

The Role of Pedagogical and Technical Knowledge in Preparing Students for Professional Activity

Ruzimurat Kungratovich Choriev^{1*}, Deni Darmawan²

¹ Tashkent Institute of Irrigation and Agricultural Mechanization, National Research, Uzbekistan

² Educational Technology Department, Faculty of Education Science, Universitas Pendidikan Indonesia

Correspondence e-mail * : choriye63@bk.ru

Abstract : Deepening the organic connection between production structures and natural, technical, and social sciences has a positive impact on the effectiveness of education. Furthermore, in the further development of the theory and practice of professional education, integration processes such as further expansion of the integrative organizational function of education, modernization of forms and methods of education, and the formation of personal and professional qualities play an important role based on ensuring the harmony and continuity of elements of innovative professional potential. The research employed methods of comparative study and critical analysis of scientific sources, didactic materials, curricula and programs, educational and regulatory documents, textbooks and teaching materials related to the problem: conversation, observation, questionnaires and testing, modeling, expert evaluation, pedagogical experiment; mathematical and statistical processing of research results.

Keyword : integration process, education, diagnostic methods, teachers

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INTRODUCTION

During the research, a number of important scientific results were obtained on the problem of creating methodological foundations for multidisciplinary educational complexes in the process of training future teachers of vocational education, ensuring the sequence of integration-divergent processes, developing systematic models of integrative knowledge acquisition, and improving methods of diagnosing the professional training of future specialists. Students not only identify the interdependence of pedagogical and technical knowledge, but also perform certain actions to ensure its interdependence. For example, "didactic preparation" (E.F. Zeer) requires tasks that require a technical text (designing a lesson plan, a brief summary, etc.).

The results of this study were discussed at 15 international and 20 republican scientific-practical conferences. To ensure the integration of pedagogical and technical knowledge in diagnosing the readiness of future teachers of vocational education for pedagogical professional activity, "Integration of pedagogical and technical knowledge in diagnosing the readiness of future teachers of vocational education for professional activity," in co-authorship "Using the possibilities of modular teaching technology" and "Integration of pedagogical and technical knowledge in diagnosing the readiness of future teachers of vocational education for

professional activity". Organizational and didactic support has been developed, such as electronic textbook programs for the subjects "Methods of Teaching Special Disciplines."

The scientific significance of the research lies in the development of a concept for preparing future teachers of vocational education for professional activity, a set of parameters and quality indicators of competence requirements, demonstrating the organizational and functional capabilities of elements of the structure of professional activity by ensuring their interdependence based on the integration of diagnostic criteria and pedagogical tools and the methodology of teaching and preparation for professional activity based on the integration of pedagogical and technical knowledge is explained by the development of scientific and methodological recommendations for improving the quality and effectiveness of education, organizing the educational process, and improving curricula and programs in higher education institutions based on an integrative approach. The practical significance of the research results lies in the fact that the means of preparing future teachers for pedagogical professional activity based on the integration of pedagogical and technical knowledge and the system of criteria and methods for assessing the diagnosis of readiness for professional activity are used in the modernization of the educational and upbringing process of the professional education

system, as well as in the improvement of the educational and upbringing process, serves to improve the methodology and teaching and methodological support of general professional and specialized subjects based on the integration of innovative educational technologies and pedagogical and technical knowledge in preparation for professional activity.

During the experimental work, in order to determine the level of students' ability to correctly solve certain pedagogical problems and diagnose them, we presented them with pedagogical and technical-technological problem-situational assignments. Special attention was paid to organizing experimental work based on the theoretical foundations of integrating pedagogical and technical knowledge in diagnosing the readiness of teachers of vocational education, particularly students studying in technical universities, for professional activity and its results. The purpose of organizing the experimental work is to determine the level of effective use of recommended pedagogical conditions that allow for the diagnosis of readiness for professional activity and its results based on the integration of pedagogical and technical knowledge.

The experimental work was conducted over four years at the Tashkent Institute of Irrigation and Mechanization of Agriculture, the Bukhara Branch of the Tashkent Institute of Irrigation and Mechanization of Agriculture, the

Bukhara Institute of Engineering and Technology, and the Jizzakh Polytechnic Institute in the areas of "Professional Education." Through the conduct of experimental work, the possibilities of using the diagnosis of readiness for professional activity based on the integration of pedagogical and technical knowledge were identified, and its qualitative development and effectiveness were practically proven based on scientific hypotheses. When assessing the pedagogical and technical knowledge, skills, and abilities of future specialists, their competence in conscious, creative assimilation and creative use of them was used as a criterion for the results of preliminary and final tests. The results obtained at each stage of the experimental work were systematically analyzed. As noted in the theoretical part of the study, we distinguish the following components of the formation and diagnosis of the results of professional skills of a future teacher of vocational education in professional activity: design, organizational, communicative, evaluative-analytical, and gnostic. In diagnosing readiness for professional activity, we deemed it necessary to emphasize the skills that include each component to assess the readiness of teachers. To determine the level of professional skill development, we identified the following evaluation criteria:

1. completeness of pedagogical and technical knowledge (knowledge of

- concepts, clarity of the connection between them);
2. clarity of events (establishing a rational order of actions, choosing several optimal options, self-control)
 3. independence of actions;
 4. the direction of actions aimed at the tasks of vocational education.

METHODOLOGY

The organization of the experimental work based on a specific goal and set tasks in accordance with it has led to the following situations:

1. have a clear direction of experimental work;
2. Effective use of existing opportunities;
3. Effective use of experimental work;
4. predicting the expected outcome in advance;
5. achieving a clear result;
6. ensuring a high level of effectiveness of experimental work.

The experimental work was conducted in the following three stages:

1. The primary experimental stage involved organizing pedagogical activities aimed at identifying the existing direction of the level of effectiveness of integrating pedagogical and technical knowledge in the diagnosis of readiness for professional activity. To achieve the stated goal, methods

such as pedagogical observation, conversation, questionnaire surveys, as well as the study of documents illuminating the essence of educational and spiritual-moral work were used in diagnosing the readiness of students studying in the field of professional education for professional activity. All of this made it possible to determine to a certain extent the main direction and program of the research. The scientific works of leading educators and scientists on the research topic were analyzed.

2. During the formative stage of the experiment, practical and methodological work on diagnostics was organized based on the instructions, instructions, and methodological developments recommended by the dissertation author. At the same time, attention was paid to the general pedagogical impact aimed at diagnosing the readiness of students for professional activity using methods such as direct or indirect pedagogical observation of students' activities, the organization of practical trainings on the formation of diagnostic skills with their participation, conversation, questionnaire survey, and the improvement of students' professional competence based on an integrative approach to the methodology of organizing integrated lessons. The scientific solutions identified as a result of

theoretical research were applied in practice in the creation of methodological recommendations and manuals, on the basis of which experimental work was carried out. In the second stage of the experimental work, the possibilities of modular teaching technology, the development of skills and abilities in the use of syllabuses in the organization of integrated lessons, which are planned to play an important role, were achieved.

3. A model for integrating pedagogical and technical knowledge in diagnosing readiness for professional activity was developed during the confirmatory experimental stage. Experimental work was conducted on the implementation of this model into practice and the evaluation methodology, the results were analyzed, and the effectiveness of the methodology recommended by the researcher was determined, as well as the state of the level of improvement of the integration of pedagogical and technical knowledge in the diagnosis of readiness for professional activity. Formative experimental work was carried out, and the research results were implemented in practice. The achievement of positive results in the diagnosis of readiness for professional activity during the experimental work was confirmed by mathematical and statistical

methods and evaluation by qualified experts.

The successful conduct of the experimental work was ensured by the presence of the following objective and subjective factors:

1. the creation of methodological conditions aimed at integrating pedagogical and technical knowledge in the diagnosis of readiness for professional activity in higher education institutions;
2. the presence of a sufficient material and technical base of higher educational institutions where experimental work was carried out in the diagnosis of readiness for professional activity;
3. the effectiveness of integrating pedagogical-psychological, theoretical, and practical knowledge, interdisciplinary integration, integration of pedagogical and technical knowledge, and improving the professional competence of students in diagnosing readiness for professional activity has been proven.
4. Effective use of a model of integrative technologies, modern educational tools, and information technologies in diagnosing the process of educational and upbringing work in preparation for professional activity
5. in the diagnosis of readiness for professional activity, in ensuring the integration of pedagogical and technical knowledge, special

attention is paid to the organization and conduct of integrated lessons, pedagogical practices at a high level, the development of the "Master-Apprentice System" activity on the integration of science, education and production, the performance and protection of graduation qualification work;

6. The establishment of a systemic, technological, and integrative approach to the process of diagnosing readiness for professional activity;
7. acquisition of knowledge based on modular educational technologies in the diagnosis of readiness for professional activity, as well as in ensuring the integration of pedagogical and technical knowledge, the ability to use teaching and methodological complexes, syllabuses, and electronic libraries based on a modular system.

RESULT AND DISCUSSION

Results

In statistical analysis of the results of the experiment conducted to determine the effectiveness of diagnosing the readiness of future teachers of vocational education for professional activity based on the integration of pedagogical and technical knowledge in higher educational institutions, we relied on the following criteria:

Table 1.
Indicators of the level of formation of professional skills based on the integration of pedagogical and technical knowledge (in percentages)

№	Indicators	In the control groups n = 184 students (per cent)			In the experimental groups n ₁ = 180 students (per cent)		
		Up per	Mid dle	Lo wer	Up per	Mid dle	Lo wer
1	Completeness of pedagogical and technical knowledge (knowledge of concepts, clarity of the connection between them)	22/33	38/40	40/27	19/54	39/38	42/8
2	Understanding of events (determining a rational order of actions, choosing several optimal options, self-monitoring)	24/34	42/39	34/27	16/53	33/32	51/15
3	Independence of action	23/33	39/38	38/29	14/48	33/33	53/19
4	The direction of actions aimed at the tasks of vocational education	21/28	41/39	38/33	11/51	28/30	61/19

Note: numbers at the beginning of the experiment, numbers after the fraction (drop) - indicators at the end of the experiment.

The results of the experimental work conducted demonstrate the

readiness of future specialists for professional activity based on the integration of pedagogical and technical knowledge (pedagogical and technical knowledge, their diagnosis; the formation of professional skills based on the integration of pedagogical and technical knowledge; integration of pedagogical-psychological theoretical and practical knowledge; integration of pedagogical and technical (special) subjects:

1. intra-disciplinary (reproductive educational activity),
2. interdisciplinary (partially productive educational activity);
3. meta-subject (productive educational and cognitive activity);

Levels	Control Groups				Experimental groups			
	At the beginning of the experiment 182 respondents		End of experiment 184 respondents		At the beginning of the experiment 176 respondents		End of experiment 180 respondents	
	number of respondents	%	number of respondents	%	number of respondents	%	number of respondents	%
Upper	35	19,2	37	20,1	34	19,3	76	42
Middle	78	42,9	82	44,6	78	44,3	84	47
Lower	69	37,9	65	35,3	64	36,4	20	11
total:	182	100	182	100	176	100	180	100

Table 2. Indicators of respondent readiness for professional activity based on the integration of pedagogical and technical knowledge. Table 2 and Figure 2 show that, based on the integration of pedagogical and technical knowledge, the level of students' readiness for professional activity at the beginning of the experiment was low, and at the end of the experiment it was high.

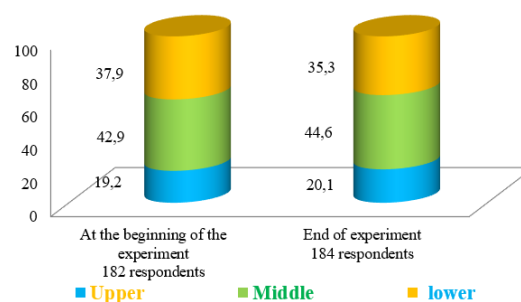


Figure 1. Control Groups

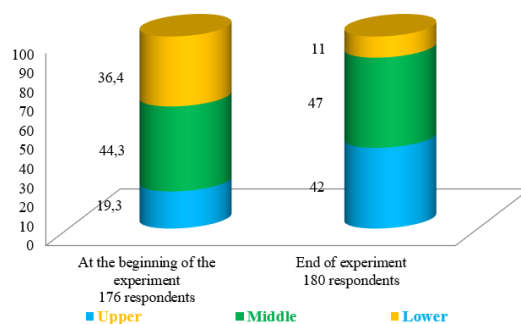


Figure 2. Experimental Groups

Levels of assimilation of students based on the integration of pedagogical and technical knowledge. Pearson and Student's t-test were used to determine the reliability of the obtained results. The data obtained as a result of the experiment in Table 1 was analyzed using mathematical and statistical methods.

For this purpose, the control group's learning outcomes were determined using X_i , while the

experimental groups' results were determined using Y_i . The levels of "upper," "middle," and "lower" in the control and experimental groups were conditionally replaced with grades of "5," "4," and "3" respectively, and the values of the levels for the groups were determined by m_i and n_i . As a result, the following tables 3 and 4 were obtained based on Table 2.

Table 3.
Statistical data at the beginning of the experiment.

Levels	Control groups			Experimental group		
	At the beginning of the experiment 182 respondents			At the beginning of the experiment 176 respondents		
	X_i	P_i	n_i	Y_i	q_i	m_i
Lower	3	69	0,379	3	0,363	64
Middle	4	78	0,429	4	0,444	78
Upper	5	35	0,192	5	0,193	34
Total	Σ	182	1	Σ	1	176

$$P_i = \frac{n_i}{n}, \quad q_i = \frac{m_i}{m}, \quad n = n_1 + n_2 + n_3, \quad m = m_1 + m_2 + m_3$$

Table 4.
Statistics at the end of the experiment.

Levels	Control groups			Experimental groups		
	End of experiment 184 respondents			End of experiment 180 respondents		
	X_i	n_i	P_i	Y_i	m_i	q_i
Lower	3	65	0,353	3	20	0,11
Middle	4	82	0,446	4	84	0,47
Upper	5	37	0,201	5	76	0,42
Total	Σ	182	1	Σ	180	1

The main task of mathematical statistics is to conduct a comparative analysis of the internal data of Tables 3

and 4 (according to X_i and Y_i) and their own.

$$\bar{X} = \sum_{i=1}^3 X_i P_i = 3 \cdot 0,353 + 4 \cdot 0,446 + 5 \cdot 0,201 = 1,059 + 1,784 + 1,005 = 3,848;$$

$$\bar{X}\% = \frac{100 \cdot \bar{X}}{5} = 76,96\% \sim 77,0\%$$

$$\bar{Q} = \sum_{i=1}^3 Y_i q_i = 3 \cdot 0,11 + 4 \cdot 0,47 + 5 \cdot 0,42 = 0,33 + 1,88 + 2,1 = 4,31;$$

$$\bar{Q}\% = \frac{100 \cdot \bar{Q}}{5} = 86,2\%$$

Calculations show that at the end of the experiment, the average increase in the control groups was $77.0\% - 76.3\% = 0.7\%$, while this indicator was significantly higher in the experimental groups, reaching $86.2\% - 77\% = 9.2\%$, i.e., 9.2% .

Determining the indicators corresponding to the control and experimental groups using a_x and a_y , we check the correctness of the hypothesis about their equality using the Student's t-test.

$$T = \frac{|\bar{x} - \bar{y}|}{\sqrt{\frac{s_x^2}{n} + \frac{s_y^2}{m}}} = \frac{|4,26 - 3,85|}{\sqrt{\frac{0,1560}{184} + \frac{0,2809}{180}}} = \frac{0,41}{\sqrt{0,0008478 + 0,0015605}} = \frac{0,41}{\sqrt{0,0024084}} = \frac{0,41}{0,04907} = 8,36$$

The 95% critical point corresponding to the Student's t-test is $t_{kr} = 1.96$, and the statistical value is greater than it:

$$T = 8,36 > 1,96 = t_{kr}$$

The results of mathematical and statistical analysis confirmed an increase in the effectiveness of integrated lessons at the beginning and end of the experimental work, the effectiveness of preparation for professional activity based on the integration of pedagogical and technical knowledge. This testifies to

the effectiveness of integration in the process of professional training.

CONCLUSION

The main conclusions and results obtained during the research are as follows:

1. Currently, the growing demands of society on teachers of vocational education contribute to the integrative (comprehensive) application of pedagogical and technical knowledge in the process of professional education.
2. It was noted that there is a need to equip future specialists with integrative knowledge and insufficient pedagogical conditions and methods for the widespread implementation of integration trends in pedagogical practice, as well as the presence of contradictions between them. The algorithm for implementing the method of diagnosing integrative learning and its results, which serves to increase the effectiveness of professional and pedagogical training, was considered an important factor in resolving these contradictions.
3. The foundations of pedagogical and technical knowledge, interdisciplinary integration, the content and levels of integration of pedagogical and special disciplines, the state of formation of professional competencies in future teachers of vocational education, the stages of introducing the content

of integrative education in targeted professional training, as well as the components of diagnosing the result of preparation for professional activity and their content are determined.

4. The results of the pedagogical experimental work, scientific and practical developments, methodologies, and instructions for preparing for professional activity based on the integration of pedagogical and technical knowledge and diagnosing its results, showed that the effectiveness of improving the quality of preparation for professional activity of future specialists in the experimental groups is higher than in the control groups.

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AUTHOR CONTRIBUTIONS

Conceptualization : All Authors;

Methodology : All Authors ;

Investigation :All Authors ;

Writing original draft preparation :
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