Individual Spirituality in Post-nonclassical Arts Education

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EXPERIMENTAL ANALYSIS OF THE CULTURE OF SCIENTIFIC RESEARCH AMONG TRAINEE MUSIC TEACHERS IN THE PROCESS OF PROFESSIONAL PREPARATION

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The current stage of development and the functioning of the system of higher musical and pedagogical education should be accompanied by a strengthening of its research component. The arsenal of scientific methods needs to be expanded and their use integrated into educational reality on an interdisciplinary basis. This requires a rethink of the pedagogical influence of science on the personal development of future teachers of music (FTM). The purposeful formation of research and methodological competence should be taken as an indicator of a teacher's professional and social maturity. In this regard, academic study of science can be considered both an independent element of its own as well as becoming a nucleus of teacher training.

These sociocultural challenges are reflected in the text of official documents, such as: The National Doctrine on Educational Development in Ukraine in the 21st Century; Ukrainian legal documents—On Education, On Higher Education, and On the Professional Development of Employees; the State National Programme—Education (Ukraine of the 21st Century) and the Action Plan to Improve the Quality of Artistic and Aesthetic Education for 2009–2012 etc. Their relevance is also confirmed by the requirements of the Bologna Process, which seeks to consolidate the efforts of the scientific and educational community in increasing the competitiveness of higher education and its role in sociocultural transformation. This is further reflected in the UNESCO Educational Declaration—Education 2030 (Inchon Declaration of 2016); and the European Union Framework Program for Research and Innovation (Horizon 2020). The main reforms of European education are aimed at the convergence of teacher training systems in the countries of the European Union and their improvement on the basis of common criteria that define

the professional qualities of a European teacher/researcher. The characteristic features of the European dimension of education include a set of common value orientations and a vision of a teacher as an individual and creator, who is capable of scientific research and operates in a humanist and innovative learning environment.

In the context of contemporary concepts of culture; the fundamentalization and universalization of education; the variability and multiculturalism of educational systems; frequent changes in scientific paradigms; and the growth in volumes of science, pedagogy, and art, the research culture of future teachers of music has become an important personal phenomenon. Key to this phenomenon is a capacity for intellectual analysis and the ability to develop scientific strategies for research on the basis of different 'logics' and multicultural dialogue. Furthermore, one must have an understanding of the variability of pedagogical and educational technologies and systems and a command of the conceptual apparatus of music and pedagogical theory and practice. It is on the basis of such skills and knowledge that one can create individual concepts for the solution of scientific problems in the field of music education.

The relevance of this issue is highlighted in the contradictions that arise between:

- The objective need of a society, and its labor market, for competitive mobile educational specialists in the field of artistic education who are capable of professional and personal realization through research activity, and the absence of a coherent approach to this problem in musical and pedagogical practice and theory.
- The search for and reproduction of new didactic technologies that meet modern requirements of higher education in a globalized context and the absence of a scientifically and methodologically grounded model for training future teachers, in particular, teachers of music, in research culture.
- A modern awareness of the human-centered paradigm of education and a recognition of the interdependence of culture, education, science, and art and the failure to consider these interconnections when training future teachers, musicians, and researchers.

In our research, we proceed from the fact that scientific and pedagogical justification of a scientific research culture among future music teachers, in terms of its content and structural and functional components, should become a theoretical foundation for the development of a scientific research culture among students.

On the basis of a phenomenological analysis, we have determined *the essence of scientific research culture among future music teachers (SRC of FTM)* as a complex of socio-pedagogical, scientific, research, and artistic values. Together, they represent an integrated set of personal qualities, which reflect the content and procedural characteristics of this culture and are aimed at ensuring the professional realization and creative growth of teachers, researchers, and musicians. They should be able to develop purposefully planned scientific research strategies and a positive attitude to scientific knowledge (pedagogical and artistic) and science in general.

For the music teacher, the scientific comprehension of artistic reality is aimed at pedagogical comprehension of artistic and cultural processes; the global context of musical works; the cognitive, moral, and aesthetic potential of music; and various modes of musical and pedagogical activity. All of this deepens one's professional, pedagogical, artistic, and culturological competence and provides a basis for enriching musical and pedagogical knowledge with the latest technologies and innovative techniques.

The scientific path of a music teacher as a researcher may be interpreted in accordance with the tasks of artistic and aesthetic training and education and the various aspects of artistic education, which require knowledge of music itself and interpretation of musical compositions. It is the features of this musical material, in the analysis of intonational structure, genre, and stylistic characteristics of musical compositions on the part of a musician and teacher, which determine the effectiveness of musical and pedagogical research.

The specificity of a scientific research culture among future music teachers shows itself in: the combination of various scientific methods as the realization of scientific knowledge; the conceptual apparatus of music education with its pedagogical models and strategies; and the search for artistic images and frames that are manifested in sensory and aesthetic forms. As a special form of learning about the reality of art, the artistic frame has its own specific features among which metaphoricity, contiguity, and paradoxicality can be distinguished. In this context, the artistic image represents a tension between individuality and generalization, presented in an emotionally and sensually rich form.

Consequently, the scientific research culture of future music teachers constitutes a unity of pedagogical thought, scientific research, and an artistic worldview. This is manifested in a combination of certain qualities aimed at the effective implementation of research tasks in the field of artistic education. Such a culture is determined by a methodological consciousness and a scientific style of thinking and research activity. This

foundation predetermines the development, formulation, and enrichment of the researcher as a subject of their professional and pedagogical creed. Comprehension of the world's artistic realities on a scientific basis activates the ability of a music researcher to make broad creative generalizations through applying methods of scientific and aesthetic analysis.

In accordance with this, systematic and cultural approaches offer theoretical and methodological grounds for developing the scientific research culture of future music teachers as polystructural (axiological-orientational; technological; personal-cognitive; and creative) and polyfunctional (humanistic; epistemological; integrative; communicative; educational; creative; and social). Deductively, the conclusion was made that the *axiological-orientational component* of the SRC of FTMs should embody, on the one hand, the priorities of scientific knowledge, scientific research values, and the normative guidelines that guide the scientific and cognitive processes of researchers, and, on the other hand, the educational values and pedagogical ideals of current artistic education, drawing on theoretical ideas of pedagogy, anthropology, and cultural studies. The cognitive, pedagogical, and artistic values of music teachers and researchers define conscious research goals and encourage the creation and implementation of humanistic and innovative technologies in the practice of musical pedagogy.

These artistic values are born of the unity of objective and subjective senses and meanings that are 'embedded' in the spiritual and cultural continuum of the music teacher's personal identity. These values actualize and determine the vectors of research in the field of musical and pedagogical education and the means of solving relevant scientific problems on their theoretical, methodological, and practical levels.

Methodological grounds in the phenomenology of scientific research values have been highlighted by P. Aleksieiev, L. Mikeshyna, and N. Motroshylova. They propose that the two sides of an axiological position on the subject of knowledge should be distinguished: the 'entrance' of scientific creativity (the conditions of the process of the production of knowledge) and the 'exit' of knowledge (the integral system of conceptual knowledge). Given the sources studied in relation to such axiological issues, the values of scientific research can provide the means of investigating scientific and pedagogical problems and finding personal cognitive senses and meanings in them; on the other hand, pedagogical and artistic values are those that determine the architectonics of the axiological fabric of music education and determine the research strategies of a music teacher.

These concepts, on the basis of which the specific mechanisms of the management and organization of research as an integrative, multi-vector, multi-level process that influences its qualitative and quantitative characteristics, form the basis for revealing the *technological component of the SRC of future music teachers*. This reflects the ways (methods, techniques, algorithms, schemes, norms, and logic of research) that scientific knowledge is obtained and gives an idea of the organization of scientific research activities, which usually follow a particular sequence (S. Honcharenko, V. Zahviazynskyi, I. Zymnia, V. Kraievskyi, O. Novykov, and V. Slastonin). The mechanism of such activity, that is, its technology, includes two interrelated aspects: a division by aspects and operations (*activity-operational aspect*); and a division by stages, i.e. by the logic of the research and the content of each stage (*content aspect*). This represents an optimal organization and management of scientific and pedagogical research, the main feature of which is the internal coherence of all its components.

Consequently, the technological component represents a research instrument—a technology of scientific knowledge—which is conditioned by the existing scientific style of the pedagogical field. It is built as a system, from consistent action, both horizontally (the phase of research: design/conceptual, technological, and reflexive) and vertically (the level of research: strategic, tactical, and operational). This component is provided by design, modelling, informational, analytical, experimental, diagnostic, practical, and transformative functions.

The personal-cognitive component of the scientific research culture of a FTM is found in the personal qualities that inform the motivational and operational aspects of the researcher and their self-realization in the world of science and art. We consider the motivational sphere of future music teachers and researchers as enabling the holistic development of personal identity, possessing the mechanisms of scientific and pedagogical creativity and capable of the realization of a whole spectrum of research methods. This sphere leads such a teacher to another level in their professional development. It is the syncretic character of knowledge at the micro-level as a reflexive understanding of personal gnostic and cognitive processes in artistic education and at the macro-level as dialogue—as a polyphony of theoretical considerations, conceptual positions, methodological approaches, and, in a broader sense, the dialogue of cultures, which forms the basis for scientific research by future music teachers. This all requires certain new motivational qualities.

The operational content of the personality-cognitive component is found in consciousness (self-consciousness), the actions of which are

manifested as external (substantive) and internal (semantic) regulation of the research carried out in the field of musical pedagogy.

The creative component of the scientific research culture of a future music teacher determines the innovational and heuristic nature of research in the field of artistic education. It encourages effective functioning and perspectives on other components that acquire a creative, stimulating character. In so doing, they interact and create conditions for the formation of a personal research identity.

Consequently, the essence of the scientific research culture of a future music teacher, as a personal phenomenon, becomes clear in the context of the general orientations and characteristics of their musical and pedagogical culture. This lays the foundations for the development of the spiritual, moral, artistic, educational, creative, aesthetic, and humanistic orientation of a music teacher's identity.

In talking of the direction taken by music education, one should speak of the the integration of science, art, and education as being necessary for effective training of future specialists in this field. It is a matter of creating a cultural, scientific, and educational environment that displays a strong research foundation and innovation in pedagogical, scientific, and cognitive processes. The functioning of this cultural, scientific, and educational environment becomes possible through principles of cultural conformity (values and norms of education in line with modern culture); productivity (transforming the character of education); multiculturalism (a plurality of values and forms of activity); and integrity (personality, pedagogy, pedagogical technologies, and the cultural content of education).

As such, the preparation of music teachers and researchers is important. The most important result is a certain 'system of coordinates' that determines the behavior and activity of a music teacher. The possibilities available to the researcher are engaged only if they have an appropriate level of professional and psychological potential. Furthermore, it is through humanistic reflection that they become enable to withstand the enormous modern flow of information and find the most appropriate (human-centered) cognitive, evaluative, analytical, and innovative research approaches—ones that will make it possible to realize their social and cultural needs and offer the possibility of self-development and self-improvement.

Professional training is an organic combination of fundamental, culturological, scientific, methodological, and ideological directions that ensure a strong foundation for the realization of the researcher's personal potential.

The fundamental nature of the training of a music teacher is determined by the unification of a number of elements, including scientific knowledge and educational and artistic processes. The system in which it is formulated is characterized by the integrity, inter-relation, and interaction of all of its components.

Culturological training focuses on revealing the main vectors of cultural development: science, education, and art. It influences the formation of ideas about the person, both as a creation and creator of culture, and stimulates a creative and analytical style of thinking, which determines the personal, pedagogical, and artistic values of research.

General scientific training aims to update both the objective status of the scientific ideal and its subjective characteristics as regulative of internal semantic activity. The realization of different directions in research strategies (scientific and pedagogical; creative and experimental) and the creation of conditions for mastering the culture of scientific research all enable the competencies of a teacher.

Methodological training is active in the formation of a methodological consciousness, which unites such characteristics of scientific and pedagogical knowledge as conceptuality and normalization. Mastering methodological reference points allows us to determine the general strategy, scientific principles, and tactics of pedagogical research and to realize the methodological function of knowledge.

World-view preparation gives the idea of the system of modern scientific knowledge in its cultural, educational, ideological, prognostic, and practical functions. This ensures that historical, philosophical, ontological, phenomenological, ethical, and reflexive elements all become part of the researcher's consciousness.

In order to verify the theoretical positions within the chosen area of research and the effectiveness of the scientific and methodological apparatus of the pedagogical system, an experiment was designed and carried out. The experiment consisted of the following stages:

1) *analytical and forecasting* (studying the current state of the problem; determining the strategy and tactics of research);

2) *qualifying stage* (development of a research criterion and diagnostic apparatus; testing and adjustment of its instruments; identifying levels (low; lower than average; average; higher than average; high) of the formation of scientific research culture in future music teachers);

3) *formative stage* (introduction of a model of the phenomenon studied into the educational process and checking of its effectiveness);

4) *control-generalization stage* (carrying out a control test; quantitative and qualitative analysis of the research results; statistical processing).

1,232 students of music pedagogy and arts faculties of higher educational institutions in Ukraine and 187 teachers were involved in the experiment. The experimental group consisted of 310 students and the control sample of 305 student. One control and four experimental groups were formed.

To study the current state of the research problem from the standpoint of its organizational and pedagogical support, students of musical and pedagogical specialties were examined regarding their readiness for the implementation of various vectors of scientific research (scientific, pedagogical, creative, and experimental research). They were also examined on their personal qualities as researchers. The results of this suggested that the following components were under-developed: the ability to make connections between pedagogical conditions and the results achieved; the components of the educational process at the experimental stage of research (90.3%); organizational and methodological schemes in research (89,7%); scientific and diagnostic apparatuses of research (92,1%); the logic, mechanisms, and concepts of resarcher activity (91.2%); methodological analysis of a scientific problem (93.8%); the association of theoretical positions and their practical implementation (88,1%); monitoring the dynamics of personal and pedagogical phenomena under study (81.5%); prioritization of tasks in music pedagogy (88,2%); hypothetical assumptions concerning the directions taken by the pedagogical and artistic phenomena being investigated (87,9%); and the implementation of research developments in pedagogical practice (77,1%).

Study of the products of learning, the research activity of the music students, and pedagogical experience of the teachers regarding methods and means of research training allowed us to highlight the *key issues* that need to be addressed. These include: the status of science itself in music pedagogy and art faculties and the need to prioritize interdisciplinary research; the quality of general scientific and methodological training of future music teachers with the aim of forming their scientific research culture and identifying the factors that influence this process; the cultural, scientific, and educational environment in which the perspectival, methodological, and epistemological functions of scientific knowledge are actualized.

At the qualifying stage of the experiment, considering the interconnection and interdependence of the components of the scientific research culture of future music teachers, the combination of requirements of higher musical and pedagogical education led to the identification of the following *criteria and indicators*. These criteria and indicators acted as the parameters of measurement and evaluation of the formation of this culture:

a) *Motivational criterion*. This aims to reveal the motivational of the student as a researcher, including the degree of assimilation and reproduction of scientific research, teaching, and artistic values.
b) *Gnostic-cognitive criterion*. This serves to identify the personal and cognitive resources in the formation of those professional and personal qualities and skills necessary for a music teacher/researcher.
c) *Research and operational criterion*. This indicates the purposefulness, accuracy, and flexibility of the implementation of technological research tools. Key parts of which include a logical sequence in the phase-by-phase deployment of research (conceptual (goal-setting); technological (goal realization); reflective phases) and the realization of its functions (design and modelling; informational and analytical; experimental and diagnostic; and practical and transformative);
d) *Creative criterion*. This focuses on the creative orientation of the procedural and substantive characteristics of scientific research and the individual and creative development of a future music teacher acting as a researcher.

In accordance with the previously defined features of the scientific research culture of future music teachers, including features of vocational training, and the requirements of higher education in relation to the realization of scientific and cognitive tasks, the following stages of its formation were developed:

Educational/research stage. The aim of this stage is the assimilation of pedagogical and artistic ideals and values by the researcher. This stage sees the activation of processes that are: analytical and synthetic; inductive and deductive; creative and heuristic; and research driven and educational. Artistic, aesthetic educational, scientific, and pedagogical awareness are formed and intellectual, research activities dominate.

Scientific research stage. This stage is directed towards the formation of a scientific style of thinking. This may be characterized in its: argumentation; consistency; integrity; dialecticity; logic; reflectivity; problematicity, and predictive character. The researcher is a subject of: scientific and artistic knowledge; scientific and pedagogical communication; and scientific and research activity.

Scientific-methodological stage. This stage is aimed at mastering the methodological guidelines and the principles of multilevel, multifunctional research. Systemic; phenomenological; ontological; historical; pedagogical; and other analytical frameworks useful for studying pedagogical phenomena are to be mastered. This also involves the assimilation of

values of educational paradigms (humanistically oriented; culture-centered; polysubjective, etc.).

The formation stage of the experiment is aimed at solving the following tasks:

- ✓ Introduction of the conceptual model of the system of the formation of a scientific research culture among future music teachers in the process of professional training.
- ✓ Verification of the effectiveness of scientific and methodological support of this system.
- ✓ Strengthening of the research, scientific, and methodological components in education.
- ✓ Preparation of educational and methodological support of the educational process.

At this stage of the experiment, the effectiveness of the system of forming a scientific research culture among future music teachers was examined. The organizational structure of its phased implementation and the use of the complex of complementary and intercompensating technologies and mechanisms in the process were also analyzed. The implementation of complementary organizational, pedagogical, methodical, and educational measures included certain requirements for the teachers in the intensification of cognitive and innovative processes; the building up and deepening of scientific knowledge; and the activation of scientific reflection on the problems under study. There was also a need for self-reflection by the future music teachers in their role of researcher.

Taking into account the main requirements and trends of higher education, the strategy for the formation of a scientific research culture among future music teachers displayed a normative and varied nature. In this sense, it provided for the *invariance* of the structure of the educational process and the variability of the organization of research training.

This *variability* relates to the content of the research findings and is driven by multi-vector, multilevel, and interdisciplinary scientific research in the field of artistic pedagogy.

The didactic strategy of education, in our opinion, should be based on a theoretical interpretation of the personal identity of a music teacher and be aimed at the formation of an integrative structuring of their scientific research culture. Under these conditions, the interaction between different didactic methods and techniques and individual and collective forms of education will ensure the integrity of pedagogical theory on the identity of future music teachers.

At the *control stage of the experiment*, taking into account the pedagogical effects of the experimental work, pedagogical monitoring as a final method of diagnosing the levels of formation of the scientific research culture of future music teachers was performed. Quantitative and qualitative analysis and comparison of the results of the research before and after the experiment using statistical methods were undertaken. Motivational and newly-created personal qualities (intellectual; research; methodological; sense-seeking, reflexive; and creative skills); students' achievements in science and research (pedagogical; creative; methodological; and experimental); music pedagogy and scientific and pedagogical practice; and qualifications (master's degree; diploma) were all evaluated. Based on analysis of the data, the level of formation of the various components of the scientific research culture among future music teachers was established. An assessment to show the formation and development of the personal research identity was undertaken.

In order to analyze existing intellectual, research, methodological, sense-seeking, and reflexive skills as criteria for assessment of the scientific research culture among music students, we proposed various vectors of scientific research: pedagogical; creative; experimental; and methodological. Students' answers during seminars, practical classes, and conferences and the results of their scientific and pedagogical practice were taken into account.

The results on the formation of *intellectual skills* as evaluative indicators of of the scientific research culture among future music teachers show that after the completion of the experiment: 96.7% of students demonstrated the ability to apply widely different forms of mental activity (generalization; finding the main idea; systematization of theoretical material; analysis, etc.) in educational, research, musical, and pedagogical activities; 89,9% of students were able to critically understand musical and educational reality; 92.3% of students could handle large quantities of information, approach scientific work creatively, and utilize various directions and methods when searching for information; 88,7% of students demonstrated the ability to update their knowledge in new educational situations and to substantiate research positions; and 95.1% of respondents manifested a greater dictionary knowledge of science and pedagogy. They also displayed a readiness to discuss musical and pedagogical problems under study; make hypothetical assumptions; and identify causal relationships and interdependencies between different pedagogical systems.

Empirical data on the formation of intellectual skills among students/future music teachers and researchers in the experimental group (EG) are presented in Table 1.

Table 1: Results of intellectual skill formation as evaluative indicators for assessing the scientific research culture of students in the experimental group (%).

Indicators of formation of intellectual abilities	Levels				
	High	Higher than average	Average	Lower than average	Low
The ability to master different forms of mental activity (generalization, systematization, analysis, synthesis, finding the main idea, etc.)					
	31,4	35,5	18,4	8,4	6,3
The ability to master citation methods based on critical reflection of scientific thought					
	29,1	31,3	22,9	10,8	5,9
The ability to orient oneself in information flows and carry out creative and research work					
	32,5	37,1	19,3	8,4	2,7
The ability to actualize knowledge, argue, and justify one's own point of view					
	29,5	30,5	25,3	9,4	5,3
The ability to carry out a prognostic analysis of a problem, and form a scientific, pedagogical and artistic lexicon					
	27,7	29,4	26,3	10,1	6,5
Average X	30	32,7	23	8,8	5,3

The results of the control test on the development of *research skills* as an indicator of the formation of scientific research culture among students in the EG are presented in Table 2. 92.3% of students could independently conduct research in the system, following the procedure—experiment, description, explanation (justification), forecasting; 89,6% of students could select the necessary diagnostic research instruments, develop an evaluative apparatus, and make a comparative analysis of research results, using quantitative and qualitative analysis; 87,1% were capable of constructing and reasoning about different research methods; 91.0% of students showed the ability to develop a general strategy of educational and research activities and search independently for solutions to scientific and pedagogical problems; 85.7% of students were able to analyze musical and pedagogical phenomena, revealing their historical, theoretical, methodical, and practical trajectory.

Table 2: Results of research skills formation as indicators for assessing scientific research culture among experimental group students (%).

Indicators of research skills formation	Levels				
	High	**Higher than average**	**Average**	**Lower than average**	**Low**
The ability to conduct research in the system: experiment–description–explanation (justification)–forecasting (micro-research)					
	29,0	34,3	21,1	11.5	4,1
The ability to develop the necessary diagnostic instruments and research apparatus; make a comparative analysis of research results; the ability to assess different research methods and justify their choice (pedagogical experiments)					
	28,7	31,5	26,2	9,9	3,4
The ability to develop a general strategy of research and search for ways of solving a scientific problem (pedagogical experiments, scientific articles)					
	25,9	26,4	29,5	10,9	7,3
The ability to reveal pedagogical phenomena in their historical, theoretical, methodical and practical trajectories (scientific articles)					
	26,4	30,7	28,2	9,2	5,5
Average X	27,8	30,1	25,5	10,1	6,5

The results of the formation of *methodological skills* as an indicator for assessing the scientific research culture of future music teachers showed that: 81.0% of the students of the EG displayed an ability to determine the methodological characteristics of a study; 82.3% of students could apply different theories and concepts creatively in research; 88.3% of future music teachers showed readiness to undertake research using various methodological approaches; 84.7% showed themselves ready to carry out systematic, phenomenological, ontological, and other forms of research analysis; 86,9% of students showed that they had developed the ability to apply a structural and functional analysis of pedagogical phenomena to reveal their essence; 95.7% were able to identify and analyze the problems arising in contemporary artistic education and resolve theoretical contradictions; 83.9% of future music teachers/researchers showed the ability to conceptualize knowledge and work with the conceptual

apparatus of pedagogical science. The summarized results are presented in Table 3.

Table 3: Results of methodological skills formation as indicators for assessing scientific research skills among the students of the experimental group (%).

Indicators of formation of methodological abilities	**Levels**				
	High	**Higher than average**	**Average**	**Lower than average**	**Low**
The ability to determine the methodological characteristics of pedagogical research; ability to see problems and identify contradictions					
	21,0	29,3	31,7	11,4	6,6
The ability to carry out cultural, ontological, phenomenological, analysis of a research problem					
	19,1	26,8	31,9	12,4	8,8
The ability to undertake research using different methodological approaches					
	22,7	25,2	31,9	11,6	8,5
The ability to formulate methodological support for pedagogical research and apply different theories and concepts creatively					
	24,9	27,0	29,4	12,5	7,2
The ability to conceptualize knowledge and work with the conceptual apparatus of pedagogical science and art					
	19,2	23,7	35,6	13,2	8,3
Average X	20,7	26,4	32,9	12,8	7,8

The results presented in Table 4 present the sense-seeking skills of students from the EG. 91.7% of students showed the ability to interpret pedagogical concepts and facts and to substantiate them; 84.8% of the students demonstrated the ability to identify internal and external connections, revealing the essential features of pedagogical and artistic phenomena; 92.1% were ready for a critical rethink of the content and methods of music pedagogy in the context of research; 95.9% of students were able to analyze the historical and pedagogical phenomena being investigated; 95.0% of students expressed a readiness to find the most effective pedagogical theories to solve research problems.

Table 4: Results of sense-seeking skills formation as indicators for assessing scientific research culture among students of the experimental group (%)

Indicators of formation of sense-seeking abilities	Levels				
	High	Higher than average	Average	Lower than average	Low
The ability to interpret pedagogical concepts, categories, and facts through understanding their internal connections					
	21,8	29,9	30,5	12,3	5,5
The ability to reveal the essence of pedagogical and artistic phenomena and identify cause and effect relationships					
	25,7	29,1	29,4	10,2	5,6
The ability to critically rethink the meaning and methods of modern music pedagogy					
	22,8	29,3	29,1	12,3	6,5
The ability to carry out historical and phenomenological analysis of pedagogical and artistic phenomena					
	19,1	26,8	32,5	14,7	6,9
The ability to search for effective pedagogical theories for research problems					
	24,9	30,1	25.8	12,9	6,3
Average X	24,0	29,4	28,2	12,4	6,0

The results on the formation of *reflexive abilities* as indicators of scientific research culture among future music teachers showed that: 92.3% of the students of the EG formed the ability to establish relationships between conditions and results, and identify the relevant components of the educational process at the experimental stage of research; 94.1% of students were able to monitor the dynamics of personal development and pedagogical phenomena; 94.7% of students were ready to evaluate and comprehend their identity in terms of the statements—'I am a teacher/researcher/musician,' 'I am a professional,' 'I am a person of culture'—so as to determine their prospects for professional development; 91,6% of students were capable of undertaking self-evaluation and self-diagnosis as future researchers in the field of music pedagogy; 90.2% of

students were ready to undertake research and evaluate research activities and behavior according to external and internal scientific criteria (motives; goals; needs); 88.1% were ready to characterize their own positions and value orientations and build an individual trajectory of professional self-realization by means of research; 86.7% of students were ready to form a self-concept, which would affect the formation of their professional and pedagogical constructs. The results are recorded in Table 5

Table 5: Results of the formation of reflexive abilities as indicators for assessing scientific research culture among students from the experimental group (%)

Indicators of reflexive skills formation	Levels				
	High	Higher than average	Average	Lower than average	Low
The ability to evaluate one's image—'I am a teacher/researcher/musician,' 'I am a professional,' 'I am a human being'					
	30,7	31,5	21,7	11,4	4,7
The ability to carry out self-reflection and self-diagnosis					
	31,6	32,1	22,5	10,1	3,7
The ability to establish relationships between conditions and results and to track the dynamics of the personal and pedagogical phenomena being investigated					
	30,2	32,3	23,6	9,5	4,4
The ability to regulate research behavior from the standpoint of internal (motives, goals, needs) and external criteria					
	28,7	30,4	25,9	9,6	5.4
The ability to characterize one's own positions and value orientations and build an individual trajectory of professional self-realization					
	28,1	30,6	24,8	10,7	5,8
Average X	29,8	31,3	23,7	10,2	4,8

Verification of the differences between the mean values of one feature in two sets was carried out using the F-test by R. Fisher. Nonparametric methods of mathematical statistics using x^2 (chi-square) were also used. The value of $\boldsymbol{T}$ of x^2 was given by:

$$T = \frac{1}{n_1 \cdot n_2} \sum_{i=1}^{C} \frac{(n_1 O_{2i} - n_2 O_{1i})^2}{O_{1i} + O_{2i}}$$

for the samples of the EG and CG respectively. *C* is the number of results of the properties being studied. The generalized results of the research are presented in Table 6.

The results of the values of motivational, gnostic, research, operational, and creative criteria in the formation of a scientific research culture among future music teachers, before and after the experiment, allowed us to conclude that there was a significant positive developmental dynamic in its components. The experiment confirmed the presence of higher levels of scientific research culture formation among the students of the EG after the experiment. They revealed a high level of formation of the orientational component, which increased from 6.3%, recorded at the beginning of the experiment, to 31.7%; and at a higher than the average level—from 8.6% to 30.1%. The number of students with a well-formed personal component increased from 0% to 28.0% and from 4.1 to 31.1%, respectively; the technological component increased from 0% to 31.2% and from 0% to 41.6%; while the rate for the creative component increased from 0% to 24.2% and from 4.9 to 33.3%, respectively.

Analysis of the results of the experiment convincingly testifies to the effectiveness of the proposed system for the formation of a scientific research culture among future music teachers during their professional training. The experiment emphasizes the efficiency and productivity of the scientific and methodological support of the system, the pedagogical technologies used, and the cultural, scientific, and educational environment developed. This all confirms the main conceptual and theoretical provisions of the study.

Table 6: Generalized results of experimental work on the formation of scientific research culture among future music teachers in the CG and EG (%)

Group	The levels of formation of scientific research culture of future music teachers									
	High		Higher than average		Average		Lower than average		Low	
	Before the experiment	After the experiment	Before the experiment	After the experiment	Before the experiment	After the experiment	Before the experi-ment	After the experiment	Before the experi-ment	After the experiment
Orientational component										
CG	6,0	9,4	8,9	11,3	18,5	21,5	29,0	26,3	37,6	31,5
EG	6,3	31,7	8,6	30,1	18,4	15,9	28,5	16,8	38,2	5,5
Personal component										
CG	0	9,7	3,9	15,3	20,1	31,4	33,3	21,5	42,5	22,1
EG	0	28,0	4,1	31,1	21,4	24,6	32,7	13,5	41,8	2,8
Technological component										
CG	0	16,4	0	19,5	11,2	26,3	41,1	22,9	47,7	14,9
EG	0	31,2	0	41,6	10,5	15,5	39,9	8,8	47,3	2,9
Creative component										
CG	0	12,2	5,1	15,6	22,2	35,5	37,6	22,9	35,1	13,8
EG	0	24,2	4,9	33,3	21,8	26,4	36,9	12,3	36,4	3,8

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