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# Diagnosis of scientific-professional thinking in psychology students: An Initial Psychometric Validation of the Methodology

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## Abstract

**Introduction.** The need to ensure the technological leadership of our country in modern conditions requires, among other things, an effective system of training personnel for scientific activities, including the formation of scientific-professional thinking among its subjects. Scientific-professional thinking of psychologists is a cognitive process that consists of identifying objective essential properties, connections, and patterns of psychological phenomena studied by a psychologist, manifested in behavior and activity, as well as determining the formulation and solution of scientific and applied psychological problems by a psychologist. The purpose of the article is to present the results of the primary psychometric verification of the methodology to diagnose scientific-professional thinking in psychology students. **Methods.** In its structure, the proposed method correspondes to the established standards of thinking research methods and includes tasks that reveal: 1) respondents' knowledge of basic scientific concepts denoting mental phenomena, knowledge of their essential characteristics and patterns; 2) formation of mental operations of analysis, synthesis, comparison, generalization, classification of psychological concepts; 3) ability to adequately and logically use psychological concepts in judgments and conclusions. Reliability (internal consistency) was checked by using the Cronbach alpha coefficient; the normality of the sample distribution was determined using the λ-Kolmogorov-Smirnov criterion; the validity of the content was checked using expert evaluation; during the validity check, indicators of the relationship between the indicators of the subtests of our methodology and other methods that were used to study thinking were calculated. **Results.** The methodology was tested on

230 respondents studying in the following areas of study: "Psychology", "Psychological and pedagogical education". Psychometric verification of both forms (A and B) of the diagnostic technique showed their similarity in identifying the levels of scientific-professional thinking formation in all subtests. **Discussion.** The data obtained indicate that the proposed diagnostic procedure meets the basic requirements for test methods. The results of psychometric tests serve as a basis for using the diagnostic methodology of scientific-professional thinking of psychology students for research and applied purposes as a reliable diagnostic tool.

## Keywords

scientific-professional thinking of psychologists, psychodiagnostic methodology, psychometric verification, normality of sample distribution, correlation analysis, reliability-consistency, validity

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# Introduction

According to the Presidential Decree "On the national development goals of the Russian Federation for the period up to 2030 and for the future up to 2036 " (Presidential Decree “On National Development Goals of the Russian Federation: 2030 and Outlook to 2036” // http://www.kremlin.ru/events/president/news/73986) (dated 07.05.2024), by 2030 the Russian Federation should be among the top 10 countries in the world in terms of research and development. An important factor in solving this problem is the broad involvement of young people in scientific activities, carried out through master's, postgraduate, doctoral studies, the creation of experimental sites, scientific and educational centers, holding competitions for research projects, etc. (Senko, 2015; Eremin, 2019; Varushchenko & Vladimirov, 2021; Panamareva, 2021; Zabolotnaya, 2023; Sorokoumova et al., 2024; Marupova & Shadiev, 2025). All this implies the purposeful formation *of psychological readiness among their participants not just for scientific activities*, but for scientific and professional activities, when doing science becomes a profession aimed at the development of science itself (Dubovickaya, Zabolotnaya, 2022; Zabolotnaya, Dubovickaya, 2022b).

International studies highlight the role of creating an enabling environment for the introduction of artificial intelligence and digital literacy in higher education (Frolova et al., 2020; Valdés, Cerdá Suárez, 2021; Ebn Saifudin et al., 2024; Sun et al., 2024; Mieg, Odebiyi, 2024), which can facilitate the research activities of undergraduates and postgraduates. It emphasizes the productivity of using pedagogical innovations in the form of video conferences,

discussion forums, symposia, etc. (Khatri et al., 2017; Walder, 2017; Kim, & Wilkinson, 2019; Guardia et al., 2021), which lay the foundations for the development of innovative (Sun et al., 2024) and scientific thinking (Bezuidenhout, 2011; Barz, & Achimas-Cadariu, 2016; Koes Handayanto et al., 2024). The introduction of scientific approaches to the education system in the digital age contributes not only to the development of science, but also to the formation of students' and schoolchildren's interest in engaging in scientific activities (Ainley & Ainley, 2011; Xiao & Sandoval, 2017; Akhmetova et al., 2025).

A special role in the development of a professional scientist should be assigned, in our opinion, to the purposeful formation of a special mindset, which manifests itself in the form of scientific-professional thinking, which, as applied to the scientific activity of a psychologist, was previously defined by us as "*a cognitive process that consists in establishing objective essential properties, connections and patterns of mental phenomena manifested in behavior and activity, as well as determining the formulation and solution of scientific and applied psychological problems*" (Zabolotnaya, Dubovickaya, 2022a; Dubovickaya, Grishina, Zabolotnaya, 2024).

The activity of forming scientific-professional thinking involves understanding the mechanisms of its functioning, conditions for purposeful development, as well as identifying the level of its formation, which determined the *purpose of our research*: developing a methodology for diagnosing the formation of scientific-professional thinking. To achieve this goal, we relied on the traditional procedures and methods of studying thinking presented in psychological science.

As is well known, the main forms in which thinking is manifested and realized are concepts, judgments, and inferences that are verbal in nature. L.S. Vygotsky, in particular, compared everyday (spontaneous) and scientific concepts (Vygotsky, 1982). The highest stage of development of thinking is verbal-logical (abstract, theoretical, conceptual) thinking. For its research, the following diagnostic procedures are used, in particular: "exclusion of concepts", "classification of concepts", "comparison of concepts", "simple / complex analogies", etc.

Each branch of science is characterized by its own conceptual and categorical apparatus (Arsenyev et al., 1967; Yakovlev and Yakovleva, 2010). At the same time, a distinctive feature of psychological terminology is that in its everyday application, it is widely found and used in everyday speech, thereby creating a sense of ease of understanding its essence and the psychological science itself. In everyday speech, many psychological concepts are synonymous, interchangeable, although they differ in scientific terminology. For example, this applies to the following concepts: "sensation", "perception", "sensitivity"; "communication", "communication"; "management", "leadership"; "language", "speech"; "motive", "stimulus"; "work", "activity", "work". In the psychological science itself, within the framework of various directions, schools, and approaches, the same concepts have many definitions. Nevertheless, professionals understand each other, mutually expand the categorical apparatus of science, presenting it in their scientific articles, psychological dictionaries, encyclopedias, from where it gets into textbooks and textbooks with small variations. At the same time, unfortunately, our analysis showed that despite the existing differences in the definitions of concepts/categories, their essential characteristics and key terms, as a rule, are identical.

As an example, there are several definitions of the category "activity".

1) Activity – "*purposeful activity* that fulfills *the needs* of the subject" (Asmolov, 2005, p. 10).
2) Activity is "a dynamic system *of active* interactions of the subject with the outside world, during which the subject *purposefully* affects the object, thereby satisfying its *needs"* (Golovin, 1998, p. 100).
3) Activity is "*active* interaction with the surrounding reality, during which a living being acts as a subject *that purposefully* affects the object and thus satisfies its *needs*" (Meshcheryakov and Zinchenko, 2002, p. 122).

After comparing the presented definitions, you can note the so-called "key terms" that are found in all definitions. Such terms in the proposed example are: *activity, needs, and goal/purposefulness*. Relying on key terms makes it easy to remember the definition of the corresponding concept and formulate your own definition. For example, an *activity is a form of human activity aimed at achieving a goal and meeting a need.*

In our opinion, the objective basis for studying the formation of scientific-professional thinking is the possession of the conceptual and categorical apparatus of science and the ability to correctly formulate your thoughts. So, it is known that tests of intelligence, defined, in particular, as "a relatively stable structure of an individual's mental abilities"(Golovin, 1998, p. 147), often contain the following scales:" General awareness "(Wexler's test; STMD – "School Test of Mental Development"),"Vocabulary subtest" (Wexler's test); "Addition of sentences"(Amthauer's test).

All this served as the basis for the development of the author's methodology for diagnosing scientific-professional thinking of psychology students and its psychometric verification.

## Methods

### *Description of the method*

The methodology has two forms (form A and Form B), each of which includes three subtests with equivalent tasks. In terms of content, the methodology was based on the conceptual framework of the course "General Psychology". Well-known dictionaries (Asmolov, 2005; Golovin, 1998; Meshcheryakov and Zinchenko, 2002) and textbooks (Kornilova, 2002; Maklakov, 2008) were used as sources of the conceptual framework.

At the preliminary stage of the psychometric check, some of the questions were removed. Initially, the forms (A and B) of the methodology included 68 questions. Subtest 1 had 14 questions in each form and subtest 2 and subtest 3 had 10 questions each. During the methodology testing, it was decided to reduce the number of tasks in both forms of the methodology. As a result, subtest 1 contains – 9 questions each, subtest 2 – 8 questions each, and subtest 3-5 questions each. So Forms A and B consist of 22 questions each.

***Subtest 1. Knowledge of concepts.*** The subtest consists of 9 tasks that are aimed at identifying the mastery of psychological concepts/categories.

In each task, the examinee must determine the definition of which psychological concept / category the proposed "keywords" correspond to. And, if possible, formulate this definition.

*Example.* Keywords: "motivation", "need", "activity".

*Possible answers:* goal; mood, image, motivation.

*Correct answer*: Motive.

*Definition:* "Motive – an incentive to activity related to the satisfaction of the subject's needs" (Golovin, 1998, p. 230).

Other concepts stated in the methodology were also the following: "Psyche", "Personality", "Intelligence", etc.

***Subtest 2. Exclusion of concepts.*** It consists of 8 tasks; each task contains 5 concepts. The subtest is designed to study the ability to analyze and generalize on essential features, and to abstract from non-essential ones.

In each task, the examinee must indicate an "extra" concept that does not fit the meaning of the rest ("fifth extra").

*Example:* "credibility", "conviction", "validity", "reliability", "representativeness".

*Correct answer:* The word "conviction" is "superfluous", and the remaining terms are parameters of psychometric verification of diagnostic techniques.

***Subtest 3. Making a meaningful sentence / utterance***. It consists of 5 tasks, each of which is represented by a set of words (from 3 to 5) related to psychological research. The subtest is designed to identify the ability to formulate a thought using scientific terminology, to build a logical statement or text.

The examinee should use the suggested words/phrases, as well as supplement their own words, if necessary, to make a meaningful sentence.

*Example*: "language", "sign", "communication".

*Answer option:* "Language is a system of signs that is a means of communication."

Based on the received answers, standard results are processed, where the subject receives 1 point for each correct answer.

The sample used for the psychometric testing of the methodology consisted of 230 psychology students and postgraduates from several Russian universities. Of these, 9.1% were graduate students,12.2 % - specialty students, 33.9 % - undergraduates, 44.8 % - bachelors, second-and third-year students in the areas of "Psychology", "Psychological and pedagogical education".

Psychometric verification of our proposed methodology included:

1) checking the reliability (internal consistency) of each individual subtest and the methodology as a whole (Table 1). 3), using the Cronbach's alpha coefficient;

2) determination of the normality of the sample distribution, using the λ-Kolmogorov-Smirnov criterion;
3) verify the validity of the content, which was carried out using expert evaluation.
4) verification of constructive validity, during which indicators of the relationship between the results of the subtests of our methodology and the scales of other methods that diagnose the corresponding abilities related to success in scientific and professional activities were calculated: the "Addition of sentences" subtest from R. Amthauer test (Amthauer, 1953; Amthauer et al., 1999; Amthauer et al., 2001; Gurevich et al., 1993);methodology for the diagnosis of personal creativity (Tunik, 2003, 2013);methodology for determining the thinking style (Belousova, 2011);Questionnaire "Differential type of reflection" (Leontiev et al., 2009)".

# Results

## *Reliability assessment*

The reliability of both forms of the method was tested using the "splitting" method and further calculation of the corresponding correlation coefficients for odd and even responses (Orel and Senin, 2007). The obtained correlation coefficient of odd and even responses of form A subtest 1 was 0.717 ($p<0.001$), indicating the reliability of this relationship. Considering the correlation of the methodology total score of the subtests with each question, we obtained a high positive significant correlation from 0.408 to 0.741 ($p<0.001$), which confirms the high level of internal consistency of this methodology (Table 1).

**Table 1**
*Correlation of indicators of questions/tasks of subtests with the total score on scales (Form A)*

| # | Correlation Coefficients Subtest 1 | Correlation Coefficients Subtest 2 | Correlation Coefficients Subtest 3 |
|---|---|---|---|
| 1 | 0.519 | 0.640 | 0.548 |
| 2 | 0.489 | 0.653 | 0.606 |
| 3 | 0.715 | 0.710 | 0.670 |
| 4 | 0.576 | 0.648 | 0.704 |
| 5 | 0.741 | 0.630 | 0.705 |
| 6 | 0.727 | 0.685 | |
| 7 | 0.745 | 0.572 | |
| 8 | 0.677 | 0.408 | |
| 9 | 0.636 | | |

***Note.*** *The correlation is significant at the level of $p<0.001$.*

The correlation coefficient of odd and even responses of form B subtest 1 is 0.637 ($p<0.001$), which confirms the high reliability of this relationship. There was also a high positive significant correlation of the methodology total score of the subtests with each question in the range of 0.346 to 0.756 ($p<0.001$), which indicates a high level of internal consistency of the methodology. The results for this form are presented in Table 2.

**Table 2**

*Correlation of indicators of questions/tasks of subtests with the total score on scales (Form B)*

| # | Correlation Coefficients Subtest 1 | Correlation Coefficients Subtest 2 | Correlation Coefficients Subtest 3 |
|---|---|---|---|
| 1 | 0.560 | 0.516 | 0.751 |
| 2 | 0.661 | 0.533 | 0.756 |
| 3 | 0.445 | 0.676 | 0.656 |
| 4 | 0.728 | 0.546 | 0.621 |
| 5 | 0.630 | 0.543 | 0.749 |
| 6 | 0.346 | 0.634 | |
| 7 | 0.744 | 0.586 | |
| 8 | 0.668 | 0.707 | |
| 9 | 0.656 | | |

***Note.*** *The correlation is significant at the level of $p<0.001$.*

***Reliability-consistency*** of subtests of both forms of the methodology was calculated using the formula of L. Cronbach (Muslov, 2023). The data obtained indicate a high internal consistency of the scales. The results of the tests of the methodology to diagnose scientific-professional thinking of psychologists are presented in Table 3.

**Table 3**
*Reliability of subtests of the method of diagnostics of scientific-professional thinking of psychologists*

| # | Subtest name | Number of points | Cronbach's alpha coefficient | |
|---|---|---|---|---|
| | | | value Form A | Form B |
| 1 | Subtest 1 | 9 | 0.859 | 0.850 |
| 2 | Subtest 2 | 8 | 0.865 | 0.853 |
| 3 | Subtest 3 | 5 | 0.870 | 0.881 |

We also tested the internal reliability of the diagnostic tool, which was determined by the internal consistency method using the correlation of three subtests of the form A and B methods with each other (Table 4, Table 5).

**Table 4**
*Significant correlations of subtests of the method of diagnostics of scientific-professional thinking of psychologists (form A), N = 98*

| | Subtest 1 | Subtest 2 | Subtest 3 |
|---|---|---|---|
| Subtest 1 | 1 | | |
| Subtest 2 | 0.414** | 1 | |
| Subtest 3 | 0.434** | 0.454** | 1 |

***Note.*** *The correlation is significant at the level of p<0.001.*

**Table 5**
*Significant correlations of the subtests of the method of diagnostics of scientific-professional thinking of psychologists (Form B), N=98*

| | Subtest 1 | Subtest 2 | Subtest 3 |
|---|---|---|---|
| Subtest 1 | 1 | | |
| Subtest 2 | 0.218* | 1 | |
| Subtest 3 | 0.288** | 0.561561*** | 1 |

***Note.*** ** – Correlation is significant at p<0.05; * * - Correlation is significant atp<0.01; * * * - Correlation is significant atp<0.001.*

As can be seen in Tables 4 and 5, all three subtests of the Form A and B methods have a positive correlation with each other. This relationship of subtests shows the internal reliability of the test.

The distribution of values is normal for all scales/subtests of the methodology of both forms (calculations were made using the λ-Kolmogorov-Smirnov criterion). As can be seen in Table 6, the Kolmogorov-Smirnov test using the distribution showed that there was no significant difference from normality (p = 0.07298 and p = 0.08454, where p>0.05), and it can be argued that the empirical values correspond to the normal distribution.

**Table 6**
*Distribution normality indicators*

| Kolmogorov-Smirnov p-values | |
|---|---|
| Form A (p-value) | Form B (p-value) |
| 0.07298 | 0.08454 |

***Note.*** *The correlation is significant at the level of 0.05.*

## *Validity assessment*

***Content validity*** was evaluated taking into account the correspondence of the content of tasks/questions of subtests to the type of thinking that was supposed to be evaluated within the framework of the developed methodology.

This technique is designed to study the formation of scientific-professional thinking among psychology students by performing the following tasks.

- In subtest 1-these are tasks that are based on the conceptual apparatus of psychological science, with their help, the level of proficiency in psychological concepts / categories is revealed.
- In subtest 2, tasks are designed to study the formation of mental operations: analysis, comparison, generalization.
- In subtest 3, tasks are designed to identify the ability to formulate a logical thought using a given scientific terminology.

Seven specialists-psychologists (university teachers, candidates and doctors of psychological sciences) were involved. Experts were asked to complete the tasks of the methodology and assess their compliance with the stated criteria for the formation of scientific-professional thinking of psychologists. Expert evaluations confirmed the correspondence of the questions of form A and B with each other in relation to their internal content, as well as their prognosticality in relation to the criteria for the formation of scientific-professional thinking. Experts generally gave a positive assessment of the methodology. The correlation coefficients (from 0.64 to 0.94) are statistically significant. Therefore, the degree of representativeness of the the content of questions in each subtest of the methodology meets the requirements of the measured area.

The constructive validity of the methodology was determined by identifying correlations of the developed methodology for diagnosing the formation of scientific-professional thinking with indicators of such methods as:

1) The "Addition of sentences" subtest is R. Amthauer's test (Amthauer, 1953; Amthauer et al., 1999; Amthauer et al., 2001; Gurevich et al., 1993).
2) "Personal Creativity Assessment" Method (Tunik, 2003, 2013);
3) "Thinking Style Identification" Method (Belousova, 2011);
4) "Differential Type of Reflection" Questionnaire (Leontiev et al., 2009)" (Table 7).

**Table 7**
*Indicators of correlation between the methodology and external criteria*

| Methods and their scales | Form A | Form B |
|---|---|---|
| *R. Amthauer Intelligence Structure Test (IST)". subtest 1 "Addition of sentences"* | Correlation coefficient | |
| General awareness. amount of available knowledge. breadth of cognitive interests. Ability to extract information from long-term memory | 0.431*** | 0.564*** |

| Methods and their scales | Form A | Form B |
|---|---|---|
| *Scales of the "Personal Creativity Assessment Method"* | Correlation coefficient | |
| Risk | Appetite 0.377 *** | 0.192* |
| Curiosity | 0.205* | 0.187* |
| Difficulty | 0.293*** | 0.226** |
| Imagination | 0.255** | 0.200* |
| Total score | 0.262** | 0.176* |
| *Scales of the "Personal Creativity Assessment"* method | Correlation coefficient | |
| Initiative thinking style | 0.197* | 0.330 *** |
| Critical thinking style | 0.206* | 0.290** |
| Managerial thinking | style 0.359 *** | 0.216* |
| Practical thinking style | 0.225** | 0.270** |
| *Scale of the "Differential Type of Reflection"* | Correlation coefficient | |
| System reflection | 0.316 *** | 0.248** |
| Introspection | 0.021 | 0.008 |
| Quasi-reflection | Quasi-reflection 0.147 | -0.159 |

***Note.*** – Correlation is significant at p<0.05, * * - Correlation is significant atp<0.01, * * * - Correlation is significant atp < 0.001.*

The obtained correlation coefficients, presented in Table 7, demonstrate a positive and statistically significant relationship of the total scores of both forms of the developed methodology with the addition of sentences of Amthauer's Intelligence Structure Test (IST; Amthauer, 1953; Amthauer et al., 1999; Amthauer et al., 2001; Gurevich et al., 1993), the creativity property scales ("Risk Tolerance", "Curiosity", "Complexity", "Imagination") of the

Personal Creativity Assessment Method (Tunik, 2003, 2013), the initiative, critical, managerial, and practical thinking styles of the Thinking Style Identification Method (Belousova, 2011), and the "System Reflection" scale of the Differential Type of Reflection Questionnaire (Leontiev et al., 2009). The revealed interrelations of scientific-professional thinking of psychology students correspond to well-established studies that have examined correlated qualities as professionally important characteristics of psychologists (Achina, 2012; Badalova, 2015; BeniBeniova, 2021; Bakhshalieva, 2022; Medvedeva & Osin, 2023; Li et al., 2024; Zhong et al., 2024).Thus, the analysis showed a good correlation and internal consistency of the construct of the psychodiagnostic methodology of scientific-professional thinking with the scales of external methods.

## Discussion

During the study, the author's method of diagnosing the formation of scientific-professional thinking of psychologists was developed and its psychometric verification was carried out, which showed compliance with the basic requirements for diagnostic tests (Orel & Senin, 2007). Subtests of the method showed internal consistency among themselves (correlation coefficient from 0.346 to 0.756; significant at $p<0.001$), which confirms the internal reliability of the method. We also received confirmation of the constructive validity of the methodology, where statistically significant correlations with external scales (from 0.216 to 0.564) indicate the ability of the construct of the tested methodology to determine the level of formation of scientific-professional thinking.

The proposed methodology diagnoses the research potential of psychology students, their ability to conduct research in the field of psychology, but does not reflect their interest and motivation for this activity. It is also known that scientific activity in the field of psychology differs from the practical activity of a psychologist working with real psychological problems of people, which requires other personal qualities. Therefore, the question of psychological diagnostics of professional competence of future psychologists at the stage of training in higher education remains open.

The correlations obtained during the study between the methodology for diagnosing the formation of scientific-professional thinking with indicators of other diagnostic methods, the reliability and validity of which have already been proven, demonstrate the validity of the author's methodology, the possibility of introducing this diagnostic tool into the practice of training future professionals and applying it for research purposes (Zabolotnaya, Dubovickaya, 2022b; Zabolotnaya, 2023; Dubovickaya et al., 2024).

### *Conclusion*

The focus of our country on ensuring technological leadership implies the training of scientific personnel in higher education institutions who possess the appropriate technologies and have the necessary cognitive prerequisites, including scientific-professional thinking. All this sets

special tasks for the higher education system, which should create conditions for the formation of appropriate competencies and competencies of future scientific personnel.

The diagnostics of scientific-professional thinking of psychology students presented in the article, which is based on the theory and practice of thinking research that has developed in psychological science, can serve as a basis for developing a similar procedure for studying scientific-professional thinking of other categories of specialists.

The proposed methodology can be expanded by developing and supplementing it with other diagnostic procedures (subtests), in particular, tasks for classifying concepts. A special approach is required to diagnose the readiness of future scientific personnel to conduct empirical research.

The modern practice of assessing the quality of training of future professionals for scientific, analytical and productive activities cannot be limited to traditional procedures in the form of examination and test questions and so-called achievement tests aimed at checking the level of mastering knowledge in academic disciplines and proficiency in certain applied skills. They should be supplemented by research on the formation of professionally significant personal qualities and cognitive abilities, which means that appropriate technologies for their formation and diagnosis in students are needed.

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# Appendix

## *Methods of diagnostics of scientific-professional thinking of psychology students*

### *Subtest 1-Proficiency in concepts*

*Instruction manual.* In each proposed task, write the psychological concept or category that corresponds to the proposed "keywords". If you don't have a clear answer, write "I can't answer".

| No. p / p | Keywords | Concept / category |
|---|---|---|
| 1 | Property of the brain, reflection of the objective world | |
| 2 | Activity, goal, need | |
| 3 | Unconscious readiness, predisposition to activity | |
| 4 | Foresight, result of actions, anticipation | |
| 5 | Perception, past experience, addiction | |

| No. p / p | Keywords | Concept / category |
|---|---|---|
| 6 | Mental state, need, source of activity | |
| 7 | Concentration, focus, clarity of consciousness | |
| 8 | Holistic reflection, subject, sense organs | |
| 9 | Mental abilities, problem solving | |

*Subtest 2 - Exclusion of concepts*

*Instruction manual.* In each proposed task, specify an "extra" concept that has a different meaning in relation to other concepts, as well as what unites the remaining concepts.

| No. p / p | Words | Excluded concept / what unites the remaining |
|---|---|---|
| 1 | Selectivity, distribution, switching, implementation, volume | |
| 2 | Quality, volume, intensity, duration, localization | |
| 3 | Objectivity, integrity, concentration, constancy, structure | |
| 4 | Activity, reactivity, emotionality, logic, introversion-extraversion | |
| 5 | Analysis, comparison, switching, generalization, classification | |
| 6 | Systematization, schematization, agglutination, hyperbolization, typing | |
| 7 | Orientation, sensitivity, activity, plasticity, extraversion | |
| 8 | Rigidity, introversion, simultaneity, reactivity, | |

### *Subtest 3-Making a meaningful sentence/utterance*

*Instruction manual.* In each row, you need to make a meaningful statement using all the suggested words/phrases, changing their endings if necessary, and also adding your own words to them. If you find it difficult to answer/explain, then write "I can't answer".

### *Example*

Words: "understanding", "sudden", "problem solving".

Variants of sentences: "Insight –"*a sudden*, instantaneous and non-deducible new *understanding*, comprehension of essential relationships, tasks, problems and the structure of the situation as a whole, through which a meaningful *solution to the problem* is achieved" (Golovin, 1998, p.269). Insight – "sudden understanding," grasping "the relationships and structure of the problem situation, finding a solution to the problem" (Meshcheryakov and Zinchenko, 2002, p. 180).

| No. p / p | Words | Examples of utterances |
|---|---|---|
| 1 | Personality, consciousness, activity | |
| 2 | Principle of conscience, "Ego", reality principle | |
| 3 | "Third force", Behaviorism, Freudianism | |
| 4 | Edge effect, memorization, middle of a number of elements | |
| 5 | Statistical method, relationship assessment, correlation analysis | |

1 point is awarded for each correct answer.

## Key to the methodology

### *Subtest 1-Proficiency in concepts*

| No. p / p | Keywords | Concepts / Categories |
|---|---|---|
| 1 | Property of the brain, reflection of the objective world | Psyche |
| 2 | Activity, goal, need | Activity |
| 3 | Unconscious readiness, predisposition to activity | Attitude |

| No. p / p | Keywords | Concepts / Categories |
|---|---|---|
| 4 | Foresight, result of actions, anticipation | Anticipation |
| 5 | Perception, past experience, addiction | Apperception |
| 6 | Mental state, need, source of activity | Need |
| 7 | Concentration, focus, clarity of consciousness | Attention |
| 8 | Holistic reflection, subject, sense organs | Perception |
| 9 | Mental abilities, problem solving | Intelligence |

### *Subtest 2 - Exclusion of concepts*

| No. p / p | Words | Excluded concept |
|---|---|---|
| 1 | Selectivity, distribution, switching, implementation, volume | Implementation / others – properties of attention |
| 2 | Quality, volume, intensity, duration, localization | Volume / others – properties of sensations |
| 3 | Objectivity, integrity, concentration, constancy, structure | Concentration / others – properties of perception |
| 4 | Activity, reactivity, emotionality, logic, introversion-extraversion | Logic/other-properties of temperament |
| 5 | Analysis, comparison, switching, generalization, classification | Switching / other – mental operations / processes |
| 6 | Systematization, schematization, agglutination, hyperbolization, typing | Systematization / other - mechanisms for creating images of the imagination |
| 7 | Orientation, sensitivity, activity, plasticity, extraversion | Orientation / the rest – psychological properties of temperament |
| 8 | Rigidity, introversion, simultaneity, reactivity, | Simultaneity / the rest – psychological properties of temperament |

### *Subtest 3-Making a meaningful sentence/utterance*

| No. p / p | Words | Examples of utterances |
|---|---|---|
| 1 | Personality, consciousness, activity | Personality is a person as a carrier of consciousness and a subject of activity (copyright).<br><br>Personality is an individual as a subject of social relations and conscious activity (Golovin, S. Y. Dictionary of Practical Psychology, Moscow: AST, Harvest, 1998, p. 191). |
| 2 | Principle of conscience, "Ego", reality principle | "Ego" is guided by the principle of reality, "Super-Ego" – the principle of conscience.<br><br>According to Freud, the personality structure consists of the following instances: It (Id), I (Ego) and Super-I (Super-Ego) (Meshcheryakov, B. G., Zinchenko, V. P. Bolshoy psikhologicheskiy slovar'. 3rd ed., Moscow. - 2002. - 632 p. - p. 524). |
| 3 | "Third force", Behaviorism, Freudianism | Humanistic psychology positioned itself as a "third force", contrasting itself with behaviorism and psychoanalysis (Meshcheryakov, B. G., Zinchenko, V. P. Bolshoy psikhologicheskiy slovar'. 3rd ed., Moscow. - 2002. - 632 p. - p. 104). |
| 4 | Edge effect, memorization, middle of a number of elements | "The edge effect is a phenomenon that when memorizing a row of material, the elements at the beginning and end are remembered faster than the elements in the middle." (L. A. Karpenko. // General psychology. Psychological lexicon. Encyclopedic dictionary in six volumes: Developmental Psychology / Ed. - comp. by L. A. Karpenko. Under the general editorship of A.V. Petrovsky. Moscow-PER SE, 2005. p. 202). |
| 5 | Statistical method, relationship assessment, correlation analysis | "Correlation analysis is a statistical method widely used in empirical psychological research to assess the measure, form and nature of the relationship of the studied properties or attributes" (Avanesov, V. S., Shmelev, A. G. General psychology: A psychological lexicon. Encyclopedic dictionary in six volumes / Ed. - comp. by L. A. Karpenko. Under the general editorship of A.V. Petrovsky, Moscow: PER SE, 2005, p. 229). |

## Analysis of results

Due to the normal distribution of the methodology indicators, the standard deviation (σ) is used to determine the standard test indicators. The Xsr index ± 1/2σ is used as the norm limits. Accordingly, indicators above or below these limits reflected a high or low level of development of scientific-professional thinking. The final distribution of the boundaries of the levels of development of scientific-professional thinking is as follows.

1) 0–7 points – low level of formation of scientific-professional thinking;
2) 8–15 – average level of formation of scientific-professional thinking;
3) 16–22 – high level of formation of scientific-professional thinking.

## Interpretation of results

*The low level of scientific-professional thinking* indicates a weak command of the conceptual and categorical apparatus of psychological science, significant difficulties in thinking operations using psychological concepts (difficulties in their analysis, comparison, generalization) and inability to build a logically correct thought.

*The average level of scientific-professional thinking* reflects an acceptable level of proficiency in the conceptual and categorical apparatus of psychological science and the formation of mental operations (analysis, comparison, generalization) carried out using psychological concepts; it indicates that the ability to formulate a logically constructed thought based on scientific psychological terminology is sufficient for scientific activity.

*A high level of scientific-professional thinking* indicates a full-fledged mastery of the conceptual and categorical apparatus of psychological science, its adequate use in scientific and professional activities when describing the results of research on mental phenomena, and high professional competence in the field of psychological science.

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## Authors Contribution

**Elena V. Zabolotnaya** – conducting an empirical study, collecting and analyzing information, interpreting experimental results, compiling tables, reviewing literature, writing an article.

**Tatyana D. Dubovickaya** – general management of the research direction, verification and making edits to the text of the article, final approval of the version for publication.

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## Conflict of Interest Information

The authors have no conflicts of interest to declare.