information space, the totality of information conditions for the existence of a subject, including the availability and various characteristics of information resources. According to Ozherelyeva (2014), the information environment, in contrast to the information space and the information field, is always connected with some object in relation to which it is considered. This is that part of the information space that is related to the object of study and includes the informational interactions that determine it.

In our opinion, an important point for psychological research is that the assessment of the level of comfort or favored information environment for each subject is determined by internal (personal, cognitive, motivational, etc.) characteristics, such as: information

potential, cognition, the level of the demand for information and others (Selivanova et al. 2018, Khusainova et al. 2018). Thus, in the model reflecting the ratio of main characteristics of the information environment, in our opinion, it is required to include a subjective component determining the degree of favorability of the environment, and ultimately the effectiveness of information interaction. It can be concluded that, being incorporated indirectly in the process of socialization, informational interaction turns out to be mutually determinable by the psychological qualities of the subject (Maliborskaya 2016, Sergeev 2010).

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Table 1. Cognitive styles of students in learning educational material

Global. A holistic image must be presented to students - they want to see the whole picture before they can perceive the details.	Analytical. Students should be given the opportunity to look for explanations themselves, to get "meaning" themselves.
Abstract. Lectures and textbooks are needed.	Specific. They cannot listen to lectures, they need to do something on their own, something like projects
Selective. They cannot follow the schedule, need a variety.	Consistent. They love order, go from one phenomenon to another, learning the first one
Reflective. They need time to get involved.	Impulsive. They cannot do one job for long
Inductive. They must experiment, do not want to remember ready-made provisions, rules	Deductive. They prefer ready conclusions, rules; they go from the rule to the use; they want to stay at the level where they understand everything

Recently, special concepts have been developed that define the peculiarities of the interaction of a subject in the information environment. Cognitive preconditions can be specified in the notion of "cognitive strategies", which reflects the specific character of the functioning of subject characteristics in the dynamics of information interaction: firstly, the complex nature of the interaction of cognitive processes, and secondly, the characteristics of cognitive processes under conditions of uncertainty, lack of information, cognitive complexity etc. (Allakhverdov 2012). Ovsyannikova (2007) gives the following definition of a cognitive strategy in broad terms: "the ways of working with information that are used to organize behavior".

The activity component of cognitive learning provides a positive dynamic in the development of students' professional knowledge and skills. The cognitive approach, on the one hand, is based on the provisions of cognitive linguistics, the main component of which is the category "meaning"; on the other hand, on the points of cognitive psychology, the most important category of which is "understanding", that contributes to a deep insight into the essence of the subject at all stages of processing information. The cognitive mechanism for solving mental tasks gives practically an infinite process of generating and understanding meanings in speech activity. The cognitive approach to learning is impossible without taking account of students' cognitive styles (Efimova et al. 2015, Enyashina et al. 2017, Vasyakin et al. 2005, Vlasova et al. 2016).

The concept of "cognitive style" itself, denoting individual methods of information processing, was derived at the intersection of personality psychology and psychology of knowledge. However, the individual originality of the mind is not reduced to the severity of cognitive styles, the latter is only a particular form of individual cognitive styles, among which are also styles of coding information, outlining the problem and solving it, cognitive attitude to the world. The theory of cognitive styles has direct access to the practice of education - to the problem of success of learning in general and professional in particular. In this respect, posing the question of defining cognitive styles in learning activities *as an individually unique way of learning information in the course of learning activity is of particular interest.*

In modern education, the view on the individual approach to learning seems to be fundamentally different: the goal of taking account of the individual characteristics of learning is transformed into the goal of forming a personal cognitive style. Personal style

develops as a person's intellectual development: the higher the level of a person's intellectual maturity, the more pronounced is the personal cognitive style, which is directly related to cognitive activity. The term "cognitive style" was originally used in cognitive psychology to refer to the persistent characteristics of how different people think, perceive and remember information (Masalimova and Chibakov 2014, Masalimova et al. 2014, Mitin 2016, 2017).

Cognitive style is usually distinguished from cognitive ability or level - the latter is measured by so-called intelligence tests. There are still disagreements about the meaning of the term "cognitive style". However, the term "cognitive style" is now widely used in educational psychology, where the term cognitive style, as we have already noted, has a synonym - "learning style" or "personal cognitive style" (Ovsyanik et al. 2016, Salakhova et al. 2016a, 2016b, Salakhova and Oschepkov 2016).

METHODOLOGICAL FRAMEWORK AND METHODS

The cognitive style of an individual is determined on the basis of how the student takes into account his or her environment, searches for meaning and acquires knowledge. In addition to determining the ways to master learning tasks, cognitive style can orient a student to professional goals. In literature, there are various classifications of cognitive style levels:

- 1) attention to global properties - attention to subtle details and incentives;
- 2) classification of incentives into large (small) categories;
- 3) the tendency to classify objects on the basis of explicit characteristics, such as similarities in functioning, in time, in space, or a general idea of some abstract properties;
- 4) fast, impulsive - slow, diligent approach in solving the problem;
- 5) intuitive, inductive or logical, deductive thinking;
- 6) the tendency to attribute one's own structure to what was perceived versus allowing the perceptions of the perceived to be structured by the stimulus itself, which is the focus of attention, and to be influenced by the context in which the presentation was acquired or gained from another external source.

Cognitive styles of students in learning educational material can be summarized in **Table 1**.

Table 2. Matrix of derived components with indication of factor loadings above 0.5 (derivation method - principal component analysis; eight factors were derived)

Name of the block.	Name of the variable that gained significant loads	№ component (factor)				
		1	2	3	4	5
Thinking styles assessment	Synthetic	-,396	,264	-,182	,129	-,636
	Pragmatic	,149	-,210	-,040	,415	,553
	Analytical	,025	,429	,129	-,629	-,098
Profile_of abilities	Realistic	,047	-,272	,428	,435	,412
	«Word exclusion»	,346	,020	,543	,138	-,199
	«Analogies»	,312	-,080	,593	-,083	-,214
	«Math problems»	,743	,332	,214	,052	,009
	«Numerical series»	,698	,326	-,419	,026	-,043
	«Spatial imagination»	,793	,258	-,307	,080	-,019
	«Spatial generalization»	,680	,294	-,370	,003	,071
Indicators of stylistic self-regulation of personality.	General intelligence (non-verbal)	,367	-,048	,589	-,114	-,217
	Planning (the goals)	-,194	,399	,152	-,227	,572
	Modeling (conditions)	-,371	,561	,262	,377	-,010
	Programming (actions)	-,309	,595	-,081	-,152	,170
	Assessment of the result	-,397	,694	,153	-,168	,196
	Flexibility	-,259	,359	,042	,577	-,192

Cognitive strategies of mastering and learning, that is, the measures that are taken to achieve results in the educational process are the result of understanding the individual and group characteristics of students. The formation of cognitive strategies provides:

1. students' ability to isolate new information and consciously correlate it with previous knowledge, creating a greater number of cognitive connections that help to preserve information.
2. effective organization of their own learning.
3. strategies used to perform one task can be successfully modified for new tasks.

McCarthy (1972) asserts that students differ in two important areas: perception (feelings - thinking) and performance (participation - observation), so the former can be attributed to four large learning styles:

- students with a great power of imagination, perceive information specifically and reflexively process it. They listen, share, and strive to correlate and combine school experience with their own;
- analytical students perceive information abstractly and reflexively process it. They are equally attentive to both the details and ideas; they tend to think consistently and value ideas more than people;
- sensible students perceive information abstractly and actively process it. They tend to be pragmatic in their learning, they appreciate a concrete solution to a problem, they like experimenting;
- dynamic students perceive information specifically and process it actively. They tend to combine experience with its application and are very enthusiastic about everything newly learned, always ready to immerse themselves in study by trial and error and are well versed in the field of everything that is risky.

Cognitive style "Who" - this is one of the aspects through which the teacher can create programs, taking account of the individual characteristics of students' cognitive activity.

In our study, it was hypothesized that there are structural characteristics that determine the interaction strategies of the subject in the information environment. We relied on the previously formulated model of

intellectual potential, which comprises three basic components: structural and substantive (the structure of intellectual abilities of a person), operational and effective (personal characteristics of intellectual activity, stylistic characteristics of thinking), regulatory and evaluative (motivational and self-regulatory features of intellectual activity) (Jerit et al. 2006). Thus, the three groups of indicators were used connected with the assessment of potential characteristics of the subject's cognitive strategies: Block 1 – the assessment of intellectual abilities using the Amthauer's Intellectual Structure Test (IST) techniques adapted by Yasyukova (1999) and Cattell's "Cultural-free Intellect test" (Cattell and Brimhall 1921); Block 2 is the assessment of thinking styles according to the method "Styles of Thinking" offered by Alekseyev and Gromova (1921); Block 3 – regulatory-activity and regulatory-personal style characteristics according to the method "Style of self-regulation of behavior" (SSP) by Morosanova (2004).

The exploratory phase in question was conducted on a sample of senior students who responded positively to a question of the mini-questionnaire "Are you an active user of Internet resources?" and indicated the program of training (77 people aged 19 to 24, 15 of them in humanities, 62 – technical programs; 42 boys and 35 girls). To test the hypothesis about the features of the structural characteristics that determine the strategies of information interaction, the method of factor analysis was used, that helps to justify the data classification (Mashin 2010, Nasledov 2008, Smirnov 2001).

RESULTS AND DISCUSSION

The results of the factor analysis were obtained using the principal component method (SPSS 17.0). According to the Bartlett sphericity test, the data is suitable for conducting factor analysis ($p = 0.000$), and the correlations obtained are different from the value of zero. The percentage of total variance due to factors and the results of the "eigenvalue" chart (scree plot) have demonstrated that the first factor is most important, then

a decrease in the curve indicates factors 2–4, then 5, and so on. **Table 2** considers significant loads variables for the first five factors. The remaining variables were excluded from the analysis (a total of 21 variables were considered).

Of the factors presented in the table, the first one is the most “loaded”, then the 2–5th. It is noteworthy that the first factor includes variables correlated with “mathematical” and “spatial” intelligence, that is, they are professionally significant for specialists of technological professions. This observation is confirmed by the results of a comparative analysis of samples according to the Mann-Whitney criterion with the predominance of trends for students of technical programs of study. One can assume that this is about a profile of abilities that are responsible for interaction in the information environment, but not determining the success of the interaction, its subjective comfort.

The second factor includes the load on the variables “modeling conditions”, “programming actions” and “assessing the result”. These are the scales that in the Morosanova’s (2004) model are attributed to the regulatory activity. Probably, the model of self-regulation of the information search will be associated not so much with the intended purpose of the activity, but with the anticipated assessment of its effectiveness and involves the use of more complex mechanisms for coordinating search activities.

The third factor incorporates assessments on scales that are related to verbal abilities: “word exclusion” and “analogies”, as well as the assessment of general (non-verbal or “cultural-free”) intelligence. The first verbal characteristic determines, according to Yasyukova (1999), intuitive conceptual thinking: the ability to single out the most important in unstructured material, “discard” unnecessary, secondary things. The second variable (“analogies”) contributes to the combination of elements, the identification of objective interrelationships between the analyzed phenomena, the analysis of activity algorithms. We can assume that the third factor is the general characteristics of the subject of information interaction as simulating a certain picture of the world based on the information resources used and their own needs.

The fourth and fifth factors differ from the previous ones in the fact that they, to a greater extent, unite stylistic cognitive characteristics. The fourth factor includes “analytical”, “realistic” thinking styles and the flexibility of self-regulation. This is a synthesis of two thinking styles, at which striving for practical verification of facts (realistic style) at the expense of careful selection and analysis of information is of maximum importance (see the negative coefficient for analytical style). The flexibility of self-regulation makes it possible to restructure activities in a situation of changing the general information picture. The fifth factor combines “synthetic” (negative coefficient) and “pragmatic” thinking styles, as well as such a parameter of self-regulation of personality, as “planning the goals”. Probably, the point is about the orientation towards stability, about striving not so much to learn and create new things but to recognize familiar, practice-oriented things. Pragmatic style is directed towards the ways of achieving a specific goal, finding resources and opportunities. We can assume that the regulation characteristic “planning the goals” makes it possible in this case to specify the direction and search options, organize and direct the activity.

CONCLUSION AND RECOMMENDATIONS

As a conclusion, we would like to note that the obtained empirical results revealed more likely cognitive preconditions determining the direction of the subject of information interaction, but not its effectiveness in this activity. Prospects for further research are the verification of the identified strategies using a comparative experiment and the development of practical recommendations in accordance with the specific character of the sample group. The practical significance of the study lies in the search and justification of cognitive mechanisms of information interaction, which can contribute to improving the quality of the organization of the educational process at the university and the development of information competence of its participants.

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