



Г. В. МАКОТРОВА, О. А. МОИСЕЕНКО, Е. Н. КРОЛЕВЕЦКАЯ, Н. А. ПОЛОЦКАЯ, Д. Н. ЕФИМЦЕВА

Моделирование процесса развития научного потенциала личности в вузе: подходы и идеи

Введение. Беспрецедентное экономическое и политическое давление, которому подверглась Россия, остро ставит вопрос о новых принципах и моделях развития отечественной системы подготовки будущих лидеров науки, путях повышения конкурентоспособности ученых в быстро меняющемся мире. Авторы предлагают идти от содержания феномена «научный потенциал личности студента» и оценки состояния его развития к построению новой образовательной модели, в которой реализуются идеи целостности, культуротворчества, системогенеза, диалогичности.

Материалы и методы. В экспериментальном исследовании приняли участие 1724 человек студентов гуманитарных и естественно-математических факультетов Белгородского государственного национального исследовательского университета (Российская Федерация). Для обработки данных использовались методы математической статистики: корреляционный анализ, расчет среднего статистического веса одной связи.

Результаты исследования. Установлено наличие высокого процента студентов, имеющих репродуктивный уровень развития научного потенциала личности (39%), выявлены значительные дефициты в технологической готовности студентов к исследованию; показано преобладание студентов с креативным и эвристическим уровнем развития научного потенциала личности на гуманитарных специальностях по сравнению со студентами естественно-математических специальностей.

Наибольший статистический вес в корреляционной плеяде, составленной для студентов с креативным уровнем развития научного потенциала, имеет такой его показатель как уровень научного общения ($k=60$; $p<0,05$). Наибольшей статистически значимой связью для креативного уровня развития научного потенциала студентов оказалась связь между уровнем научного общения и уровнем увлеченности исследованием ($r=0,685$; $p<0,05$).

Заключение. Выявленные признаки-характеристики научного потенциала студентов позволяют давать уровневую оценку его развития на уровне прошлого и настоящего, а также проектировать его дальнейшее развитие. Разработка новой образовательной модели профессиональной подготовки в вузе должна быть направлена на обеспечение субъект-субъектного взаимодействия участников научного творчества в научно-исследовательской образовательной среде вуза, развитие исследовательской деятельности обучающихся от культууроосвоения к культуротворчеству, педагогическое сопровождение творческого самодвижения личности обучающихся в процессе познания.

Ключевые слова: студенты вузов, научный потенциал, антропологический подход, целостность, системогенез, культуротворчество, диалогичность

Ссылка для цитирования:

Макотрова Г. В., Моисеенко О. А., Кролевецкая Е. Н., Полоцкая Н. А., Ефимцева Д. Н.
Моделирование процесса развития научного потенциала личности в вузе: подходы и идеи
// Перспективы науки и образования. 2022. № 6 (60). С. 29-46. doi: 10.32744/pse.2022.6.2



G. V. MAKOTROVA, O. A. MOISEENKO, E. N. KROLEVETSKAYA, N. A. POLOTSKAYA, D. N. EFIMTSEVA

Simulation the process of scientific potential development of the personality at the university: approaches and ideas

Introduction. The unprecedented economic and political pressure that Russia has been subjected to sharply raises the question of new principles and models for the development of the domestic system for training future leaders of science, ways to increase the competitiveness of scientists in a rapidly changing world. The authors propose to go from the content of the phenomenon of "scientific potential of the student's personality" and the assessment of the state of its development to the construction of a new educational model in which the ideas of integrity, cultural creativity, system genesis, dialogicity are implemented.

Materials and methods. 1724 students of the humanities and natural-sciences and mathematical faculties of the Belgorod State National Research University (Russian Federation) took part in the experimental study. For data processing, methods of mathematical statistics were used: correlation analysis, calculation of the average statistical weight of one connection.

Results. It has been established the presence of a high percentage of students with a reproductive level of development of the scientific potential of the individual (39%). There have been identified significant deficiencies in the technological readiness of students for research. It is shown the predominance of students with a creative and heuristic level of development of the scientific potential of the personality in the humanities in comparison with students of natural sciences and mathematical specialties.

The greatest statistical weight in the correlation pleiade, compiled for students having creative level of development of scientific potential, has such an indicator as the level of scientific communication ($k=60$; $p<0,05$). The greatest statistically significant relationship for the creative level of development of student's scientific potential is the relationship between the level of scientific communication and the level of passion for research ($r=0,685$; $p<0,05$).

Conclusion. The revealed signs-characteristics of the scientific potential of students allow us to give a level assessment of its development at the level of the past and present, as well as to design its further development. The development of a new educational model of vocational training at a university should be aimed at ensuring the subject-subject interaction of participants in scientific creativity in the research educational environment of the university, the development of research activities of students from cultural development to cultural creativity, pedagogical support for the creative independent advancement of the personality of students in the process of cognition.

Keywords: university students, scientific potential, anthropological approach, integrity, system genesis, cultural creativity, dialogicity

For Reference:

Makotrova, G. V., Moiseenko, O. A., Krolevetskaya, E. N., Polotskaya, N. A., & Efimtseva, D. N. (2022). Simulation the process of scientific potential development of the personality at the university: approaches and ideas. *Perspektivy nauki i obrazovaniya – Perspectives of Science and Education*, 60 (6), 29-46. doi: 10.32744/pse.2022.6.2

Introduction

The world educational system like the Russian educational system, is going through a deep crisis. This is due, first of all, to a change in the system of values, both at the global level and at the level of individual states, among which Russia is no exception [1]. The crisis of education lies in the fact that the educational system does not have time to rebuild in accordance with the rapidly changing socio-cultural situation, with profound changes in the information, technical, technological and economic spheres. It does not have time to respond to the challenges of modern reality [2; 6]. Under the conditions of unprecedented political and economic pressure on the country, Russian education is in the process of transition from the previous state to new guidelines. It is in the process of searching for values and constants that determine the further existence and development of the entire system, that is the process of building a new education system in the context of Russia's inclusion in the global and Pan-European educational space [7; 8].

It means that the strategic goal of the state youth policy in the current conditions of Russia's development is in creating conditions for the successful socialization and effective self-realization of young people, for the development and use of their potential in the interests of the innovative socially oriented development of the country [9]. To achieve this goal, higher education in Russia focuses on the formation and development of students' activity and purposefulness in the knowledge of the world around them, motivation for creativity and innovation, a number of competencies for the implementation of research design and information and cognitive activities, which is reflected in the Federal State Educational Standards [10; 11].

At the same time, Russia has not fully defined the methodology for integrating educational and scientific activities, which in the future may result in a significant reduction in the personnel potential of the scientific sphere. There is no full-fledged relationship between professional education, research and practical activities, which increases the discrepancy between the content of education and educational technologies to modern requirements and the tasks of ensuring the competitiveness of Russian education in the world market of educational services [12]. Such kind of situation confirms the need for a transition from a reproductive educational model to an anthropological one, accompanied by means of updating of the personal and professional potential of the subjects of the educational space. It also sets the task of developing a personality culture in the process of education.

The results of assessing the state of development of the scientific potential of the personality of university students indicate the need to develop an educational model of its development in the context of the idea of anthropologism. According to N.V. Bordovskaya and S.N. Kostromina, the positive dynamics of the research potential of the student's personality from the group of bachelors to the group of masters is only typical for the motivational component of their research potential; many of the undergraduates do not have a clear idea of what a scientific publication, scientific project, scientific and practical conference is, despite the fact that they can cope at a fairly high level with the mandatory types of research activities provided for by the standard and curriculum [13].

The researchers T.I. Zabrodina, V.A. Kurina, L.F. Muryasova and S.Yu. Shirokova singled out the problem of the peculiarities of the manifestations of the creative qualities of the

personality of students in the humanities and natural sciences in the conditions of joint solution of creative problems, organization of individual and group reflection, updating the motives of creative activity [14].

The International Center for Sociological Research of the Belgorod State National Research University (I.S. Shapovalova, A.V. Kiselenko, S.D. Lebedev, etc.) when analyzing the results of a survey of a representative sample of students showed that the dynamics of the number of students, requiring various types of assistance in the implementation of research, not only does not significantly decrease from course to course, but increases with an increase in the complexity of the ongoing search activity (increase in requests for help in mastering skills in project management, formulating a problem, using a systematic approach in cognitive activity, putting forward a hypothesis, data analysis, evaluation and self-assessment of the results of cognitive activity, discussion, including representatives of other cultures [15].

The statement of the existence of the problem of developing the research qualities of the personality of university students raises the fundamental question of creating and implementing an educational model for the development of the scientific potential of the student's personality. To find answers, it was set the task of comprehending the phenomenon "scientific potential of a student", obtaining an assessment of the state of its development and putting forward ideas for developing theoretical provisions which can be the core of a new educational model at a university.

Materials and methods

The experimental study involved 1724 students of the humanities and natural sciences and mathematical faculties of the Belgorod State National Research University (Russian Federation) from the 1st to the 5th year. The complex of complementary research methods includes (1) general theoretical methods such as comparative-contrastive, logical-deductive analysis of philosophical, psychological and pedagogical sources, structural-functional analysis and system synthesis of theoretical positions and scientific facts; (2) empirical methods such as ascertaining, preliminary experiment, observation, expert evaluation, computer testing; (3) methods of mathematical statistics, such as correlation analysis (analysis of the total number of correlations according to K. Pearson, calculation of the average statistical weight of one connection).

Results

Our theoretical and experimental studies within the framework of the anthropological approach showed that the scientific potential of the student's personality as an integrative personal education, due to inclinations, abilities, experience of learning in learning and life, is a dynamic personal resource, including the unity of the student's personality orientation towards self-knowledge, other people and the world, sensually visual images and knowledge about the Universe, living nature, society and man, ways of knowing the world around. Its purpose is to provide, in the course of solving research problems, personal and professional self-determination, restructuring of the direction and content of scientific and cognitive activity and creative self-development.

As can be seen, when define the concept "scientific potential of a student" it was used the category of "resource". Unlike the category "opportunity", which indicates the direction of the deployment of processes, the category "resource" represents not so much the direction of the advancement of processes as the state and level of implementation of the existing capabilities of the trainees. The use of the category "resource" in the definition of the concept "scientific potential of a student" makes it possible to think about it in different contexts:

1) as a "silent" scientific potential of a student (as a resource that can be realized, as a warehouse "just in case");

2) as an "acting", "speaking" scientific potential of a student (as a resource realized in a certain amount);

3) as something that can be used for a specific purpose (as a resource that represents the unity of what has been achieved and what is possible, new increments that arise due to the learning conditions created by the teacher and the potency triggered by the processes of creative self-development).

It means that the student's scientific potential is considered as a dynamic personal resource representing different time slices (levels of the past, present and future). In the structure of a student's scientific potential as a component of a person's potential, there are tonic and resource (behavioral) components, which are recorded in the practice of training and education with the help of a system of their indicators. In the course of receiving higher education, each of the components is to some extent launched and structured by the process of creative self-development, caused by the connection of internal conditions, including the structural elements of the student's scientific potential, and external (psychological and didactic) conditions. We consider the advancement from the "silent" scientific potential of the student to the "speaking" one as a process of modifying the activity of the system of indicators of the student's scientific potential, and as the advancement of the current (changing) matter, which each time, depending on the measure of activity of its behavioral (resource) and tone parts, acquires different forms. These forms are: (1) the form of a resource, the form of the "silent" scientific potential of the student, "sleeping" opportunities, which includes a system of its indicators with different levels of their development; (2) the form of intention, in which certain components of the tonic part of the student's scientific potential are active to some extent, which manifests itself in the form of relationships, goal formation, meaning formation, in the form of action orientation; (3) the form of potency that characterizes the preparation for the implementation of the student's scientific potential, in which certain components of his tonic and behavioral parts are active to one degree or another, and, finally, (4) the form of the acting, "speaking" potential, in which the "selected" components of the resource (behavioral) and tonic parts of the student's scientific potential are used to perform specific research activities (Figure 1).

This advancement can be observed in the conditions of a learning situation, when the updating, "revival" of the student's cognitive experience, including in the conditions of life, result in the appearance of a certain attitude, meanings, and then to the formulation of a question, problem (scientific potential of the student is in the form of intention), and then the concept, idea, hypothesis (scientific potential of the student is in the form of potency). After that, the student, with varying degrees of his independence, carries out activities to test the hypothesis (the scientific potential of the student is implemented,

“says”). The student's going beyond the limits of his abilities in the process of obtaining new knowledge will result in increasing the student's scientific potential, i.e. the implemented “speaking” scientific potential of the student, having “calmed down”, will then acquire a new “potency”.

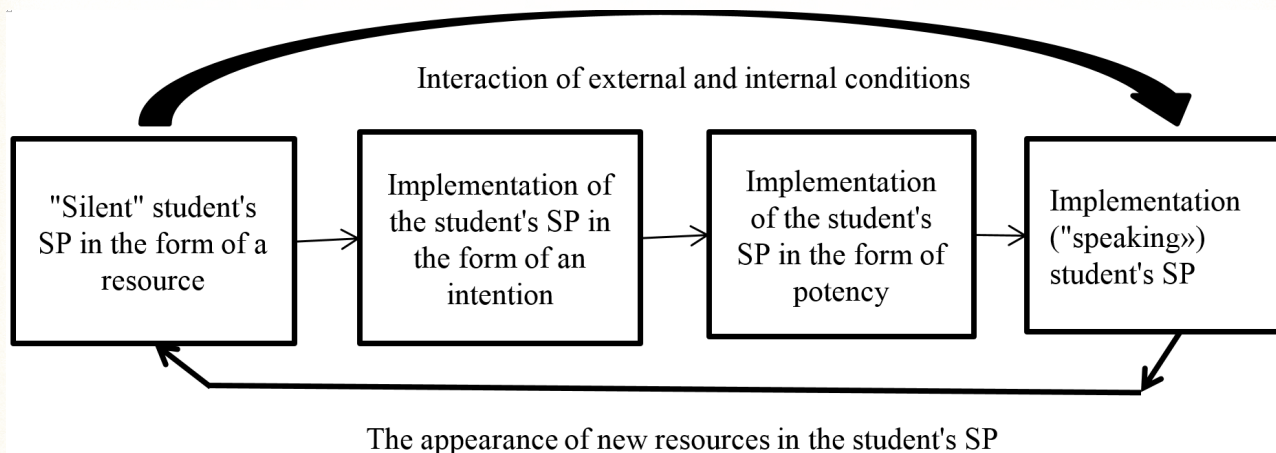


Figure 1 Accumulation of increments in the student's scientific potential (SP)

Depending on the level of complexity of the search activity, performed by the student, and the degree of creativity manifested in it, a different range and magnitude of manifestations of his/her research potential is recorded in the process of cognition. If the implementation is not in full, then a reserve is created. Understanding the extent to which the scientific potential of students is implemented, assessing the accumulation of new increments in it, requires the teacher to know the theoretical foundations of its advancement and their use in the educational process of the university.

Thus, the concept "scientific potential of students" reflects the process extended in time, and the above reasoning illustrates the use of categories "opportunity", "resource", "reserve" in characterizing the scientific potential of students. The scientific potential of a student as an opportunity is connected with future activities; as for reserve, it means the measure of its use in the present time; the resource indicates the accumulated knowledge which can be used in cognitive (research) activities.

The content of the concept "student's scientific potential" as well as the presented views on the results of training and its content made it possible to single out the motivational-semantic and cognitive-value components in the tonic part of the student's scientific potential; the resource part includes cultural-activity and reflexive-activity components. All these made it possible to determine the facts of their manifestation and interpret the problems of the development of the scientific potential of the personality of students. The description of the identified structural components of the scientific potential of the student's personality as

1) a systemic concept made it possible to present it as an integrative personal education, represented by a set of educational scientific and worldview values accumulated in the learning process and used by the person to obtain new knowledge for educational and scientific purposes;

2) a way of student research activity;

3) a manifestation of student creativity in scientific research; as a specific way of his/her advancement of essential forces, socialization and self-determination.

Considering the scientific potential of the personality not only at the level of the present and future, but also at the level of the past, at the level of experience gained, at the level of the research culture of the individual, it was identified the criteria and indicators of student advancement. It was identified the following criteria for assessing the state of development of the scientific potential of the student's personality: research motivation, scientific style of thinking, creative activity, technological readiness for research, orientation towards scientific research in the future profession. Research motivation is assessed by the following indicators: the intensity of the cognitive need, awareness of the value of research (knowledge), enthusiasm for research, scientific style of thinking (understanding the structural links of the elements of one's own research activities, following the norms and requirements of the scientific style of thinking, generalizing the subject and operational results of the study; technological readiness for cognition is assessed by the following indicators: possession of the conceptual apparatus of the issue under study, skills and abilities to use the methods of scientific cognition, compliance with the rules of the scientific organization of the student's work; creative activity is assessed by the following indicators: the level of independence in the transformation of ideas and connections between them, the degree of familiarity with the history of science and its modern problems, the level of scientific communication; orientation towards scientific research in the future profession is assessed by the following indicators: the degree of participation in research activities at the university; interest in research activities in professional activities; interest in university science.

Indicators of motivation for research, orientation towards scientific research in the future profession, creative activity of the personality (e.g. familiarity with the history of science and its current problems, scientific communication), the indicator of technological readiness for research (possession of the conceptual apparatus of the issue under study) characterize the tonic block of the research potential of students. As for the other indicators, they relate to resource block.

There were created computer diagnostic programs that allow us to quickly obtain information about the development of certain criteria and indicators of the scientific potential of the personality of students. The degree of manifestation of the listed criteria and indicators makes it possible to conclude the value of each of the criteria and the level of advancement of the student's scientific potential. The ascertaining experiment included 1724 students of different faculties. It was revealed the following: the number of students with an adaptive level is 1%, reproductive level is equal to 39%, heuristic level is 55%, creative level is 5%. Among students of humanitarian specialties, the percentage of respondents with a creative level is 5.1%, with a heuristic level is 60.9%, with a reproductive level is 32.6%, with an adaptive level is 1.4%. Among students of natural sciences and mathematical specialties, the percentage of respondents with a creative level is 4.8%, with a heuristic level is 51%, with a reproductive level is 44%, with an adaptive level is 0.5%. These data indicate the predominance of students with a creative and heuristic level in the humanities.

The analysis of the structure of correlations within the scientific potential of the personality showed that the increase in the level of its development is due to the growth in the significance of the connections and the statistical weight of all the above criteria and their indicators.

It is necessary to consider the dynamics of the development of the scientific potential of university students (for N= 85 at each level: creative, heuristic and reproductive levels

(Table1, Table 2, Table 3) and for N = 13 at the adaptive levels) according to the results of self-assessment.

Table 1

Intercorrelations of indicators of the scientific potential of students of creative level

		Indicators														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
indicators	1		0,439	0,553	0,249	0,247	-0,023	0,137	-0,186	-0,116	0,513	0,527	0,395	-0,259	0,299	0,364
	2			0,208	0,329	0,207	-0,316	0,267	0,098	0,159	-0,060	-0,204	0,275	-0,604	-0,046	0,236
	3				-0,057	0,009	0,010	-0,384	-0,364	-0,252	0,149	0,419	0,685	-0,280	0,367	0,113
	4					0,107	0,083	0,158	0,053	0,016	0,061	0,168	0,349	-0,421	0,168	0,396
	5						0,409	0,311	0,134	-0,192	0,467	0,065	0,300	-0,045	0,151	-0,108
	6							0,158	0,091	-0,122	0,447	0,231	-0,026	-0,008	0,617	-0,169
	7								0,630	0,546	0,209	0,109	-0,432	-0,178	-0,173	-0,327
	8									0,160	0,201	0,274	-0,357	-0,055	-0,137	-0,358
	9										-0,501	-0,175	-0,297	-0,143	-0,070	-0,191
	10											0,523	0,073	0,216	0,155	0,035
	11												0,280	0,084	0,447	0,045
	12													-0,304	0,351	0,291
	13														-0,233	-0,047
	14															0,315
	15															

Designations of indicators of the scientific potential of students: 1) the level of intensity of the research need; 2) the level of awareness of the value of research (knowledge); 3) the level of enthusiasm for research (cognition); 4) the level of knowledge of the conceptual apparatus of the issue under study; 5) the level of skills and abilities to use the methods of scientific research (cognition); 6) the level of compliance with the rules of the scientific organization of the student's work; 7) the level of understanding the structural elements of their own research activities; 8) the level of adherence to the norms and requirements of the scientific style of thinking; 9) the level of generalization of the subject and operational results of the study; 10) the level of independence in the transformation of ideas and connections between them; 11) the level of intensity of acquaintance with the history of science and its modern problems; 12) the level of scientific communication; 13) interest in research activities in professional activities; 14) the degree of participation in professionally oriented research activities; 15) professional interest in science at the university (college) of university students of the creative level for N=85 at the at the $r_{0,05} = 0.21$

Firstly, we have determined the main indicators that are the most mobile in the structure of the scientific potential of the personality of university students. On the basis of the constructed correlation pleiades and taking into account the methodology for determining the weights of indicators for each level of development of scientific potential, it was made the analysis of the dynamics of the structure of interrelations of indicators of the scientific potential of students and the values of their weights in order to characterize the process of developing scientific potential at each stage of cultural genesis. To do this, we carried out a detailed review of the obtained correlation pleiades, built on the basis of matrices for various levels of development of scientific potential with a reliability of $p=0.05$. The analysis of the structure of connections within the scientific potential made it possible to identify permanent connections characteristic of all sections; temporary connections that are present only at certain stages; connections that appear at a certain stage, but do not disappear in the future. The increase in the level of development of scientific potential was due to the growth in the importance of connections and the weight of all the above criteria and their indicators.

Table 2

Intercorrelations of indicators of the scientific potential of students of heuristic level

		Indicators														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
indicators	1		0,412	0,576	0,308	0,315	0,083	0,244	0,418	0,275	0,589	0,499	0,126	0,384	0,245	0,281
	2			0,470	0,173	0,158	-0,114	0,214	0,269	0,148	0,270	0,166	0,124	0,220	0,127	0,120
	3				0,157	0,183	0,061	0,273	0,264	0,175	0,502	0,383	0,079	0,352	0,267	0,446
	4					0,366	0,142	0,317	0,299	0,154	0,229	0,165	0,078	0,156	0,064	-0,143
	5						0,519	0,472	0,466	0,271	0,315	0,180	0,178	0,227	0,094	-0,124
	6							0,344	0,521	0,133	0,251	-0,037	0,162	0,254	0,168	-0,042
	7								0,427	0,355	0,260	0,204	0,062	0,261	0,194	-0,028
	8									0,437	0,461	0,203	0,152	0,274	0,073	-0,003
	9										0,221	0,096	0,033	0,053	-0,016	-0,093
	10											0,509	0,375	0,468	0,344	0,330
	11												0,188	0,258	0,276	0,437
	12													0,394	0,481	0,216
	13														0,447	0,510
	14															0,440
	15															

Designations of indicators of the scientific potential of students: 1) the level of intensity of the research need; 2) the level of awareness of the value of research (knowledge); 3) the level of enthusiasm for research (cognition); 4) the level of knowledge of the conceptual apparatus of the issue under study; 5) the level of skills and abilities to use the methods of scientific research (cognition); 6) the level of compliance with the rules of the scientific organization of the student's work; 7) the level of understanding the structural elements of their own research activities; 8) the level of adherence to the norms and requirements of the scientific style of thinking; 9) the level of generalization of the subject and operational results of the study; 10) the level of independence in the transformation of ideas and connections between them; 11) the level of intensity of acquaintance with the history of science and its modern problems; 12) the level of scientific communication; 13) interest in research activities in professional activities; 14) the degree of participation in professionally oriented research activities; 15) professional interest in science at the university (college) of university students of the creative level for N=85 at the $r_{0,05} = 0.21$

At the adaptive level, the following indicators have the greatest weight: interest in research activities, intensity of cognitive need, enthusiasm for research, awareness of the value of research. But other indicators are very poorly trained. These data are confirmed by the qualitative results of the study. At this level of connectivity, the system is disintegrated: most of its elements are not interconnected. The development of the scientific potential of students is determined by the contribution of the indicators of the criterion "motivation for research".

The primary integration of structural elements takes place at the reproductive level. It is observed the formation of several substructures, united by weak functional ties, which result in the success of certain types of cognitive activity. The process of primary integration is characterized by an active restructuring of the development of scientific potential due to a change in the weight of indicators. The existing gaps in the structure of the scientific potential of students, as follows from the analysis of the correlation pleiade for the reproductive level of development of the scientific potential, indicate not the low significance of the studied trait-indicator, but its lack of formation and unconsciousness. Among them, we have identified: generalization of the subject and operational results of the study; possession of the conceptual apparatus of the issue under study, independence in the transformation of ideas and connections between them; level of scientific communication.

Table 3

Intercorrelations of indicators of the scientific potential of students of reproductive level

		Indicators														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
indicators	1		0,224	0,279	-0,070	-0,032	-0,020	0,031	0,074	0,179	0,217	0,256	0,067	0,132	0,158	0,186
	2			0,342	-0,006	0,078	-0,226	-0,008	-0,054	0,151	-0,160	0,092	-0,064	0,084	-0,153	0,103
	3				-0,061	0,128	0,024	0,146	0,086	0,034	-0,027	0,016	-0,016	0,119	-0,054	0,115
	4					0,284	-0,082	0,170	0,091	-0,046	0,132	0,093	0,098	0,054	-0,145	-0,128
	5						0,343	0,476	0,335	0,122	0,150	0,096	-0,051	0,166	0,060	-0,046
	6							0,383	0,321	-0,028	0,046	0,033	-0,061	0,284	0,351	0,236
	7								0,496	0,065	0,190	-0,001	-0,144	0,038	0,062	-0,124
	8									0,188	0,387	0,279	0,042	-0,033	0,153	-0,078
	9										0,151	0,248	-0,039	-0,045	0,074	0,081
	10											0,228	0,161	-0,015	0,242	-0,082
	11												0,135	0,194	0,172	0,164
	12													0,247	0,133	0,308
	13														0,329	0,623
	14															0,359
	15															

Table 3 - Intercorrelations of indicators of scientific potential
 Designations of indicators of the scientific potential of students: 1) the level of intensity of the research need; 2) the level of awareness of the value of research (knowledge); 3) the level of enthusiasm for research (cognition); 4) the level of knowledge of the conceptual apparatus of the issue under study; 5) the level of skills and abilities to use the methods of scientific research (cognition); 6) the level of compliance with the rules of the scientific organization of the student's work; 7) the level of understanding the structural elements of their own research activities; 8) the level of adherence to the norms and requirements of the scientific style of thinking; 9) the level of generalization of the subject and operational results of the study; 10) the level of independence in the transformation of ideas and connections between them; 11) the level of intensity of acquaintance with the history of science and its modern problems; 12) the level of scientific communication; 13) interest in research activities in professional activities; 14) the degree of participation in professionally oriented research activities; 15) professional interest in science at the university (college) of university students of the creative level for N=85 at the $r_{0,05} = 0.21$

At this stage of the development of the scientific potential of students, the following indicators have the greatest weight: the skills and abilities to use scientific research methods, interest in research activities, and participation in research activities. Compliance with the rules of the student's scientific organization of labor and adherence to the norms and requirements of the scientific style of thinking act as key features that have the largest number of connections and show a tendency to develop. The most significant relationship at this level was recorded between indicators of interest in research activities and interest in science at the university under the criterion "orientation towards research in the profession".

The heuristic level of scientific potential is characterized by the formation of a system that contains a greater number of key features. Among them, the greatest number of connections have the following ones: independence in the transformation of ideas and the connections between them, the intensity of the cognitive need, adherence to the norms and requirements of the scientific style of thinking, interest in research activities. Therefore, we can explain the success of students' research activities not by the level of development of individual features of the structure of scientific potential, but by the resulting complexes. At this level it was recorded the most significant relationship between the indicators of the intensity of the cognitive need and the enthusiasm for the study of the criterion "motivation for research". It is reserved and strengthened the relationship between the indicators

of interest in research activity and interest in science at the university of the criterion "orientation to research in the profession".

Despite the fact that the largest number of connections in the structure of the scientific potential of the individual, which has a heuristic level of its development, was found in a number of such indicators as independence in the transformation of ideas and connections between them, the intensity of the cognitive need, adherence to the norms and requirements of the scientific style thinking, interest in research activities, in the structure of the scientific potential of students it was noted a relatively low statistical contribution of technological readiness for research, expressed in a number of deficits in its development (Figure 2).

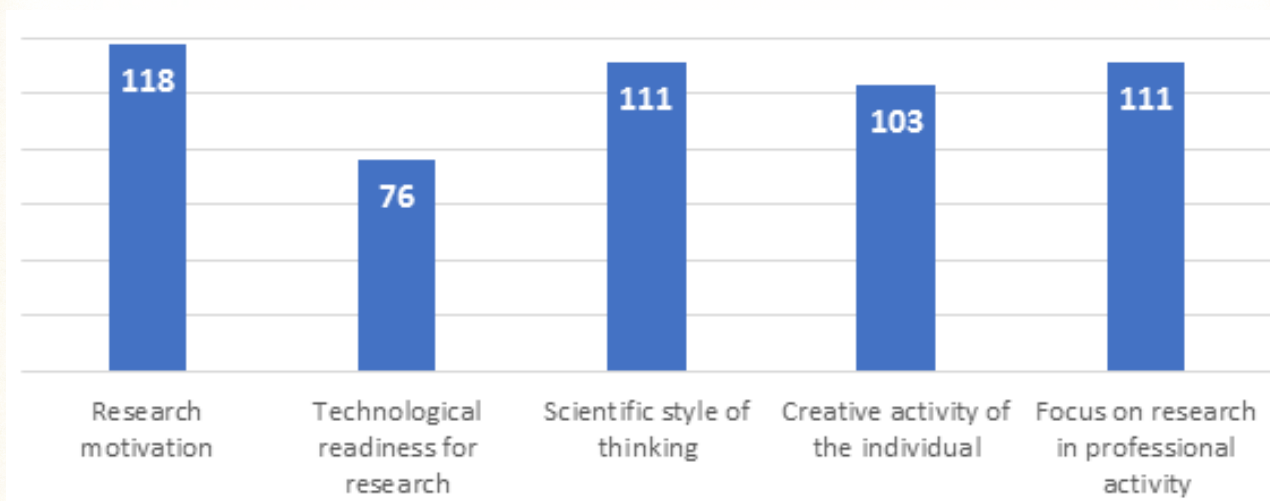


Figure 2 Statistical contribution of criteria to the structure of the heuristic level of development of the scientific potential of university students

At the creative level, it is established stable relationships between the subsystems. It is observed the consistency and integrity of the scientific potential of students. A comparative analysis of the creative level pleiade shows that the level of system integration, in comparison with the previous levels, is the maximum. The increase in the share of most indicators in the structure of the scientific potential of the creative level indicates the "systematic effect", that is, the formation of structural subsystems on their basis that ensure the optimal development of the scientific potential of students.

At this level of development of the scientific potential of students, the indicator of independence in the transformation of ideas and connections between them has the greatest weight. This indicator is a backbone in the correlation pleiade. It has the most stable connections with such indicators as interest in research activities, compliance with the rules of scientific organization of the student's work. It was recorded the most significant relationships between the indicators of the criterion "orientation to research in the profession". They are as follows: interest in research activities and the degree of participation in research activities, as well as the degree of participation in research activities and interest in science at the university. The most significant relationship was established between the indicators "interest in science at the university" and "intensity of acquaintance with the history of science and its up-to-date problems". It indicates a stable and natural connection between professional training at a university and research, conducted by students in the field of their future profession.

Consideration of the weight components of the structure of the scientific potential of students of a creative level showed that in the structure of their scientific potential, creative activity and orientation towards research in the future profession predominate, which indicates that the development of the creative level of the scientific potential of students is approaching the development of personal parameters that correspond to cultural creativity in science.

Analysis of the dynamics of correlations in the structure of the scientific potential of personality provided us the opportunity to characterize a university student with a certain level of realization of the scientific potential of the personality. Thus, the adaptive level of development of a student's scientific potential is characterized by an unstable, mainly external motivation for educational research, which can sometimes arouse interest in research activities and briefly captivate research. A student with this level represents the goals and objectives of educational research in a general way; there are no clear guidelines for educational research in his/her mind. The cognitive activity of a student is of a reproductive nature; its technological readiness for research is determined mainly by the existing research algorithm provided by the teacher. Therefore, educational research proceeds according to a previously worked out scheme, which has become an algorithm; creativity and initiative in educational research are practically not manifested. The student does not show interest in studying the problems of science and its history outside the program, the degree of familiarity with them reflects his/her episodic cognitive activity associated only with the educational process. He/she is not included in the university research environment, does not seek to become a member of the student scientific society.

The reproductive level of development of the student's scientific potential is distinguished by the awareness of the value of research at the level of its significance for the active understanding of the material and for practical purposes. A student with such kind of level responds to the opportunity to work in a student scientific society, conducts an adequate self-assessment of his/her cognitive interests and abilities, and enthusiastically performs research work within the framework of reproduction. Unlike a student of an adaptive level, such kind of student is aware of the importance of the principles of the scientific style of thinking, he/she is able to quite successfully solve educational and research problems using the provided algorithm of actions. The level of his/her general educational skills is higher. In the technological component of the scientific potential there are attempts of transition from reproductive methods of search to their own findings. The creative activity of such kind of students is manifested within the framework of reproducing activity, but with elements of finding new solutions in standard situations, especially when they are in a creative group with other students. Occasionally, such kind of student shows interest in research activities related to the future profession.

The heuristic level of development of a student's scientific potential is characterized by a greater intensity of mental work, purposefulness, awareness of the ways and means of solving a research problem, enrichment of cognitive motives, and enthusiasm for research. In the educational process, such kind of student evaluates and comprehends the proposed research topic, following the norms and requirements of the scientific style of thinking. In the structure of the technological component of his/her scientific potential, there are noticeable changes that testify to the formation of the student's personality as

a researcher. They are as following: the ability to plan and solve non-standard research problems, use the rules of the scientific organization of labor, apply various methods and techniques of thinking are at a high level. In the structure of research activities an important place is occupied by the comprehension of the results obtained. The independence of the student in the transformation of ideas and connections between them increases. He/she willingly responds to the given opportunity to carry out research in the student scientific society, to solve a cognitive problem in a creative group, and takes initiatives in it. It is interesting for him to communicate on solving cognitive problems in the organizational forms provided to him/her (for example, to participate in the work of scientific and practical conferences).

The creative level of development of the scientific potential of the student is characterized by a high degree of effectiveness of the study. The student chooses research activity in accordance with cognitive motives, not only at the suggestion of the teacher, but also guided by his/her own orientation towards knowledge as a value. At the same time, he/she is active and independent, creatively solves research problems, showing a high level of research skills. The student comprehends the structural elements of his/her own cognitive actions. He is independently guided by the principles of the scientific style of thinking as a norm, successfully generalizes the subject and operational results of cognitive activity. When performing research, a student is distinguished by a high degree of scientific communication. He can independently, without teacher's help or advice, plan and conduct a study, based on the existing high level of training in the academic discipline. When solving problems of a new type, the student can analyze their conditions, put forward a hypothesis to develop a way to solve it. The nature of his/her research is mainly professionally oriented. He/she is also well acquainted with the history of scientific discoveries and up-to-date problems of science. He/she constantly reads scientific and popular science literature, scientific articles on websites and in journals, formulating interesting questions. The student has a wide range of scientific communication, which he/she strives for him/herself (e.g. discussion of the problems of science, the results of his/her own research within the framework of the work of the student scientific society, at scientific and practical conferences, on the Internet, etc.).

Discussion of the results

The anthropological approach acted as a generalized methodological basis for solving the set task within the framework of the philosophy of a holistic person, considering him/her as a biopsychosocial and cultural being, made it possible to focus on the integrity of a person, acting as a specific quality in four modes of human existence (according to B.G. Ananiev): an individual, in which the unity of human development as a most complex organism is manifested; personality; the subject of knowledge, activity, communication; individuality [16]. To highlight the ideas that serve to develop an educational model for the development of the scientific potential of students, it was used anthropological, cultural and polysubjective approaches.

The implementation of the idea of developing the scientific potential of a student as a person in the context of the anthropological approach involves the advancement of scientific thought not from the student's cognitive activity or from the scientific and educational

environment to the characteristics of his/her scientific potential (namely: implementation of the advancement “research activity → scientific potential of the student”, “scientific and educational environment → scientific potential of the student”), but from a higher “whole”, that is, from the student as a person to his capabilities in learning new things, which reflects the use of the general scientific principle of anthropologism, the post-non-classical period in the development of pedagogical science, use, ongoing innovative processes in modern Russian higher education [17; 18].

Within the framework of the culturological approach, the dynamics of the scientific potential of the individual can be considered for the first time as a process of cultural development, the essence of which is the generation, and not the appropriation of culture. This process reveals the nature of the individual's entry into the culture of scientific activity, which reflects the hierarchy of cultural forms of cognition (cultural development, cultural use, cultural interpretation, cultural creation) [19; 20].

The polysubjective approach focused attention on intersubjective interaction, on the importance of considering the student's research activity and his/her need for self-development not in isolation, but against the background of relationships with other people, built on the principle of dialogue [21-23]. The subjective research activity of a student is determined not only by his/her own scientific interests and potential, but also by the norms, values, attitudes of the collective subject of research activity. Therefore, the use of a polysubjective approach makes it possible to identify the ways of pedagogical support of scientific communication and creative self-development of the student's personality, ensuring the position of the student and the collective community as the subject of the relationship, the subject of "generating personal meanings" when creating a common significant scientific result, achieving the resulting synergistic effect within the framework of subject-subject interaction subjects of scientific creativity [24-26].

None of the works in the development of the concepts "scientific potential of the individual", "development of the scientific potential of students" presents the convergence of three factors in the development of the scientific potential of the student (student, graduate student). They are: a research educational environment that provides subject-subject interaction of participants in scientific creativity, development of research activities and creative advancement of the individual. We believe that without taking into account the simultaneous interaction of three factors, it is impossible to answer the questions that arise in the course of pedagogical research: How and why is the scientific potential of a student updated in some conditions and is not updated in others? How are internal and external conditions connected, leading to the emergence of motivation to research activity "here and now"?

The methodological approaches defined as the leading ones allowed us to consider a number of promising ideas for the development of the scientific potential of the personality of students, which can serve as the development of promising ways of its development. Within the framework of the anthropological approach, we singled out the ideas of integrity and system genesis. The idea of integrity involves taking into account the totality of the psychological, biological and social characteristics of students, the advancement of the content of education from the whole to the part, providing a person-specific way of relating to the outside world, which consists in transforming the world in accordance with the goals of a person. System genesis focuses on the pedagogical support of the creative self-

development of the individual in the course of cognition (research) [27]. Turning to the idea of system genesis means setting and solving the following tasks: determining ways to organize students' activities in learning situations; development of methods of pedagogical support for the creative self-development of students, consisting of processes-systems at each dialectical turn (self-knowledge, self-determination, self-organization, self-education, self-regulation, self-control, self-realization); suggestion of methods for operational diagnostics of the problems of its development.

The use of the culturological approach highlighted the idea of cultural creativity namely, ensuring the vigorous activity of students as subjects of the educational process for the development and increment of cultural products [28; 29]. This process reveals the nature of the entry of the individual into the culture of scientific activity, its consistent advancement through the stages of cultural development, cultural interpretation, cultural use and cultural creation, each of which consistently implements certain components of the scientific potential of the individual, allowing at each level of complexity of cognitive activity to maximize all its manifestations.

Within the framework of the polysubjective approach, the idea of dialogicity was highlighted. Its implementation requires the organization of subject-subject interaction between the teacher and the student, which is aimed at mutual enrichment of all participants in such a dialogue, at ensuring the position of the student to be the subject of the relationship in cognition, as well as the organization of subject-subject interaction in a team research activity.

In the context of the highlighted ideas, it is considered the development of the scientific potential of students as a process of pedagogical support for the creative self-development of subjects and polysubjects of research activity when they comprehend themselves, others, the world at different levels of complexity in the information and educational environment in the course of a creative cognitive advancement from a general holistic to a more specific, accurate understanding of reality, from cultural development to cultural creativity.

The results obtained could influence the development of research in the direction of creating an educational model for the development of the scientific potential of the individual and improving the diagnostics of the development of the scientific potential of the individual. It could also influence preparing teachers for the implementation of the created educational model for the development of the scientific potential of students, the use of modern didactic tools in cultural situations, studying the processes of individualization of the development of scientific potential personality. New scientific solutions can be:

1. the definition of possible relationships between the identified components of the scientific potential with other personal characteristics;
2. creation of a monitoring system for the development of the scientific potential of the individual;
3. didactic model of the development of the scientific potential of the personality of students;
4. a project for the use of information and communication resources and technologies in the implementation of the educational model for the development of the scientific potential of the individual;
5. psychological and pedagogical model of individualization of the development of the scientific potential of the individual at various stages of cultural genesis.

Conclusion

In the process of theoretical and experimental research, the following conclusions were obtained:

1. In the essential features of the scientific potential of the personality of students as an educational phenomenon, for the first time were revealed such features as manifestations of non-cognitive experience like sensory-visual images relating to the Universe, wildlife, society and man, focus on knowing him/herself, other people, the world, defining, along with cognitive experience, its position as a subject of relations in cognition.

2. Signs-characteristics of the scientific potential of students allow us to give a level assessment of its development at the level of the past and present, as well as to design its further development.

3. Assessment of the state of development of the scientific potential of students of Russian universities showed the presence of a high percentage of students with a reproductive level of its development (39%), the predominance of students with a creative and heuristic level of development of the scientific potential of the individual in the humanities compared to students of natural sciences and mathematical specialties, revealed significant deficits in technological readiness of students revealed significant deficits in technological readiness for research.

4. In the context of the identified ideas for the development of the scientific potential of students (integrity, system genesis, cultural creativity, dialogicity), trends, patterns, principles, pedagogical conditions for its development can be identified, which will further ensure the development and implementation of a new educational model.

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Информация об авторах
Макотрова Галина Васильевна
 (Россия, г. Белгород)

Доцент, доктор педагогических наук, профессор
 кафедры педагогики
 Белгородский государственный национальный
 исследовательский университет
 E-mail: makotrova@bsu.edu.ru
 ORCID ID: 0000-0002-8781-1636

Information about the authors
Galina V. Makotrova
 (Russia, Belgorod)

Associate Professor, Dr. Sci. (Educ.),
 Professor of Pedagogy Department
 Belgorod State National Research University
 E-mail: makotrova@bsu.edu.ru
 ORCID ID: 0000-0002-8781-1636

Моисеенко Ольга Александровна
(Россия, г. Белгород)

Доцент, кандидат педагогических наук, доцент
кафедры английского языка и методики преподавания
Белгородский государственный национальный
исследовательский университет
E-mail: moiseenko@bsu.edu.ru
ORCID ID: 0000-0001-5539-8915

Кролевецкая Елена Николаевна
(Россия, г. Белгород)

Доцент, кандидат педагогических наук, доцент
кафедры педагогики
Белгородский государственный национальный
исследовательский университет
E-mail: krolevetskaya@bsu.edu.ru
ORCID ID: 0000-0002-1312-3638
Scopus Author ID: 57190879019
ResearcherID: ABH-1883-2020

Полоцкая Наталья Александровна
(Россия, г. Белгород)

Аспирант кафедры педагогики
Белгородский государственный национальный
исследовательский университет
E-mail: 1597486@bsu.edu.ru
ORCID ID: 0000-0002-3058-0275

Ефимцева Дарья Николаевна
(Россия, г. Белгород)

Аспирант кафедры педагогики
Белгородский государственный национальный
исследовательский университет
E-mail: efimtseva@bsu.edu.ru
ORCID ID: 0000-0002-4865-4367

Olga A. Moiseenko
(Russia, Belgorod)

Associate Professor, Cand. Sci. (Educ.),
Associate Professor of Department of English Language
and Teaching Methodology
Belgorod State National Research University
E-mail: moiseenko@bsu.edu.ru
ORCID ID: 0000-0001-5539-8915

Elena N. Krolevetskaya
(Russia, Belgorod)

Associate Professor, Cand. Sci. (Educ.),
Associate Professor of Pedagogy Department
Belgorod State National Research University
E-mail: krolevetskaya@bsu.edu.ru
ORCID ID: 0000-0002-1312-3638
Scopus Author ID: 57190879019
ResearcherID: ABH-1883-2020

Natalya A. Polotskaya
(Russia, Belgorod)

Postgraduate student of the Department of Pedagogy
Belgorod State National Research University
E-mail: 1597486@bsu.edu.ru
ORCID ID: 0000-0002-3058-0275

Daria N. Efimtseva
(Russia, Belgorod)

Postgraduate student of the Department of Pedagogy
Belgorod State National Research University
E-mail: efimtseva@bsu.edu.ru
ORCID ID: 0000-0002-4865-4367