International Journal of Advanced Science and Technology
Vol. 29, No. 8, (2020), pp.3669-3677

Cognitive-Psychological Diagram Of Processes Of Scientific And Technical Creativity Of Students

Ismailov T.J[1], Tagaev X[2], Kholmatov P.K[3], Yusupov K.Y[4], Alkarov K.Kh[5], Orishev Zh.B[6]
Karimov O.O[7]
[1,3] *Associate Professor, Ph.D., Jizzakh State Pedagogical Institute*
[2,4,5,6,7] *Jizzakh State Pedagogical Institute*

Abstract

One of the possible approaches to the development of cognitive-psychological schemes of the processes of scientific and technical creativity of students is given on the example of the faculty of technological training of pedagogical institutes. The classification features of three categories and two ways of thinking inductive and intuitive are described, revealing the relationship between logic and psychology when constructing a scheme of movement of schemes of creative thought.

1. Introduction

The cognitive-psychological scheme of students 'scientific and technical creativity (NTTS) processes is a system of students' scientific, technical and research activities, the purpose of which is professional self-determination of students, corresponding to the individual characteristics of each person and the needs of a higher educational institution (university) and society in staff. This activity has psychological, pedagogical and research aspects.

The purposeful work carried out in the university system on NTTS is an integral part of the educational process and is designed to contribute to the development of each participant (student), the disclosure of all sorts of potential opportunities: concentration (concentration) skills; distribution and switching of attention to solving the tasks of becoming as a future public education worker. It should be carried out based on the psychological and other characteristics of each stage from the first year to the end of the university.

Unfortunately, this scheme is not concrete enough and has many temporary options. The elimination of these shortcomings can only be carried out with the development and implementation of a cognitive-psychological scheme of NTTS processes throughout the training period.

The structural-logical scheme of NTTS processes in our opinion should be carried out according to the following contents:

- the cross-cutting nature of planning (the subordination of the entire educational process to the profile of preparation);

- completeness (all types of educational work are included);

- ensuring the most complete communication and continuity of training in academic disciplines;

- elimination of closed cycles of disciplines not related to others.

For the successful solution of the above, it is important for the mastering at a certain period of the pedagogical (creative) process to make personally significant for students, that is, they would like to study it, master it, do it, so that they recognize the creative work as freely chosen. When it is forced, it is forced to engage in creative activity. The following example can be used to explain this.

We know that the periodicity of elements (universal) was discovered by D. Mendeleev by comparing and drawing together different natural groups and families (that is, through a special one), and during the discovery he changed the atomic weights of some elements (beryllium) and predicted some missing elements (future gallium, etc.). This means that, having not yet discovered the universal, he already from

ISSN: 2005-4238 IJAST

the first manifestations found the way back from the universal to the particular and the singular.

The process of the movement of scientific thought from the individual through the special to the universal is a movement to the knowledge of truth. This is the subject of logic (dialectic). She is not interested in this movement in its entirety and complexity, with its zigzags and understandable movements, as well as such moments as “mental barriers” and springboards included in it.

From all this, logic is isolated and represents a movement towards truth in a purified form.

On the contrary, psychology is interested in just this aspect of the movement of scientific and technological thought, its zigzags and their causes, the barriers that arise in its path and their overcoming.

This reveals the relationship between logic and psychology, which from different sides study the same thing - scientific and technological creativity.

From these positions, we consider the relationship between two ways of thinking - inductive (as a special case of empirical) and intuitive (as a special case of abstract-theoretical).

When it comes to the transition from the individual (individual facts) to the specific (their primary systematization), the method of induction, that is, inductive generalization, or “guidance,” plays a special role. Using this method, human thought can move all the time within the framework of the conscious and not for a moment lose its connection with the cognizable or use completely understandable, accessible to our reason methods that, if used correctly, cannot cause any ambiguities or perplexities. This is very important, since the induction method is used primarily to detect the causes of the phenomenon under study.

The situation changes radically when, when moving from the special to the universal, an obstacle is encountered which cannot be explained either by inductive explanation, or even more so by using various methods of induction. For the time being, our thought moves here gropingly in the sphere of the unconscious, and its exit from this sphere is carried out not by induction, but by a sudden jump, incomprehensible to the person himself, from the sphere of the unconscious to the sphere of the conscious. Such a hop is usually referred to as induction. What is induction?

On this account, philosophers and psychologists give the most varied answer. Here we will not deal with the analysis of its definitions and interpretations: it is important for us only to note that it does not occur in the sphere of the unconscious, but just the opposite, when in some way incomprehensible to us, our thought breaks out of this sphere and falls into the sphere of the conscious. However, since such a transition is not an ordinary rational operation, it would be more correct to characterize it, in our opinion, not as a kind of subconsciously occurring process, but as a superconscious one that does not fit into the framework of formal logic.

So, intuition means a sudden insight into the truth without intermediate conclusions necessary from the point of view of formal logic. This circumstance is reflected in some views on intuition as a direct conclusion, carried out without intermediate links. That is how we will understand intuition in the future, referring the result of its action (disclosure of truth) to the field of dialectical logic.

It is precisely for the reason that intuition is a phenomenon that occurs outside our ordinary rational sphere, it is not fixed as a phenomenon in our consciousness and our memory, but only the result achieved by intuition.

The foregoing in terms of intuition, we needed for this purpose to build a complete scheme of the flow of scientific and technical creativity of students.

On this definition, we see how two paths of scientific thought are distinguished: the first is its movement toward discovery, to the knowledge of truth, the second is the path of scientist's information about the euthanized truth, that is, the path of bringing information about this thought to the consciousness of other people, the path of perception them of this thought.

Comparing both paths, we can say that the second path may turn out to be the opposite of the first. The question of how the discovery is made and how the information about it is then built is of great importance for the development of the cognitive-psychological scheme of the processes of students' scientific and technical creativity. It can be said that in the course of performing creative work, students (starting from the simplest handicrafts and preparing a research essay and ending with the preparation of a diploma) psychologically justifiably and explainably include various points that help the work of inventive or scientific thought, but which are not saved as a result of the work, and therefore discarded in the course of information about this outcome.

An important place in the development of students' creative thoughts is occupied by the organization of discussions on the outcome of scientific and technical creativity. It is well known that such discussions and disputes help to overcome the barriers that existed on the path to it.

Exemption from unnecessary views, blocking the path to truth is carried out using logic. It is logic that shows (unlike psychology) not how the student's thought worked in search of truth, moving the shortest way. We see this, in particular, in the case when the work of intuition (after its completion), that is, obtaining direct inference, we begin to process logically, revealing in it the hidden links of the sequential course of reasoning that creative thought was able to "slip through" with the help of intuition .

In all cases, the discussion of the results of creative work contributes to the removal of barriers that were erected on the path to knowledge of the truth, and thereby contributes to the overall scientific and technological process. There is no way to lose sight of either the logical or psychological side of the issue, we must take them in unity and interaction.

The basis of such a cognitive-psychological scheme of scientific and technical creativity is the contradiction between the known and the unknown, i.e. what the student already knows, and what he wants to know. This contradiction moves the student's thought forward. The emergence of difficulties (in the future we will call it the cognitive-psychological barrier - PPB) that stand in the way of achieving the goal gives rise to the active work of thought.

In accordance with the above three categories of individuality, features, universality, and logic and psychology expressing the levels of knowledge and the sides of the creative process, depending on the uniqueness of the nature of the development of scientific and technical creativity of students of the faculty of technological training, it can be determined that the implementation of graduation qualified works (WRC) or projects of a research nature as a universal, general technical knowledge develops in special conditions (when performing research laboratory work Real coursework and course projects, teaching and research work, etc.) in a certain time period (I-IV course) as a result of otdelnкh students and teachers (members of the circle of technical work and their scientific leaders).

Therefore, the development of the cognitive-psychological scheme of the processes of scientific and technical creativity of students serves to detect the dialectical unity of the universal, special and unitary throughout the entire period of study of gradually complicated educational or research work of a cross-cutting nature (starting with writing an essay of the first year ending with graduation thesis or diploma theses IV course).

Based on the above concepts, we have formulated a general scheme of the movement of creative thought processes in NTTS. For this, we have introduced the following letter designations: writing an abstract - the letter P; implementation of research term papers and projects, laboratory work and various types of scientific (educational) research work - the letter K; performance of final qualifying work with the letter - WRC. Then the logical diagram of the movement of creative thought towards the solution of the problem posed throughout is presented as follows:

where the arrows show the transition from the lower level of knowledge to the highest.

At the same time, some barriers (cognitively - psychological barrier - PPB), which we depicted as a black

rectangle, are getting in the way from P to WRC. Our initial circuit will then take the following form (Fig. 1)

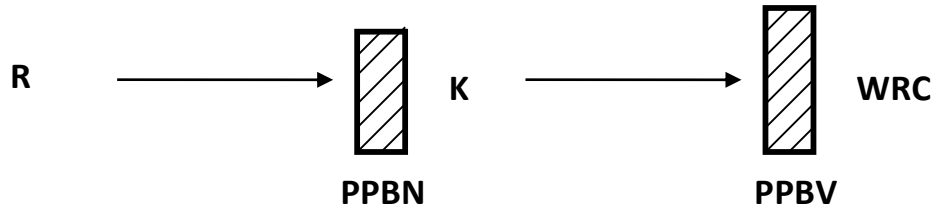

Fig. 1. Logical movement pattern creative creative thought

Conditionally embarked on the way to K PPB name the lower stage and designate PPBN, and embarked on the path to the WRC PPB higher level, respectively, designate PPBV.

The cognitive-psychological barriers that stood in the way to P prevent the transition from P to WRC and, therefore, the solution of the problem (disclosure of truth). Now we will schematically depict how these barriers are overcome with the help of tips - springboards.

Imagine such a springboard as existing in the same sphere of the unconscious, where the PPB itself has developed, and it is revealed only when the student's creative thought falls on him thanks to a hint. Let us designate these jumps with the letters TN and TV (where TN is the springboard of the lower stage, and TV is the springboard of the highest stage) and present it as an add-on above the PPBN and PPBV. Then we plow the circuit (Fig. 2).

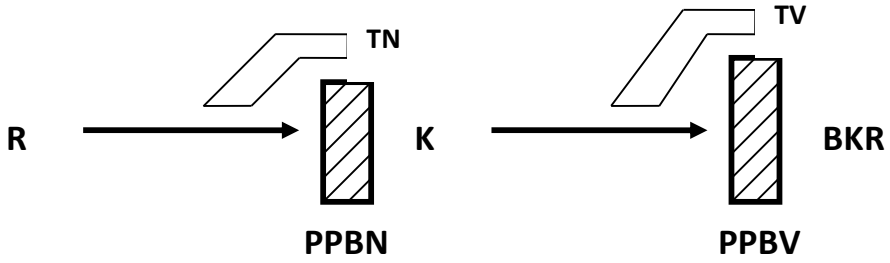

Fig. 2. Scheme of overcoming barriers using springboards

How can creative thought moving from P to WRC reach TV and TV? Who can, and who should lead and manage to maximize the effect of NIS? It seems that this issue is crucial in this scheme. There is a truth: "You cannot teach something that you yourself do not know how." Therefore, the mentors of young people should be people of a creative character, it is best if they are teachers with a tendency to inventive work, achieving technical progress in their industry, people who can analyze, think critically, and look for new solutions that can increase students. For this, what should the head of NTTS know and be able to do?

An important task of the leader in this case is to mobilize all the capabilities of each student to fulfill the main task and organize the process of completing the task. This is the main thing in his activity both as a leader and as a specialist. Sometimes leaders, especially young teachers, do not know this specific task. They consider leadership activity only as an opportunity to organize the fulfillment of tasks at a high level; they determine their participation in creative activity only from their own ideas, and not from the level of knowledge of more experienced teachers. Such leaders of NTTS should change their attitude to the organization and management of creative activity and their consciousness in order to get full satisfaction from leadership activities.

The ideal number of creative per teacher. Studies show that the actual number of students, consisting of

ISSN: 2005-4238 IJAST

freshmen to graduates, is always more than ideal. Therefore, each leader must independently draw the appropriate conclusions on the volume to be performed on the development of the creativity of its members. To do this, focus on the concepts and strategies for developing solutions.

The experience of NTTS indicates that such a leadership style is most appropriate when students themselves determine their future tasks and make high demands on themselves.

The results of our study show that mainly graduates choose the most effective way in solving the problem. And, in younger students, the stages and steps of work are set by the head of NTT. The following are the results of studies on the participation of students in planning and defining strategies for solving creative problems (in percent);

a - Freshmen
b - sophomores
c - Third-year students (graduates)

Activities	**Are involved**				
Students	**Very Often**	**Often**	**Rarely**	**Never**	**No answer**
1	2	3	4	5	6
Development of the future direction of work:					
a	1	5	28	30	36
b	3	22	22	20	33
c	20	50	24	-	6
Study design:					
a	3	6	21		
b	5	12	22	30	40
c	24	52	24	26-	35-
Discussion of plans, communications, research, organization, cooperation with other students:					
a	4	8	20	33	35
b	8	21	35	30	6
c	27	35	19	15	4
Development of working hypotheses and models:					
a	1	3	26	24	46
b	3	16	25	23	33
c	24	46	22	2	6
Technical work, writing, drawings, auxiliary work, etc:					
a	30	20	16	16	18
b	16	20	30	10	24
c	9	26	40	21	4

From the above it is clear that freshmen and second-year students require constant intervention by the leader, from setting problems to designing and putting it into practice, the leader must constantly remember the strategy and development of creative abilities; he must rationally plan the creative work of students and guide them towards successful problem solving.

As a rule, the student's knowledge is not enough to overcome the barriers that confront him. Thus, a contradiction arises between the cognitive need that arose and the existing problems, which creates good

prerequisites for the student to be included in active search activities.

Of course, it would be best for each student to come up with a solution to the problem on their own. But it provides students with complete freedom of action in solving the problem. In addition to the fact that, due to their individual characteristics, they will find a solution to the problem at different times, which already complicates the management of the cognition process, students will choose different ways to achieve the goal. Some of the students will find these ways irrational and, therefore, they may form a wrong idea of the method for solving the problem. Therefore, an important point in overcoming PPB is the organization of a search for a solution. There is a hint.

There are two types of prompts:

1. Students are invited to independently do certain experiments and explain their results. In this case, it is advisable to use the so-called "provocative" research work, aimed at focusing the student's attention on solving a problem that can help in overcoming PPB.

2. The teacher, together with the students, considers possible ways to solve the problem - problems and through analysis, selects the most effective ones. At the same time, it is advisable to develop algorithms (rules) for solving cognitive problems based on the modeling method and the similarity theory underlying it, which helps to reveal the connections and patterns in objects, processes or phenomena of the same nature.

This strategic position, associated with high productivity and original thinking, is an important prerequisite for effective leadership and in the study of students' creative potentials (participation in conferences, working with literary sources), cooperation with other comrades, the correct orientation of students in the selection of research topics, problems and areas of creative work, as well as in assessing the results.

The leader of the NTTS should regularly evaluate the work of students. A polite and tactful proposal by a manager to attract one of the employees to help in the work is a very effective tool in managing their activities.

Efficiency can be improved through regular monitoring. Properly organized control is a significant reserve for the growth of labor productivity, increased responsibility in work, consciousness. In addition, student-related monitoring reports allow you to check the intermediate and final results of work. But, on the other hand, too much pressure on students, the establishment of tight deadlines, formal control can negatively affect the nature and originality of the study.

Great responsibility lies with the leader for the level of results obtained. The clearer the manager’s strategy is manifested, the clearer the students ’orientation toward solving the problem.

Thanks to the leadership of the content side of NTTS, the leader sees the prospect of each student’s creative activity, the place of his contribution to general research and its value. Combined with positive attitudes and goals of creatively and enthusiastically involved students, this increases their interest. Therefore, in less creatively leading teachers, even less enthusiastic students take a more active part in solving creative problems than less enthusiastic and capable students.

Based on the foregoing, it should be concluded that for the development of the creative potential of scientific and technical creativity of students, the head of NTTS should:

- be guided by decisions of the State Standard aimed at accelerating the pace of scientific and technological progress;

- know the basics of legislation governing rationalization and inventive activity. Regulations on the design, experimental and creative work of students of higher educational institutions, a temporary provision on experimental design work in higher educational institutions;

- to study the reconstruction of a typical comprehensive plan for the organization of scientific and

technical creativity of students of higher educational institutions;

- know the psychological characteristics of scientific and technical creativity of students;

- own a technique for organizing scientific and technical creativity of students;

- be able to put into practice methods of enhancing creative activity;

- introduce brigade forms of organization of creative activity;

- own the basics of environmental, economic and economic activities;

- to communicate with base enterprises on the material and technical support of scientific and technical creativity of students and the involvement of specialists in basic enterprises in the work on scientific and technical creativity of students;

- own the principles of the formation of creative teams;

- determine the direction of creative activities of students and form a specific cognitive task;

- be able to develop annual and long-term thematic work plans for circles of public creative associations;

- be able to draw up business contracts, estimates and schedule plans for the implementation of experimental design work;

- To teach students the basic methods of creative and reproductive activity;

- know the methodology of organizing and conducting a competition and exhibitions of scientific and technical creativity of youth;

- own the methodology of reporting on the scientific and technical creativity of students.

Considering the general cognitive-psychological scheme of NTTS mentioned above for constructing, we denote the tips with the letters C_1 and C_2, respectively, that we know that they appear in front of the VT and the TV at the intersection of two independent necessary rows, respectively. One of them is the movement of creative thought, looking for a transition from P to K (we denote this row by the letter X_1). Another row is an event external to X_1, which is wedged in from the side into the student's thought and crosses the X_1 series (we denote this row by the letter U_1). At the moment of intersection of both rows in point C_1, the second row – U_1 - seems to be carried away by a creative thought which until then unsuccessfully tried to break through PPBN. The thought X_1, enlarged by the process of U_1 to the other side, finds a new path for itself: it falls on the VT and bypasses the obstacle that stood in its way (PPBN). Further, she goes unhindered towards K. In a similar way, we construct a scheme for the transition from C_1 to that movement of creative thought looking for a path from K to the SRS series is denoted by the letter X_2, the second row by the letter U_2 and the intersection point of both rows by the letter C_2. Let us depict all this schematically, given that with the movement of creative thought from P to K and from K to WRC, the transition from P to C_1 and from K to C_2, respectively, was accomplished by induction, and the transition from C_1 to K and C_2 to WRC, respectively, overcoming PPBN and PPBV - through intuition. Then it turns out the general cognitive-psychological scheme of the processes of scientific and technical creativity of students (Fig. 3).

The culmination point of scientific and technological creativity is no doubt the exit of the student's moving creative thought from the realm of the unconscious to the realm of the conscious. And this output is a rationalization proposal or a technical invention.

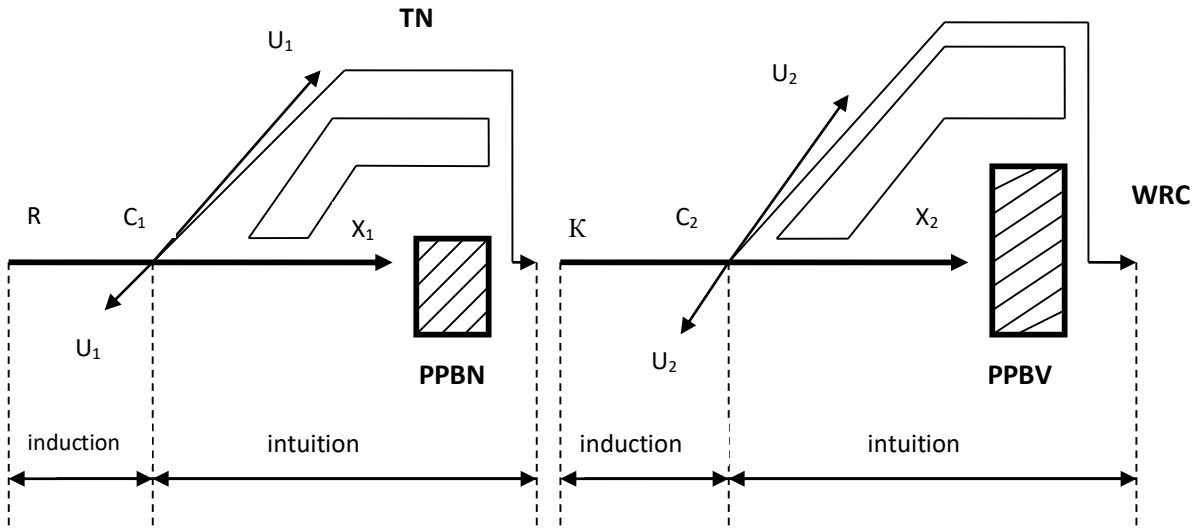

Fig. 3. General cognitive-psychological scheme of NTTS processes

Imagine conventionally two related areas of the student psyche: the unconscious and the conscious.

Between them passes the border, which can be sharp, or can be blurred in the form of a transition strip.

One way or another, creative thought is forced to cross this boundary in one or another of its places, and at the same time its gradation depends on many circumstances and factors: the correct direction of the direction of the process from the teacher; the degree of the formed general approach to solving emerging problems; accessibility of the wording and statement of the problem; awareness of the problem. The solution to which is not known; awareness of the issue and available data; identification of the relationship between data and issues, and often there is a need to put forward a hypothesis and plan its partial verification; implementation of the decision; checking the solution, correlating it with the source data and the question, etc., which we will not dwell on here. We are interested in the following: without exception, that we can learn about the process of movement of creative thought in the sulfur of the unconscious and about this very sphere of the unconscious, we will know only after the creative thought enters the realm of the conscious. But nothing, except what we learn, we still do not know about the realm of the unconscious.

Under the unconscious is understood, as usual, that area of our mental activity that is not controlled by our consciousness, our thinking, and the subconscious - that which is controlled by them.

Therefore, that which precedes the rationalization proposal or invention and occurs in the realm of the unconscious, we discover and comprehend only after it (through invention or rationalization) enters the realm of the conscious.

Thus, analyzing the role of the cognitive-psychological scheme of processes and springboard prompts in the scientific and creative work of students, we found the complete unity of both areas of the creative mind, their subordination to certain general laws, which we expressed as a general cognitive-psychological scheme (model) of a professional, self-determination of students corresponding to the needs of a creative university and society in personnel. The approach we have taken to improve the creative personality gives reason to state: for the development of a creative personality, motivated and properly structural-logical stimulated network planning, the movement of creative thought of students of a cross-cutting nature, subordinate to the entire educational process according to the profile of preparation, is necessary. For this it is necessary that the educational process be emotionally rich, and the training

itself should be addressed not only to the student's mind, but also to his feelings!

In total, members of the Technical Creativity circle for 2018-2020 published internationally 10 articles and 18 diplomas and certificates of relevant international student competitions were received.

We do not consider the work done to be completed: rather, this is only the beginning of the development of constructive ideas for developing the creative ability of students of the entire period of study using the example of the faculty of technological training of pedagogical institutes. And we hope that the content of the movement of creative thought will be able to play its role in the further scientific and methodological development of the problems of developing the creative personality of schoolchildren, college students and artisans of a wide profile.

References

1. Pushkin N.V. Heuristics is the science of creative thinking. Moscow., 1967
2. Kedrov B. About creativity in science and technology. Moscow., "Young Guard", 1987
3. Stolyarov Yu.S. other. Technical creativity of students. Moscow., "Enlightenment" 1989
4. Tagaev H. Organization and conduct of a competition of scientific and technical creativity of students. Methodical recommendation. Research Institute of Learning Tools and Study Book. Moscow., 1992
5. Tagaev H. Pedagogical foundations of the improvement of a creative personality. Russian Academy of Education. Institute of teaching aids. Toolkit. Moscow., 1993
6. Ismoilov T. A factor in improving creativity in students. Conference package. Jizzax 2002 y.
7. Tagaev H. Qualities of training: problems and solutions "UAZhBNT" Tashkent., 2003.
8. Taғaev H., Sharipov Sh. Wa boshalar. Oliy Kuv yurtlari talabalarida ichthyrocrackle shaklantirish. Tashkent., 2004
9. Tagaev H. Discussion around giftedness. Marifat. Tashkent., February 23-February 2005
10. Ismoilov T. Izhodkorlik objectlariga қўyyladigan Talablar. "Yoshlar bandligi wa talim muammolari" Halqaro conference tўplami. Samarkand - 2007 yil December 20-21.
11. Ismoilov T. Bўlajak kasb talimi увituvchilarini izhodkorlik faoliyatga tayerlash. "Uzluxes Talim" Tashkent Magazines., No 3, 2008.
12. Ismoilov T. Talabalarning technician Izhodkorlik қobilyatini rivozhlantirish tekhnologi. "Uzluxiz Talim" Tashkent Magazines., No. 1 2009.