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**INTERDISCIPLINARY INTEGRATION IN PROFESSIONAL
TRAINING OF FUTURE TEACHER**

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Abstract

Current development of higher pedagogical education depends on the interdisciplinary integration of research. Interdisciplinary integration is a basis for “convergent” specialist training who has critical thinking and is able to “solve interdisciplinary problems as well as problems of different nature”. The purpose of this study is to find ways to update the methodology for professional training of future teacher, taking into account the requirements of interdisciplinary integration and assessment of pedagogical competence. An analytical review of advanced interdisciplinary training technologies made it possible to focus on STEAM education. There was conducted a study during which the students' competencies in natural sciences as well as the development of critical thinking were assessed. In the course of the study, the interdisciplinary problems of both professional and scientific and applied nature were determined and further solved by students of Kalmyk State University (Elista) and Bryansk State University (Bryansk) during laboratory and practical trainings. At the same time, STEAM education was the basis of the educational process design for future teachers. The results of this work show the following: the incorporation of interdisciplinary tasks in the structure and content of academic disciplines contributing to the improvement of quality of professional training of future teachers since the educational process becomes practice-oriented and has a scientific nature. Interdisciplinary integration at the level of university pedagogical education, implemented through the interdisciplinary tasks of research and applied orientation, contributes to the development of interdisciplinary competencies of future teachers, which are the quality criteria of personnel training.

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1. Introduction

An analytical review of sources related to the concept of “integration” indicates its complex and mutually reinforcing nature. In the framework of the development of any specific science, there is an integration that establishes a connection between large blocks (Chekmarev, 2014). It is obvious that the provision of this connection has always been relevant. In relation to the new model of specialist development in the system of higher pedagogical education, the idea of interdisciplinary relations becomes conceptual. Both science and industry seek for specialists knowledgeable in various professional fields and in interdisciplinary fields of science (Harutyunyan, 2015). In the modern space of higher pedagogical education the personnel training occupies a special place. Pedagogical education, which today implements the competence-based approach, organizes the structure and content of the educational process in such a way that the end result is the quality of graduates' activities, measured in their competence (Mueva et al., 2017). The competence of a teacher can be indicated by three components: the inextricable interaction of both competence and profession of a teacher expressed in professional pedagogical activity. The differences between the development of specialist's pedagogical competence and the development of traditional qualities (knowledge, abilities, skills, experience) are determined by the integrative nature of pedagogical competence as a professional and personal quality of a future teacher; practice-oriented and project-oriented teaching activities. The qualitative state of future teacher – his/her pedagogical competence – can be attributed to strategic values the development of which contributes to the effective implementation of competence-based approach in pedagogical education while solving the task at the State scale, i.e. the training of highly qualified public education workers.

2. Problem Statement

The structure and content of pedagogical personnel training are subject to significant changes which is the result of the introduction of new higher education state standards. The increase in the number of disciplines of cultural and professional blocks has not affected the number of curriculum hours allocated for the study of the disciplines. It is important to understand that one of the solutions to rationalize the content of future teacher training is the implementation of interdisciplinary integration of disciplines.

3. Research Questions

When studying the issue of interdisciplinary integration in the process of future teacher training, two main problems were identified.

- First, the growing importance of synthesis of natural and research as well as human fields of knowledge when preparing future teacher during at universities.
- Second, updates regarding pedagogical technologies and the use of integrated laboratory and practice-based classes as well as lectures throughout the entire period of training of future teachers.

4. Purpose of the Study

The article focuses on the results obtained in the course of study aimed at improving the quality of professional training of future teacher who is able to apply professional competencies in solving interdisciplinary scientific and applied problems (Shkerina et al., 2018). The aim of the study is to find ways to update the methods of professional training of future teacher, taking into account the requirements of interdisciplinary integration.

5. Research Methods

The research bases were Kalmyk State University named after Gorodovikov and Bryansk State University named after Petrovsky. The number of participants in this study amounted to 102 students – 44.03.05 Pedagogical Education in the fields of Technology and Life safety. According to the logic of the analytical stage of study there was carried out a study, comparison, generalization of professional competencies in solving applied interdisciplinary problems at both Universities. During the experimental stage a survey among students was carried out as well as the analysis of the results of educational activities after the introduction of integrated laboratory and practiced-based classes and lectures. The changes regarding the indicators of development of students' professional competence through the interdisciplinary integration were stated. In this study, the level of synthesis of disciplines of general cultural and professional blocks was analyzed, the integrating factor of which was the readiness of students to solve interdisciplinary problems in the process of future teacher professional training.

6. Findings

At the stage of obtaining statistical data to diagnose the level of development of interdisciplinary competencies, the observations and conversations with university students took place. The observation was carried out in the classroom. Diagnostic techniques were divided into meaningful, indicative and evaluative. Each block had its own purpose and focus.

The first block was aimed at identifying the level of interdisciplinary knowledge of students of the concepts of integration and interdisciplinarity. The work here was based on conversations and a survey of students of all groups, i.e. participants of the experiment. The results of this survey, obtained at this stage, varied in a wide range, i.e. from simple ideas (integration is a unification) to emotional generalizations (integration is a process of movement). One noted the difficulty of student perception of this concept. The concept of interdisciplinary integration was embedded into the definition of the ability to receive and transmit information by highlighting the main point. It was obvious that the students did not have a clear understanding of interdisciplinary integration, because they could not correlate this concept with the information theory and they interchanged these concepts. Thus, the content of the answers indicates a lack of awareness and a low level of awareness of the importance of the role of interdisciplinarity in one's future profession.

The second stage – tentative – made it possible to identify the attitude of students of two Universities to the problem of development of interdisciplinary competencies and their role in the development of future teacher.

The importance of the development of interdisciplinary competencies was noted by 71 % of students of the experimental groups (EG) of Bryansk State University and Kalmyk State University and 79 % of students of the control groups (CG) of Kalmyk State University and Bryansk State University. According to the respondents, interdisciplinary competence is a priority quality of a modern person and largely predetermines the success in professional activity (Krupskaya & Sidorova, 2020).

The importance of theoretical knowledge about integration and the ability to integrate from various research and practical fields of knowledge was given by 56 % of students from the CG and 65 % of students from the EG. The students from the EG have a sufficiently formed level of knowledge of interdisciplinary integration.

Students of both groups were asked the following question “How satisfied are you with the level of development of interdisciplinary competence?” The analysis of the received answers of the respondents showed that the students from the EG were 54 % satisfied with their own level of development, and the students from the CG were 43 % satisfied. The current situation can be explained by temporary lack of understanding of the essence of interdisciplinary integration.

The attitude of students to their future profession is meaningful only when students are motivated to educational activity, which acts as a means of achievement in vocational training.

The purpose of the third block was to summarize the results of empirical research. The implementation of the model of development of interdisciplinary competence of students in the process of education at university was reflected in the levels of development of the following components:

- Motivation (understanding the goal of chosen profession, structuring the experience of assimilating new information).
- Content (knowledge regarding the relationship between the objects of study – the course of disciplines of cultural and professional blocks).

The results of the experimental work showed the respondents' attitude to the interdisciplinary competence and satisfaction with the level of their development. The importance of the development of interdisciplinary competence was noted by 73 % of students from the CG and 80 % of students from the EG. According to the respondents, the interdisciplinary competence was a priority quality of a modern person and largely predetermined the success in professional activity. 54 % of students from the CG and 43 % of students from the EG noted the importance and necessity of the development of interdisciplinary competence and were satisfied with their own level of the required quality. 46 % of students from the CG and 57 % from the EG explained their dissatisfaction with the absence of the concept of interdisciplinary competence (Table 01).

According to the design of the study, there was determined the level of development of interdisciplinary competence of students – 44.03.05 Pedagogical Education – using the self-assessment methodology. The application of this methodology made it possible to obtain information from students who answered the questions. The questionnaires aimed at determining the correspondence of the degree of manifestation of the desired quality (the need for the integration of knowledge) were assessed against a

5-point system. The objectivity of the results obtained and their reliability was achieved due to the anonymous survey (Table 02).

In this study, different levels of development of the interdisciplinary competence of future teachers were highlighted. As a feature of motivation of the interdisciplinary competence there was considered the presence of interest in the problem, the orientation of a person towards acquiring knowledge and their practical application. The questions that were offered to students assumed the identification of these features.

Table 1. Self-assessment results of the motivational component

Criteria	EG (Kalmyk State University and Bryansk State University students)	CG (Kalmyk State University and Bryansk State University students)
	Average score	Average score
Understanding the purpose of professional activity	4.3	2.4
Knowledge acquisition of interdisciplinary integration	2.7	4.3
Self-study regarding new information obtaining	3.9	3.5
Average score by group	3.4	3.5
Standard deviation by group:	0.2	0.2
Calculated value of Studen”s t-test		10
Average score for all groups:		3.8
Levels		Range
Beginner		(1–3.2)
Intermediate		(3.2–3.8)
Advanced		(3.8–5)

Table 2. Levels of development of te motivation component of interdisciplinary competence

Level	Description	Score
Advanced	Sheer interest in scientific and practical knowledge; integration oriented. The cognitive need is perceived as a personally significant motivation for activity. The development of interdisciplinary competence occurs in various types of activities in the course of mastering concepts	(3.8–5)
Intermediate	Basic knowledge about integration. A student shows the need for personal quality transformation regarding integration, conducts an understanding of the integration process, applies templates in cognitive activity. A student shows insufficient interest in the ability to integrate knowledge from various scientific fields	(3.2–3.8)
Beginner	Poor motivation, lack of interest in self-education and self-development	(1–1.2)

The average score of the motivation component in the experimental groups (Kalmyk State University and Bryansk State University) is statistically higher, because the calculated value of student’s t criterion is above than 2 (Table 03).

Thus, the average level of achievement of the motivation component in the EG of Kalmyk State University and Bryansk State University amounted to 85.7 %.

The development of the content component of interdisciplinary competence was determined by the degree of students’ awareness of the value of possessing a set of a scientific and practical knowledge.

Table 3. Content self-assessment results

Criteria	EG (Kalmyk State University and Bryansk State University students)	CG (Kalmyk State University and Bryansk State University students)
	Average score	Average score
Knowledge about the essence of interdisciplinary integration is sufficiently mastered	4.0	1.8
Complete understanding of scientific and practical knowledge necessary for development of interdisciplinary competence	2.7	1.3
Complete understanding of features of the process of integrating scientific and practical knowledge	3.9	2.0
Practical application of the acquired knowledge in professional activity	4.6	2.0
Use of didactic and methodological means of integration into professional situations	4.3	3.2
Average score by group	4.3	3.2
Standard deviation by group:	0.2	0.2
Calculated value of Student's t-test		25
Average score for all groups:		3.8
Levels		Range
Beginner		(1–3.2)
Intermediate		(3.2–4.4)
Advanced		(4.4–5)

From the presented material it can be seen that the development of the content component in the CG and the EG is different. The students from the EG had advanced level (63.1 %), while the graduates (CG) had intermediate and beginner levels, i.e. 78.9 and 21.1 %, respectively. The experiment could be explained in the following way: The students from the EG were faced with challenges regarding the interdisciplinary integration in order to understand the importance and necessity of mastering the skills of professional activity (Table 04).

Table 4. Level of content component of soft skills

Level	Description	Grade
Advanced	Solid knowledge of the essence of integration. A student seeks to get to know himself and those around him, shows high degree of activity in professional activities. A student mirrors the forms of integration effectively distributing attention and relying on comprehensive knowledge. He/she shows interest in scientific and practical knowledge	(4.4–5)
Sufficient	A student simulates an individual system of activity. He/she independently obtains information for the development of interdisciplinary competence. He/she has partial understanding of the essence and content of interdisciplinary competence	(3.2–4.4)
Beginner	A student possesses superficial knowledge in scientific and practical areas, as well as mechanisms and structures of integration. The need for the development of scientific and practical skills is insufficiently developed. Lack of activity and initiative	(1–3.2)

In order to increase the level of development of the content component, students were involved into independent activities in the educational process, i.e. lectures, practice-based classes, and extracurricular activities.

7. Conclusion

The idea of the competence-based approach is expressed in an interdisciplinary task which is a constituent part of future teacher professional training (Sirenko, 2013). The totality of various interdisciplinary tasks constitutes the integrity of the content of this training. Interdisciplinary integration theoretically substantiated and implemented during the laboratory and practiced-based classes ensured the effectiveness of the professional training of future teachers. The implementation of interdisciplinary tasks of both professional and scientific activities was carried using such methods as development of professional and motivational situations during the study of discipline; transformation of knowledge. Integrated laboratory and practice-based classes and lectures based on the technology of STEAM education, acted as a means of designing the educational process of future teachers.

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