

# Conceptual abilities as the basis of individual intellectual resource

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## Abstract

This article presents the results of the study of correlations and interactions between conceptual, intellectual and creative abilities and the manifestation of individual intellectual resource. The individual intellectual resource is treated as the individual identity of person's mental experience that determines the effectiveness of his or her intellectual activity. Assuming that the expression of individual intellectual resource is the result of actualization of the conceptual abilities (abilities to generate a new mental experience), creativity, psychometric intelligence, we carried out two series of empirical research with school and student participants (n = 230). It is shown that the conceptual (generative) creative (non-verbal) abilities and psychometric intelligence make a system formation describing the state of individual intellectual resource. The results indicate that the level of conceptual abilities is the basis of individual intellectual resources, expressed in terms of real intellectual achievements.

**Keywords:** conceptual abilities, intellectual resource, creativity, intellect

## 1. Introduction

The reasons for person's intellectual activity success have been researching for many decades, but at present the interest in this problem has increased substantially and evolved into a stable trend. This fact can be explained by changes in modern society, where person's intellectual resources have become the main values that can qualitatively change and accelerate the development of the whole of society (Werner, 1957).

Authors use a wide range of concepts in the study of individual general intellectual abilities: "the cognitive resource" (Kahneman, 1973; Druzhinin, 2008), "the intellectual potential" (Krylov, Golovei, 2003; Ushakov 2003), "the intellectual and personal potential" (Kornilova, 2009), "the individual intellectual resource" (Hazova, 2013; Kholodnaya, 2012), "the intellectual competence" (Raven, 2002; Sternberg, 1987), "the intellectual giftedness" (Babayeva (1999) and others). However, the relationship between these concepts and the limits of their use in modern psychological science has not identified that require further analysis.

Currently, a single view of the nature and mechanisms of development of individual intellectual resources is not represented (Krylov, 2003). Initially, in cognitive psychology intellectual (cognitive) resources were associated with the process of information processing and problem solving (Druzhinin, 2008, Zinchenko, 2000).

However, we believe that the concept of intellectual (cognitive) resource is beyond the scope of this problem, and is not determined only by the amount of attention or memory. The implementation of person's individual intellectual resource is not limited to the solution of specific problems, and is manifested in all situations (Hazova, 2013).

In this paper we consider, the intellectual resource is determined by the characteristics of the individual mental experience organization. First, a balanced combination of different types of cognitive abilities, including the leading role played by conceptual abilities, and secondly, the formation of the components of metacognitive experiences, including policies of involuntary and voluntary monitoring of the individual intelligent system resources, thirdly, the presence of cognitive individual preferences, intentions, etc.

The individual intellectual resource is a systemic quality of the human mind, namely, it is a result of the interaction of conceptual abilities, creativity and psychometric intelligence with the regulatory role of conceptual abilities (Kholodnaya, 2012).

In addition, in the field of intellectual abilities, it is important to take into account the dynamic aspect. Nowadays the problem of the intellectual development in different age periods is becoming more urgent. Most authors recognize the special role of the senior teenage and youthful age. This age is characterized by qualitative changes in the development of person intellectual resources, which associated with the development of "conceptual thinking" (Vygotsky), "formal thought" (Piaget), "conceptual thinking and abilities" (Kholodnaya, 2012).

The particular interest for understanding the mechanisms of individual intellectual resource is concluded in late adolescence, as during this period conceptual thinking is formed and restructuring of the entire system of intelligence occurs. In addition, at this age the role of involuntary and voluntary predictive control (ability to self-regulation of intellectual activity) is increased. Thus, older adolescents may be regarded as sensitive period for the development of individual intellectual resources, with a decisive role in its formation and mobilization of play conceptual abilities (Overton, 2006).

There are three kinds of conceptual abilities: semantic (manipulation of verbal signs), categorical (categorization of concepts) and generative (generation of new mental contents). The higher the level of conceptual abilities is, the wider the range of their resources people use when they faced with a difficult life situation (Kholodnaya, 2012).

Thus, the ratio of conceptual, creative, cognitive and real intellectual achievements can be considered aspects of the individual intellectual resource that characterizes current state of the person's intellectual sphere.

The hypothesis of this study is the assumption that there is a link between the level of psychometric intelligence, verbal and non-verbal creativity, conceptual abilities as a manifestation of the individual aspects of intellectual resources, where conceptual abilities play the most important role. In addition, we assume that in adolescence and early adulthood the conceptual abilities make a significant contribution to the success of training activities.

## 2. Procedures and Methods

### 2.1. Participants

Participants of the experiment were Russian students of secondary schools aged 14 to 16 years,  $n = 120$  (late adolescence).

For the consideration of the dynamic characteristics of the development of conceptual abilities in the structure of individual intellectual resources we have investigated a group of Russian university students for the same indicators in age from 19 to 21 years,  $n = 110$  (early adulthood).

### 2.2. Methods

As an indicator of the level of intelligence we used Raven's Standard Progressive Matrixes (SPM); a variable - the amount of points. The Raven's Standard Progressive Matrixes contain 60 nonverbal items (Raven, Court, Raven, 1992). Each item consists of 6-8 matrix with a missing piece to be completed by selecting an answer from six or eight alternatives.

As a measure of creative abilities we used verbal creativity indicators (method of "unusual use"; variables - fluency, flexibility, originality) and non-verbal creativity (procedure Torrens' "Unfinished figures"; variables - originality, fluency, elaboration, abstract names, resistance circuit). In the first case, the participants came up with an unusual way to use for the usual things: a ruler, a newspaper. In the second case, the participants made a meaningful picture of abstract lines (Druzhinin, 2008).

As indicators of conceptual (categorical) abilities we used research indicators according to the procedures (Kholodnaya, 2012):

"Generalization of the three words" (variables - the level of generalization, in points): the participants had to find an implicit semantic relationships between the three words, for example, beads, gamma, stairs;

"Free sorting words" by V. Kolga to assess cognitive style "analytic / synthetic character" (a measure of involuntary categorical control - the coefficient of categorization as a quotient of the sum of points for the selection criteria on the number of groups of isolated groups). The participants were provided with a list of 40

words, related to the time, which had to be divided into groups in the most convenient way.

As a measure of conceptual (generative) abilities we used indicators of techniques (Kholodnaya, 2012):

"The formulation of problems" (a variable- the degree of difficulty formulated problems in points). The participants formulated problems for research for words such as "soil" and "disease";

"Verbal - shaped transfer" (a variable - productivity figurative translation in points). The participants drew their first impression and the essential characteristics of these concepts: "soil" and "disease";

"The conceptual synthesis" (a variable- the complexity of linkages between the three unrelated within the meaning of concepts). The participants had to make sentences with three disjointed words, for example: "tornado", "a computer", "a clip"

## 3. Results.

### 3.1. Comparative analysis of conceptual abilities in school and student groups

The specificity of intellectual development in late adolescence to youthful age is interesting in terms of the changing status of individual intellectual resources. In late teens the formation of conceptual thinking is completed. At the same time in early youth (student) age in early youth (student) age increase in intellectual resources is expected in connection with the development of conceptual skills in a focused high school training.

Comparative analysis of samples of pupils and students showed the significant differences between most of the indicators of cognitive, creative and conceptual abilities (Table 1).

Table 1: Comparative analysis of conceptual abilities in school and student groups

Indicators	school group, $M \pm \sigma$	student group, $M \pm \sigma$	Sign.
Verbal creativity (fluency)	13,67 ± 5,95	16,33 ± 6,59	,05
Verbal creativity (flexibility)	11,16 ± 4,32	14,44 ± 5,86	0,003
Verbal creativity (originality)	33,75 ± 17,45	41,41 ± 18,98	0,05
Non-verbal creativity (fluency)	9,48 ± 1,23	9,61 ± ,66	0,34
Non-verbal creativity (originality)	6,00 ± 1,93	7,56 ± 2,98	,001

Nonverbal creativity (elaboration)	3,58 ± 1,42	4,68 ± 1,07	.001
Nonverbal creativity (resistance circuit)	3,58 ± 3,35	6,07 ± 4,90	.001
Nonverbal creativity (abstract name)	9,18 ± 5,0	10,03 ± 3,77	0,01
Analytical intelligence	32,51 ± 8,49	39,26 ± 4,62	.001
Categorical abilities	9,27 ± 4,35	11,17 ± 5,06	.24
Generative abilities	6,37 ± 3,54	9,47 ± 4,7	0,02

This result is an indirect confirmation of the fact that adolescence is a period of active formation of the individual intellectual resource, while at the same time the development goes on all types of abilities.

Exceptions are indicators of fluency (non-verbal creativity) and categorical abilities for which there are no significant differences.

### 3.2. Multiple regression analysis and Mathematical modeling

Using multiple regression analysis, we sought to identify the relative degree of influence of conceptual abilities, verbal and non-verbal creativity and psychometric intelligence on the academic success of students in later adolescence as an indicator of the actual individual achievements (respectively, as a marker of intellectual resources). The regression results indicate that the total coefficient of determination of conceptual (generative ( $R^2 = 0,41$ ) and categorical ( $R^2 = 0,23$ )) abilities is 0.64. This fact means that 64% of the general variance explained by the level of academic success due to changes in conceptual abilities, the remaining 36% due to the influence of other variables not accounted for in the equation factors. Thus, it is conceptual (primarily generative) abilities are predictors of effectiveness of intellectual activity, expressed in terms of the academic success of students.

To study the interference of conceptual, intellectual and creative abilities for real intellectual achievements (expressed in terms of academic success and ranking students) in early adulthood, we carried out confirmatory factor analysis of all indicators, which yielded the following latent variables: intellectual skills, creative abilities, conceptual ability and real intellectual achievements (RMSEA = 0,051, CFI = 0,913).

Regression analysis of the latent variables demonstrated that the conceptual abilities make the largest contribution ( $\beta = 0,47$ ;  $p < 0,01$ ) in the prediction of the level of real intellectual achievements, further intellectual ability ( $\beta = 0,22$ ;  $p < 0,01$ ) and creative ability ( $\beta = 0,17$ ;  $p < 0,01$ ). Thus,

the level of development of conceptual abilities can serve as an indicator of individual intellectual resources, expressed in terms of real intellectual achievements.

### 3.3. Factor analysis

To reduce the number of variables and finding the integral indicators, the variables of verbal and nonverbal creativity, categorical and generative abilities and psychometric intelligence were transferred to the Z-score and summed, so we got the figures:

- Level of verbal creativity (Z-vc);
- Level of non-verbal creativity (Z-nv);
- Level of categorical abilities (Z-ca);
- Level of generative abilities (Z-ge);
- Level of analytical intelligence (Z-pi).

According to results of the factor, two factors have been allocated. These factors explain 72.7% of the general variance.

Table 1: Factor analysis.

Indicators	Factor 1 (48,4%)	Factor 2 (24,3%)
Categorical abilities	0,742	-0,299
Generative abilities	0,810	0,155
Verbal creativity	0,080	0,945
Nonverbal creativity	0,840	0,087
Analytical intelligence	0,775	0,359

The first factor, which explains 48.4% of general variance, is formed integral indicators of non-verbal creativity, categorical and conceptual abilities and psychometric intelligence. Perhaps, in this regard, this fact is based on the ability to differentiate, analysis, and intellectual liability. Indeed, young people with the level of development of analytical intelligence above average show a high level of non-verbal creativity and the ability to verbally-shaped transfer (as a component of the conceptual abilities). We can also assume that in order to achieve good results on non-verbal creativity the formedness of conceptual thinking and a high level of psychometric intelligence is needed.

The second factor, which explains 24.3 % of general variance, is entered only the integral indicator of the level of verbal creativity. The independence of verbal creativity and intellectual ability was obtained in other studies (Druzhinin, 2008).

### 4. Conclusions

Underdevelopment of conceptual (categorical and generative) abilities can interfere with the process of implementation of individual intellectual resources. That is,

an individual organization conceptual experience comes to the fore and determines the success of human intellectual activity (Kholodnaya, 2012).

In general, we found evidence supporting the hypothesis of this study: there is an association between the level of development of analytical intelligence, verbal and non-verbal creativity and categorical and generative abilities as individual aspects of intellectual resources. It is shown that the conceptual abilities play a key role in the success of intellectual activity (in terms of indicators of educational success).

The data reject the idea of the antithesis of intellectual and creative abilities. Between them there is a "link": conceptual abilities, which play a major role in the development of the individual intellectual resource.

The results of this study can be used as a basis to develop a more detailed program of diagnosis conceptual abilities.

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