

The role of intellect in the scientific and creative activity of students

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ABSTRACT--This article provides a psychological analysis of the importance of intellect in the scientific and creative activity of the individual. Ways to develop students' creativity are shown. It also analyzes the successful development of creative qualities, important levels of creative potential of the individual, the stages of formation of the creative personality. In their research activities, students studied the analogy with the general intellect, the separation of concepts according to **important** features, the correlation between visual thinking. The results of students in the areas of study were analyzed, which proved to reflect the same level in solving tasks related to complex analogies. According to a complex analogy, there was a difference in the performance of students in the natural direction and the humanities. It has been proven that in the research activities of students of the natural direction, the general intellect reflects the inverse relationship with the practical intellect. Conclusions and recommendations on the formation and development of scientific creativity of the person are given.

Keywords-- Scientific and creative activity, creativity, intellect, general intelligence, visual intelligence, practical intelligence, **analogy**, the way to the successful development of creative qualities, important levels of creative potential of the person, the stages of formation of the creative personality.

I. INTRODUCTION

At a time of radical democratic changes in our country, naturally, we are faced with the task of studying the laws and scientific materials of human psychology, their widespread use in our work. Especially in the process of continuing education, it is very important to study the psychological characteristics of learners and educators, the psychological basis of their relationships. One of the most pressing issues today is to increase the effectiveness of educational work in higher education. Because the development and prospects of our republic largely depend on the skills and high intellectual level of specialists trained in higher education. To do this, we need to determine the characteristics of the student intellect, the dynamics of its development, and in this regard it is expedient to use more active, innovative, more sophisticated methods of involving students in research and rational use of new tools in practice.

The drastic changes taking place in the development of society at the present time pose qualitatively new and relatively complex tasks, in which the level of development of the individual's intellect, the regulator of his mental capacity, and moral aspects are of particular importance.

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The professional development of a person as a specialist is, in essence, a process. Professional maturity Important periods of human ontogenesis begin in the process of professional development, decision-making (14-17 years) and the end of professional activity (55-60 years). The formation and development of a creative person depends on the interaction of changes in his inner and outer world, socio-economic conditions and human ontogeny - the content of activities that require continuity, inheritance from birth to the end of life.

The formation of a creative personality can be defined as the development of an individual in terms of creative activity and the creation of creative products that are performed in a mutually compatible manner. The speed and scope of this process depends on biological and social factors, the activity and creative qualities of the individual, as well as the existing conditions, vital and professionally conditioned events. In modern conditions, students are required to have creative qualities.

II. METHODS:

We have taken into account the student period in the study of the scientific and creative activity of the individual. Because creativity is founded during the student period. This led students to explore their intellect. The traditional experience in the study of student intelligence and the factorial approach put forward in the concepts of intelligence (Terstone model), ie the primary factors that are more taken into account, general (G-factor) and special (S-factor) (Ch. Spearman models), G. Eisenk , We found it necessary to pay attention to Dj.Gilford and other models. Based on these models, we selected research methods [11].

We tried to use the method of "Complex analogies" in the study of students' logical connection between problems, abstract thinking. Complex analogies in this methodology are presented through 20 pairs of words. Students, on the other hand, focus on determining which type of abstract understanding is unique between individual concepts. In addition, the methodology allows students to think logically; the ability to distinguish types of relationships; it also helps to assess their critical approach to them.

One of the important aspects of the methodology is that it must first determine the logical connection between the concepts of task performance independently or using an experimenter. In the second stage, only the examiners who understand the first stage will continue to perform the tasks. Also, the advantage of using the methodology is that it does not cause too much complexity in terms of time, the results are not complicated to process, so the choice was made for diagnostic use.

In our study, differentiation, which serves to illuminate the intellect of students, was aimed at identifying aspects (concrete or abstract thinking) that lead to the way of thinking in mental actions. For this purpose, the method of "separation of essential features" was chosen. The advantages of using the method in the diagnosis of intelligence were considered:

- designed to study the features of thinking;
- measure the ability to differentiate important features;
- help to determine the leading way of thinking.

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psychological basis of their relationships. One of the most pressing issues today is to increase the effectiveness of educational work in higher education. Because the development and prospects of our republic largely depend on the skills and high intellectual level of specialists trained in higher education. To do this, we need to determine the characteristics of the student intellect, the dynamics of its development, and in this regard it is expedient to use more active, innovative, more sophisticated methods of involving students in research and rational use of new tools in practice.

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- Assignments in the form of demonstrations;
- Ease of adaptation to the local environment;
- has its own psychometric dimensions in assessing the level of visual intelligence;
- the implementation of a free approach to the implementation of tasks;
- that the time norm does not cause complications for the subjects, etc. The methodology consists of 40 tasks, which take 15 minutes to solve.

Our next method is designed to study the development of intelligence in the practical and psychomotor activities of students, in contrast to the previous ones. In carrying out the methodology, students perform tasks in three different areas, aimed at determining the practical intelligence:

- figure preparation test (9 tasks);
- drawing test (9 tasks);
- Figure recovery test (task 9).

The peculiarity of these test tasks is observed in the fact that students demonstrate agility in their practical implementation, observation, the ability to find consistency between the elements through vision.

The reasons for choosing this test for psychodiagnostic purposes were:

- differs from the methods of studying the intellect in its content and structure;
- designed to study the practical nature of the intellect;
- time does not cause excessive stress on the subjects in the application of the method;
- According to the results of the methodology, the IQ, unlike other tasks, is based on the operational nature of the psyche and has the appropriate criteria.

III. LITERATURE REVIEW

In recent years, in the education system of leading foreign countries, special attention is paid to the formation of creative qualities in students and students. This was followed by Bronson, Merriyman (2010), Ken Robinson (2007), Fisher, Frey (2008), Begetto, Kaufman (2013), Ali (2011), Treffinger (2008), and b. Many studies conducted by, their results can be seen.

It is known that a factor that is lacking in the process of educating students is creativity [7].

The development of creativity in students is directly related to the creative features of the ultra. According to Ken Robinson, "creativity is a set of original ideas with their own value" (Azzam, 2009). Gardner explains the concept in his research: "Creativity is a practical action performed by an individual, which must reflect a certain innovation and have a certain practical value." In terms of Emebayl's (1989) approach, creativity means "having a high level of unconventional skills as well as thorough knowledge in a particular field."

Many studies have differing views on the relationship between intelligence and creativity.

One group of researchers argues that the level of creativity and intelligence are interrelated (Kim, 2005).

According to Patti Drapeau, creative thinking is, first and foremost, comprehensive thinking on a particular issue. Comprehensive thinking requires students to rely on many ideas in the performance of a learning task, problem, and task. In contrast, one-sided thinking is based on a single correct idea. There is no denying one-sided and multi-faceted thinking on the issue in observation. Consequently, one-sided and all-round thinking plays an equally important role in shaping creativity. That is, in completing the task, the student seeks several options for solving the problem (multi-faceted thinking) and then stops at only one correct solution that guarantees the most optimal result (one-sided thinking). The decision-making process of students is important in this process [7].

Student creativity is manifested in his thinking, communication, emotions, certain types of activities, decision-making process. Creativity describes a person as a whole or its specific characteristics. Creativity is also reflected as an important factor of talent.

In foreign countries, teachers, as well as experts in all fields, determine the presence and level of their creative qualities. To do this, they are tested by E.P. Torrens in 1987 and determine whether a person has creative thinking. This test allows you to assess a person's creativity and its level on such criteria as activity in the organization of creative activity, quick thinking, originality and perfection. The answers to the questions suggested by the student should satisfy these four criteria [7,9].

According to E.P. Torrens, the concept of "creativity" [9] is based on the following:

- put forward a problem or scientific hypotheses;
- check and change the hypothesis;
- identify the problem based on the formation of the decision;
- knowledge and practical actions in finding a solution to the problem
- sensitivity to mutual contradictions

Creative thinking can be clearly reflected in any social sphere [7]. The creativity of students is reflected in their creative approach to the organization of activities.

In psychology today, a person's creativity is defined by two aspects that are specific to his or her activity. They are:

- Tests to determine a person's life experience and personal qualities;
- Tests to determine creative thinking and its results (speed, efficiency, productivity, etc.).

It is important to create a comfortable environment in the group before students develop creative thinking skills. Students studying in a creative environment gradually develop an interest in performing creative tasks and also tend to think creatively as a result of observing a teacher with creative thinking (Sternberg & Williams, 1996). A learning environment of a creative nature leads to the development in students of critical and creative thinking skills, which are of great importance in the educational process (Boykin & Noguera, 2011, 2012; Marx, 2000, as cited in Jensen, 2013).

Students with creative thinking:

- expresses ideas that other students have not thought of;
- chooses a specific way of expressing themselves;
- sometimes ask irrelevant or unusual questions;
- enjoys the tasks that remain open;
- prefers to discuss ideas on the basis of concrete evidence;
- chooses an unconventional approach to finding a solution to the problem.

Students should also have the following skills that represent the ability to organize research and creative activities:

- 1) cognitive (gnostic) skills;
- 2) design skills;
- 3) creative-practical (constructive) skills;
- 4) research skills;
- 5) communicative skills;
- 6) organizational skills;
- 7) consistency (procedural) skills;
- 8) technical and technological skills

As mentioned above, creative qualities in students do not develop spontaneously in research activities. Accordingly, research explores a number of ways to successfully develop creative qualities in an individual (including students). Patti Drepeau [7] has also shown four ways to successfully develop creative qualities in an individual (including students).

The essence of these paths is discussed below.

Way 1: Develop creative thinking skills in students. The main emphasis is on the formation of creative thinking skills, students are focused on expressing the essence of actions of a creative nature using verbs. In particular, in order for teachers to effectively develop their creative thinking skills, attention is paid to the presence of the necessary verbs in the questions that encourage students to think. If this situation is explained with examples, the control question from the students "Describe the connection between character and intellectual traits" does not form creativity in them. After all, the concept of "describe" in the content of the question is, in essence, the same as "tell your existing knowledge one by one."

The use of words (verbs) that encourage students to think when asking control questions facilitates their creative thinking. Therefore, according to the first way of forming creative qualities in students, it is expedient for educators to use words, verbs that force them to give different, antique, unconventional and thorough answers. M: The use of words (verbs) such as “find a connection”, “create”, “predict”, “express an idea logically”, “imagine” is considered to be practically effective.

Instead of asking students to "describe the connection between a person's character and his intellect," the educator should ask him to "cite all kinds of connections between character and the intellectual system." As a result, students have the opportunity to both generalize existing knowledge and advance new thoughts and ideas.

Way 2: Develop practical creative movement skills. It uses practical methods and techniques in the formation and development of creative movement skills of the individual. Using questions here can only help in the short term, but does not develop interactivity and initiative in individuals.

Way 3: Organize creative activity processes. This approach encourages students to think creatively in the process of problem solving and advancing innovative ideas. Although creative methods and techniques are not actively used in these processes, creative thinking occurs. M: “Finding the connection between character and the intelligence system” (Isaksen & Treffinger, 1985). While completing the assignment, students analyze various problems related to a person’s character. As a result, in this process, multifaceted thinking, observation takes place.

Way 4: use of creative products (developments). In doing so, the educator may ask students to create a presentation on “Individual Characteristics of a Person” using Power Point or multimedia. During the preparation of the presentation, students actively develop creative thinking skills [1-7].

In addition to the 4 ways that develop the above creativity, the 5th way below should also be considered.

Way 5: Develop student creativity in collaboration with various manufacturing institutions. Students can fully demonstrate their creative thinking skills in a comfortable environment. If students have a fear of failure, fear of misrepresentation, or criticism, it will not be possible for them to effectively form or develop creative thinking skills in such a situation. Creative thinking skills can be successfully formed in students only by making creativity a habit.

In this process, the methods and tools used by them to assess the content of the topic and creative thinking skills play an important role.

Only in an environment of a creative nature will students be able to understand the content of the topic being studied, the interrelationships between learning information, and begin to think about it (Anderson et al., 2000). M: In the process of studying the “essence of the immigration phenomenon” based on the “Brainstorming” strategy, first of all, students should have an understanding of what the strategy is and how to apply it.

Certain factors hinder the development of creative qualities and skills in individuals. Therefore, in the pedagogical process, teachers should pay attention to the elimination of these factors. The following factors hinder the development of creativity in an individual:

1. to avoid self-risk;
2. to allow rudeness in thinking and behavior;
3. underestimation of a person's imagination and imagination;
4. submission to others;
5. In any case, think only of success

It is not about whether the teacher is creative or not, but about organizing the lessons in the spirit of creativity, striving to try new ideas in the educational process. According to the "Creativity Roadmap", the teacher moves in the following four directions, and the actions in them are the signs of creativity of teachers (Patti Drepreau):

- 1) demonstrate creative thinking skills;
- 2) use strategies (methods and tools) that encourage students to learn subjects with interest;
- 3) innovative approach and creative approach to finding solutions to pedagogical problems;
- 4) expected result [7].

Creative potential is closely linked to creativity focused on the learning process. The creative potential of the teacher, in contrast to traditional thinking, is manifested in the following:

- speed and flexibility of thinking;
- ability to create new ideas;
- not to think in the same way;
- originality;
- initiative;
- tolerance of uncertainty;
- to be intelligent [1-7].

A person does not become creative on their own. His creative ability is formed through consistent study, self-study over a period of time, and he gradually improves and develops. The foundation is laid during the student years for the individual's creative ability and is consistently developed in the organization of professional activity. At the same time, it is important for a person to focus on creative activity and be able to organize it effectively. In the organization of creative activity, a person should pay special attention to solving problems, analyzing problem situations, as well as creating a variety of creative products.

When solving a problem and a situation, a person's creative approach to finding a solution to the problem helps to develop emotional and volitional qualities in him. By putting problematic issues before oneself, one is confronted with evidence that contradicts existing knowledge and life experiences. As a result, there is a need to work on oneself, to study independently. You will also need to make the right decisions to solve the problem creatively.

Important levels of a person's creative potential

Levels	Level properties
High	Regularly promotes various initiatives, consistently demonstrates creative ability, creatively very active, inquisitive
Medium	Sometimes he puts forward this or that initiative, his creative ability, although not regular, is manifested, he strives to be somewhat creatively active, inquisitive

Past	Although he is not well-founded, he strives to promote the initiative, his creative ability is not sufficiently demonstrated, he does not strive to be inquisitive.
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Creativity "is evident in decision-making on issues of education and upbringing in different situations, which characterizes the creative activity of the teacher" [14]. In essence, the development of creative qualities in university teachers is due to the fact that they are fully aware of the basics of pedagogical, psychological and specialty sciences, the formation of skills and abilities to actively apply the acquired knowledge in practice.

According to VV Utyomov, MM Zinkovkina, PM Gorev, the formation of a creative personality takes place in three stages [15]. That is:

Stages of formation of a creative personality

Stages	Meaning
Creativity based on natural possibilities	Represents the specific behavior of an individual
Primary (general) creativity	A general ability to demonstrate a person's creativity (it is manifested in the child at the age of 3-5 years, and at the age of 6-7 years it is clearly expressed in his behavior)
Specialized creativity	Ability to express creativity in a particular type of social activity (according to which, based on the experience of professional and creative activity, the overall creativity develops under its influence)

All the above-mentioned stages are equally important in the organization of activities to achieve the acquisition of creative qualities of the individual.

Part of the experiment.

Each person's ability to develop and express themselves is directly related to his or her ability to be creative.

Typically, an individual's ability to be creative is ensured through the pursuit of problem solving, the implementation of research or research projects, and the achievement of mutual creative collaboration. The combination of creativity and intellect is important in this. Therefore, in our study, we aimed to explore the relationship between students' research activities and their intellectual characteristics. In doing so, we also took into account the areas of education of students.

When we analyzed students' outcomes across areas of learning, we saw that there were relative differences between specific values, although they reflected the same level in solving tasks involving complex analogies. According to a complex analogy, there was a difference in the performance of students of the natural direction (5.36 ± 1.20) and the humanities direction (6.68 ± 1.50) ($p < 0.05$). This suggests that humanities students have a slight advantage over their peers in distinguishing logical connections between concepts. But the result does not

mean that they have a clear advantage and are highly capable of logical reasoning. There was almost no difference in the division of students according to the essential features of the concepts. This means that students in both disciplines prefer to think clearly and situationally rather than abstractly. This may also be due to the fact that in today's context of socio-economic changes, adolescents have come to the conclusion that, depending on the situation, they prefer concrete thinking.

We have to admit one thing. Differences were observed in the special cases of visual ($p < 0.05$) and applied intelligence ($p < 0.001$) of students studying in the natural (29.12 ± 2.62 ; 15.46 ± 1.68) and humanities (27.73 ± 3.67 ; 18.88 ± 2.64) directions. We recognize that this may be due to the fact that students in the natural direction perform practical tasks through hand motor skills or carry out tasks on practical, specific models, models and figures in a laboratory setting. The reason why students majoring in the humanities stay away from this situation is that they pay more attention to abstract-logical issues in their education.

We identified correlations between indicators, focusing on the study of the causes of the correlation, the internal correlation between the characteristics of students' intelligence, to ensure the continuity of the results of our experiments. The results in this regard were studied in terms of general, educational orientation, and gender differences based on the relationship between students' general intelligence and other intellectual characteristics. No analogies were observed between the general intelligence of the students and their analogy, the separation of concepts according to important features, visual thinking. (Table 1).

Table 1: Correlation between all intellectual indicators of requirements

	Tot al	Anal ogy	Separatio n of concepts according to important features	Visual intellect	Practic al intellect
General	1	- 0,114	0,103	0,098	- 0,270**
Analogy		1	-0,234*	-0,159	0,051
Separation of concepts according to important features			1	- 0,284**	-0,074
Visual intelligence				1	-0,143
Practical intellect					1

An inverse relationship was observed between general and applied intelligence ($r = 0.270$, $p < 0.01$). This may also be due to differences in the performance of practical intelligence tasks with assignments that measure students' mental abilities. There is also an aspect of similarity between the two directional tasks, i.e. the tasks were performed on the figures and in the first the similarities, differences between the figures, grouping them and ensuring consistency were done visually but through reflection. Tasks to study practical intelligence were also

performed on figures, ensuring consistency through observation, speed, and vision, based on practical, psychomotor principles.

In the second correlation observed in the overall results, the ability to differentiate concepts according to important features also formed a connection with visual intelligence, but has an inverse relationship ($r = -0.284$, $p < 0.01$). If it is necessary to ensure an integral connection on all aspects of a person's intellectual potential, this can be achieved through special training and development of features related to cognitive processes, operations. This will require the development of psychological training programs and the creation of methodological guidelines for the development of special intelligence in students.

Another aspect of our analysis is that the correlation between student intellects is reflected in the areas of education (Tables 2 and 3).

Table 2: The relationship between the intellectual performance of students studying in the natural direction

	Total	Analogy	Separation of concepts according to important features	Visual intellect	Practical intellect
General	1	-0,144	0,234	0,034	-0,506**
Analogy		1	-0,350*	0,037	-0,123
Separation of concepts according to important features			1	-0,214	-0,300*
Visual intelligence				1	0,417**
Practical intellect					1

* $p < 0.05$; ** $p < 0.01$

The internal correlation between the IQ indicators of the natural direction students was similar to the overall results, as well as reflecting new connections in some places.

The general intelligence of students of the natural direction reflected the inverse relationship with the practical intelligence ($r = -0.506$, $p < 0.01$). We can say that this situation has the same character as our interpretation above. Our previous review serves as the basis for a psychological interpretation of this correlation. Also, in the relationship between complex analogy and the separation of concepts according to important features, the general situation seems to be repeated ($r = -0.350$, $p < 0.05$).

There is also the fact that the advantage of working with concepts in students is that they do not require a positive internal connection with the practical intellect ($r = -0.300$, $p < 0.05$). This is the case even at their average values.

There is a positive correlation between students' visual intelligence and practical intelligence ($r = 0.417$, $p < 0.05$). The existence of interrelationships between types of intelligence can be explained by several reasons. First, both test assignments rely on the operations performed on the forms. Second, the performance of tasks relies on the interaction of cognitive processes. Third, the process is based on various combinations between forms and

requires practical implementation. These situations were able to serve to ensure the interaction of both intellects in the students. In fact, it is important that the practical and visual intellects in students have a high degree of interdependence, not a natural orientation, but rather a humanitarian orientation. Their maturity will undoubtedly provide students with the opportunity to apply the knowledge, skills and competencies they have acquired with their mental abilities in real life.

The interrelationships between the intellects of students majoring in the humanities showed much specificity compared to the above analyzes (Table 3).

Table 3: The relationship between the intellectual performance of students studying in the humanities

	Total	Analogy	Separation of concepts according to	Visual intellect	Practical intellect
General	1	-0,209	0,002	-0,041	0,183
Analogy		1	0,328*	-0,017	-0,150
Separation of concepts according to important features			1	-0,278	-0,032
Visual intelligence				1	0,007
Practical intellect					1

* p<0.05

No obvious correlations were observed between the intellectual aspects of these students. However, in the results on the average values of students, the data on the separation of complex analogies and concepts by important features showed a partial predominance of values in the representatives of this direction. In turn, a correlation was observed in the correlation relationship between analogy and the separation of concepts according to important features ($r = 0.328$, $p < 0.05$)

Humanities students may be the result of working more on concepts, their interactions and differences, concrete and abstract aspects in the educational process. It is not enough for students of the humanities to combine these aspects of intellect in order to shape their research activities.

IV. CONCLUSIONS AND RECOMMENDATIONS

1. Psychodiagnostic tools have the ability to study not only general intelligence and types, but also features of creativity. Each of them can evaluate the norm of IQ coefficient on the surface.
2. It is characteristic that the results of the study of the interaction of students' intellects are differentiated in specific cases rather than consistent. General intelligence did not reflect the interrelationship between visual and practical intelligence. This indicates that the student is unique in the expression of creative traits.
3. In the analysis of the results of education and gender, similarities and differences in the intelligence of students were observed.

4. In students' creativity, visual and practical intelligence had a more positive connection than other mental characteristics.

5. The extent to which intellectual performance can be dim or bright can be explored in the course of research and reflected in the dynamics of general intelligence in the form of professional and cultural relationships.

Recommendations

As one of the qualities of a creative-professional character in any person, creativity develops at certain stages. As a result of observation of educational practice, study of the activities of students and trainees, the use of diagnostic methods, it became clear that it is important to pay attention to the following stages in the formation and development of individual creativity:

- Mastering the theoretical and methodological bases of specialty disciplines (series of disciplines)
- Development of skills to apply the acquired theoretical knowledge in practice during continuous and continuous production practice, as well as in the process of practical training and independent study
- Achieve the transformation of practical skills into skills based on independent study and creative research
- Psychological preparation for the effective organization of professional activity based on existing theoretical knowledge, practical skills and abilities.

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