

SCTMG 2020**International Scientific Conference «Social and Cultural Transformations in the
Context of Modern Globalism»****DIAGNOSTICS ISSUES OF INNOVATIVE THINKING LEVELS OF
FUTURE PEDAGOGUES**

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Abstract

The article considers the concept of innovative thinking and its structure, describes diagnostic methods that reveal the formation of innovative thinking of a future teacher in order to determine its initial level and further development for more effective implementation of professional activities. The authors draw attention to the problems that arise in the diagnosis of levels of this quality in students. It is noted that the professional activities of teachers are specific, related to the need to form the specified type of thinking. Manifestations of the innovative type of thinking, based on which criteria for the levels of formation of the type under study are formulated, correspond to the expectations of an innovatively thinking person: originality and high quality of ideas. Based on the characteristics of the type of thinking under consideration, two levels of its formation are distinguished: high and ordinary, for conducting diagnostic exercises with students – future teachers. The results of an experiment to determine the levels of formation of innovative thinking in students studying in the field of education "Psychology pedagogy of primary education" of Togliatti State University are presented. In the process of experimental work, depending on the style of thinking, respondents were divided into 2 groups: innovators and adapters. The authors found that the levels of formation of innovative thinking depend not only on personal characteristics, but also on the conditions in which the educational and, later, professional activities of future teachers are implemented.

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1. Introduction

At the present stage of social development, all spheres of human activity are constantly updated with new concepts, ideas and technologies. Innovative pedagogy as a science and practice is responsible for preparing citizens who are creative and ready to face changes; able to find and analyze information, apply knowledge in practice.

Teachers are no longer experts in the subject area of knowledge, transmitting the information they know, but act as tutors and facilitators. Current reforms in education emphasize that teachers should develop students' ability to solve problems, teamwork, reflective thinking and, in general, the ability to learn.

A necessary condition for the successful professional activity of a modern teacher is the formation of an innovative type of thinking that allows the teacher to find answers to questions: What is preferred for participants in the educational process (students, their parents, future employers)? What is beneficial for the community? What technologies do we have to meet these needs? Which of the technologies available on the educational market are viable?

Based on the foregoing, the most relevant issues are related to the diagnosis of the formation of innovative thinking of a teacher to identify its initial level and its further development for more effective implementation of professional activities.

Note that many researchers are critical of the very possibility of diagnosis and innovative thinking in general. So, Cropley (2000) notices that creative achievements depend on additional factors not measured by creative tests, such as technical skills, knowledge of the field, mental health, etc. On the other hand, Utemov (2011), the study of which examined the process of formation of innovative thinking through open-type tasks, presented specific criteria for assessing the solutions to such problems, which, according to the researcher, indicate the formation of innovative thinking at one level or another.

Note that innovative thinking can be manifested in a wide range of ways, since the structure of innovativeness includes many interrelated variables. At the same time, in addition to personal characteristics, styles, abilities, interests of the individual, it is necessary to consider the environment, the area of tasks and interpersonal factors.

Most of the tools that experts use to diagnose variables related to innovative thinking (logical, creative / creative, research, communicative components) are not always suitable for pedagogical research. The very construction of this type of thinking may not be suitable for assessment using tools for which traditional psychometric expectations, assumptions, and manifestations of creative productivity can vary significantly.

One of the significant problems is "sorting" into categories (high or low level of formation of innovative thinking). Most measurements of these levels involve a wide range of criteria or abilities that can be developed with effective training.

The analysis of studies (Fersman, 2010; Kubrushko & Nazarova, 2012; Usoltsev & Shamalo, 2014 etc.) made it possible to generalize the manifestations of the innovative type of thinking, which in our opinion are: the creation of new connections between objects and phenomena; recognition of the uniqueness of one's own thinking, readiness to realize one's potential; the generation of diverse or unusual ideas; improving ideas and ensuring their feasibility.

1. Productivity of thinking (research component of innovative thinking):
2. The ability to search, organize and analyze information.
3. Curiosity (asks a lot of questions) and the generation of ideas.
4. The ability to draw conclusions, make decisions.
5. The ability to find, formulate, solve problems.

Organization and use of information (a logical component of innovative thinking):

1. The ability to classify information.
2. The ability to distinguish between relevant and unreliable data.
3. The ability to decide what additional data is needed.
4. The ability to conduct an analytical review of the facts.
5. The ability to plan your own activities

Generation of ideas (creative component of innovative thinking):

1. The ability to generate many options for solving an issue, and not just a few.
2. Using similarities, differences, and metaphors to describe an object or phenomenon.
3. Openness to new ideas and their active search.
4. Reformulation – a new look at problems.
5. Turning unlikely ideas into productive opportunities.

Communication with like-minded people and opponents (communicative component of innovative thinking):

1. The ability to join a group to test ideas based on available facts.
2. Constructive discussion of problems and issues from different points of view.
3. Combined development of methods for testing hypotheses.
4. Choosing the best ideas and plans in the group.
5. Joint efforts to bring ideas to full development.

As a rule, the manifestations of the innovative type of thinking, based on which criteria for the levels of its formation of the type under study are formulated, correspond to the expectations of an innovatively thinking person: originality and high quality of ideas.

2. Problem Statement

What are the diagnostic techniques that reveal the level of formation of innovative thinking of the future teacher and its further development for more effective implementation of professional activities?

3. Research Questions

The subject of the research is the process of diagnosing the formation of innovative thinking in future educators.

4. Purpose of the Study

The purpose of the study is to identify and implement optimal diagnostics to determine the level of formation of innovative thinking of future teachers.

5. Research Methods

Based on the above-described characteristics of innovative thinking and based on research by Brookhart (2013), for diagnostic activities with students – future teachers, we identified two levels of formation of innovative thinking: high and ordinary and the corresponding criteria for their achievement (Table 01).

The criteria in Table 01 are designed to know what factors will be considered in the assessment.

To be effective, the criteria must include important elements of the assignment, but they must be feasible for both students and educators conducting diagnostics.

Recommendations for a deeper understanding of the idea can be as follows: generate ideas in original and "surprising" ways; ask the teacher and each other questions regarding the formulated idea; brainstorm to develop several ideas and solutions to problems; formulate ideas in new and unexpected ways.

Table 01. Levels and criteria of innovative thinking of students

Criteria \ Levels	High level	Normal level
Variety of ideas and contexts	Ideas represent a wide variety of concepts from different contexts or disciplines.	Ideas represent important concepts from the same or similar context or discipline.
Variety of sources	The created product relies on a variety of sources, including various texts, media, specialists, or personal experience.	The created product relies on a limited set of sources and medium.
Merging Ideas	Ideas are combined in original and surprising ways to solve a problem or create something new.	Ideas are combined in ways that are based on the thinking of others (for example, authors in the sources referred to).
Product Practical Importance	The created product is interesting, new and useful, making an original contribution, which includes the identification of a previously unknown problem, a well-known unresolved problem or goal.	The created product serves its intended purpose (for example, solving a problem).

Realization of the innovative potential of the individual largely depends on the educational environment. Therefore, the environment in which the individual realizes his professional and educational activities, should be diagnosed, the purpose of which is to identify the level of formation of individual's innovative thinking, must also be exposed to.

The indicator of Kirton (1976), which assumes that all people solve problems, but the ways of implemented solutions are different, can be effective for researching the levels of formation of innovative thinking. He notes that "adaptation / innovation" is a bipolar construction that helps to determine a person's preferred approach to solving problems and, as a result, to identify the level of innovativeness of his thinking. Bipolarity suggests that there is a continuum of adapters on one side of the structure, and innovators on the other (Kirton, 1976).

Innovators, according to the scientist, prefer to work differently, tend to revise the entire work process. They are less interested in acting in accordance with established rules. However, it is they who provide the dynamics of the organization’s development or the search for new problems, are capable of causing periodic “revolutionary” changes, are confident in generating ideas (in our study, we relate this category of subjects to a high level of innovative thinking).

Adapters prefer to deal with problems rather than finding them, while choosing proven and understandable solutions, capable of long monotonous work, rarely challenge existing rules, are sensitive, and choose to work in a cohesive group (Kirton, 1976). In our study, this category is assigned to subjects with the usual level of innovative thinking).

Kirton's (1984) indicator allows you to determine on which segment of the scale the subject's thinking style is located. Those whose thinking style is as close as possible to one of the extreme points of the scale can be conditionally considered super-adapters (they are reliable, stable, occasionally the ideas they generate are safe and acceptable for most) or super-innovators (who think outside the box, question the generally accepted rules that generate a lot of ideas often risky).

In determining the levels of formation of innovative thinking, for the most part its creative / creative component, modified (in accordance with the age and professional orientation of students – future teachers) Divergent Productive tests developed by Guilford (1950) include verbal tasks (10 tasks) and picturesque (4 tasks). Divergent thinking, according to Guilford (1950), is closest to creativity and manifests itself in a person’s ability to give non-standard and original answers to the same question. We give examples of adapted tasks for students-future teachers (Table 02).

Table 02. Divergent productivity test (modification of the J. Guilford test)

No.	Block of tasks	Task	Answer (s)
1	Tasks to identify the ability to generate ideas	Write as many ideas as possible related to the proposed topic. For example: What needs to be done for a school to become innovative? What jobs and positions should be introduced?	Give at least 5 answers
		Come up with as many sentences as possible for four to five randomly selected letters, for example: “U, R, I, M” – “Teach your child to think innovatively,” etc. In each new sentence, new, non-repeating words must be used.	Give at least 5 answers
2	Tasks to identify semantic spontaneous flexibility	Find the unusual use of a regular school subject (pencil, eraser, pencil case, etc.)	Give at least 5 answers
3	Associative Fluency Task	Write synonyms for a word. For example, for the word “innovative”, the synonyms are “new”, “unusual”, “creative”, “original”, “modern”, etc.	Give at least 5 answers
4	The task of identifying imaginative adaptive flexibility	Come up with a new name for the course. You can take the subjects of the main program, and the program of extracurricular activities. Names should be original, attractive to students, but not distort the content of the discipline.	Give at least 5 answers
5	The task of identifying semantic (meaningful) vision	Design a symbolic sign for an innovative school. What elements can it include? A book? Torch? Smartphone? And etc.	Design a symbolic sign with at least 5 elements

The divergent productivity test can be applied not only for diagnostics, but also for the development of creative inclinations and abilities. Fluency of thinking allows you to easily find a solution to a problem situation; flexibility of thinking is the ability to abandon old ways of understanding the problem, to learn to see previously unnoticed perspectives (Guilford, 1950).

After completing each task, students were asked to conduct a group discussion of the results, during which to choose the wittiest and original answers.

The Creative Climate Questionnaire, or Situational Outlook Questionnaire (SOQ), also used in our research, is designed to measure organizational conditions that stimulate or, conversely, hinder the manifestation of innovative potential (Ekvall, 1996). The measurement takes place on a 10-point scale and includes questions designed to identify the extent to which people who work (study) in this organization are ready to produce an innovative product, whether their ideas are supported, how open and free communication in the team is when discussing new ideas and others. The closer the answers to the mark "10", the higher the level of creative climate in an institution. Examples of questions: To what extent are people working in this institution satisfied with what they are doing? Does the institution's emotional climate involve open communication and discussion of new ideas? Does the pace of work provide opportunities for developing new ideas? Is the atmosphere of the institution rather informal?

In 2018–2019, a study was conducted based on the Togliatti State University, the purpose of which was to identify the current level of innovative thinking of students – future teachers. As subjects, the study involved bachelors of 1–4 courses, studying in the direction of preparation "Psychology, pedagogy of primary education" (a total of 60 people aged 18 to 22 years).

Research Objectives:

1. To identify groups of students who differ in the level of formation of innovative thinking.
2. To analyze the factors that influences the formation of innovative thinking in the selected groups (the influence of the climate in the organization on the innovative activity of students, students' attitude to risk).

The research methods used were: Kirton's (2004) indicator for determining the subjects' thinking style, Divergent productivity test (modification of the Guildford (1950) test), Creative Climate Questionnaire, or "Situation Perspective Questionnaire" (Ekvall, 1996).

Depending on the style of thinking, which was determined by the Kirton test (2004), to determine the type of innovative thinking, respondents were divided into 2 groups: innovators (40 % of the total number of subjects) and adapters (60 %). The results of the subsequent divergent productivity test (modification of the J. Guildford test) were consistent, the discrepancy was less than 2 %.

During the study, an analysis was carried out for the following main groups:

attitude to the creative climate in the organization; assessment of the existing conditions for the implementation of innovative activities; degree of trust in teachers engaged in educational activities at the university; the influence of the attitude of the leadership of schools in which students practice; the impact of relationships with classmates, together with which innovation activity is carried out (or can be carried out); the impact of their own efforts on the success of innovation; assessment of attitudes to risk and competition (the presence of many innovative didactic and educational pedagogical products offered on different sites; the risk of lack of demand for ideas).

6. Findings

As a result of the experiment, the attitude to the creative climate in the organization showed that statistically significant differences were revealed in the assessment of the existing conditions for the implementation of innovative activities. Students with the innovative style of thinking rate higher the conditions for conducting innovative activities at the university (average scores 3.38 on a 7-point scale to 2.54 for adapters, $p < 0.01$). The manifestation of innovative thinking in the framework of the discipline "Project Activities", carried out in an end-to-end mode from 1 to 4 courses, was highly appreciated. When assessing the impact of the leadership relationship of schools in which students' practice, statistically significant differences were identified: innovators consider such relationships more positively (3.91 to 3.08 for adapters, $p < 0.05$). As for the influence of other factors, there were no statistically significant differences in relation to them in both groups (Table 03). One of the stages of the experimental work included an assessment of attitudes toward risk and competition. It is noted that students in the group of innovators often prefer an average degree of risk, while adapters try to avoid risky situations.

Table 03. Average values of climate impact assessments in an organization on students' innovative activity (%)

Factors Affecting Innovation	Innovators	Adapters
The impact of existing conditions for the implementation of innovation	3,38	2,54
The influence of trust in teachers engaged in educational activities at the university	3,5	3,08
The influence of the attitude of the leadership of schools in which students' practice	3,91	3,08
The influence of relationships with classmates with whom innovation is carried out	5,55	5,33
Influence of own efforts on the success of innovation	6,0	5,25

7. Conclusion

Thus, the hypothesis was confirmed that the degree of formation of innovative thinking depends not only on personal characteristics, but also on the conditions under which the educational (and later professional) activities of future teachers are implemented.

Innovators see more opportunities for implementing their ideas in existing conditions, give a higher assessment of caution, discipline and accuracy.

Further research will be devoted to the projection and introduction of the psychological and pedagogical conditions in the educational process of the university and the development of teaching methods that contribute to the formation and implementation of innovative thinking of students – future teachers.

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