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RESEARCH ARTICLE

On The Methodology Of Forming And Developing Students' Professional Competencies In The Vocational Education System Through The Use Of Information And Design Technologies

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Abstract

The article presents an analysis of scientific studies conducted by scholars on the concepts of competence and competency, as well as issues related to their formation and development in the educational process. It also describes a methodology for forming students' professional competencies in the vocational education system through the use of information and design technologies. In addition, the results of pedagogical experimental and pilot studies are analyzed, and relevant conclusions and recommendations are provided.

KEYWORDS

Competence, competency, vocational education, information and design technologies, pedagogical experiment, competency level, high, medium, low.

INTRODUCTION

In the current context of globalization, characterized by the increasing volume and speed of information flows, rapid development of equipment and technologies, the introduction of modern machinery and digitalization into production processes, as well as the dynamic growth of small and medium-sized business entities, there is a growing demand for mid-level specialists possessing modern competencies [2]. Under these conditions, the formation of an innovative educational environment in the vocational education system, based on the development of learners' competencies, is of critical importance for training competent mid-level personnel for economic sectors and socio-technical fields.

In Uzbekistan, the development of science and the entire system of continuous education, including vocational education, is regarded as one of the priority directions of the ongoing reforms [1]. In this regard, the Resolution of the President of the Republic of Uzbekistan dated March 14, 2017 No. PQ-2829 "On Measures to Further Improve the Activities of Secondary Specialized and Vocational Education Institutions," the Decree dated September 6, 2019 No. PF-5812 "On Further Improvement of the Professional Education System," and the Decree dated October 16, 2024 No. PF-158 "On Measures to Further Improve the System of Training Qualified Personnel in Vocational Education and Introduce International Educational Programs" envisage comprehensive structural and content-based reforms of the vocational education system.

These regulatory documents emphasize the need to enhance

the quality and effectiveness of personnel training in the vocational education sector, introduce international educational programs, and prepare competitive mid-level specialists with advanced skills and competencies that meet the demands of both domestic and international labor markets. They also highlight the importance of improving the vocational education system by providing educational institutions with the necessary учеб literature, methodological manuals, and digital content; equipping laboratories and workshops with state-of-the-art equipment; expanding the use of modern pedagogical and information technologies in the educational process; and fundamentally updating the system for assessing graduates' skills and competencies, thereby increasing the capacity to train personnel aligned with the needs of economic sectors.

Based on advanced international experience, the development of modern teaching methodologies aimed at improving the quality of knowledge acquisition in vocational education, forming students' general and professional competencies, creating software tools and multimedia educational content, and solving problem-based tasks plays a crucial role.

METHODOLOGY

The concepts of "competence" and "competency" are widely used in various fields of human activity. These terms are encountered in professional practice, management, literature, pedagogy, everyday life, and other domains. The term "competence" originates from the Latin word competo, which means "to achieve," "to correspond," "to be appropriate," as well as "to be capable" or "to be worthy" [3].

As scientific and pedagogical concepts, competence and competency, as well as issues related to their formation and development in the educational process, have been studied by numerous researchers and educators. In particular, scientific studies have been conducted by A.M. Aronov, A.G. Bermus, O.O. Daminov, I.A. Zimnyaya, E.F. Zeer, N.N. Karimova, O.Ye. Lebedev, O.A. Lukash, Y.R. Najmiddinova, T.B. Igognina, J.R. Turmatov, K.T. Umataliyeva, O.A. Qo'ysinov, A.V. Khutorskoy, M.A. Choshanov, and other scholars.

An analysis of scientific literature in this field shows that researchers have proposed various definitions of the concept of "competence" that are close in meaning and content. For instance, I.A. Zimnyaya defines competence as "a knowledge-based, intellectually and personally conditioned socio-professional activity of an individual." A.V. Khutorskoy interprets competence as a set of personal characteristics (knowledge, skills, abilities, and methods of activity) determined by a specific range of objects and processes. E.F. Zeer defines competence as "the learner's ability to carry out professional activities based on professional knowledge and skills."

According to the conclusions of T.B. Igognina, possessing competencies implies the subject's readiness for professional activity, primarily based on the knowledge and skills acquired during education and oriented toward effective assimilation into the professional sphere.

From a pedagogical perspective, competence is explained as a measure of the correspondence between the skills and experience of individuals with a certain socio-professional status and the actual level of the tasks they perform and the problems they solve. The formation and development of professional competencies in future specialists are carried out in the process of teaching curriculum subjects to learners.

This study presents a methodology for forming and developing students' professional competencies during the teaching of the subject "Informatics and Information Technologies" in the vocational education specialty "Computer Graphics and Design Operator" through the use of information and design technologies, as well as an analysis of the results of the conducted pedagogical experimental work.

An analysis of scientific research related to the problem under consideration shows that the development process, patterns, and trends of informatics education in educational institutions, problems of preparing learners for professional activity, as well as issues related to the development and application of pedagogical software tools in informatics have been investigated by M.X. Allambergenova, S.S. Beknazarova, N.X. Begmatova, S.P. Gavrilova, F.M. Zakirova, N.N. Zaripov, V.A. Krasilnikova, T.A. Kulikova, M.E. Mamarajabov, I.V. Morozova, F.R. Murodova, S. Raximov, N.I. Taylaqov, I.P. Tomina, P. Tshounikine, A.G. Haitov, D.M. Esonbayeva, Z.E. Chorshanbiyev, and other pedagogical researchers.

Based on the scientific and methodological findings of S.I. Arkhangelskiy, V.P. Bespalko, F.M. Zakirova, M.S. Kagan, D.N. Mamatov, N.A. Muslimov, M.G. Reznichenko, M.R. Fayzieva, as well as the psychological and pedagogical works of L.S. Vygotsky and S.L. Rubinstein, and our own research results on forming students' professional competencies in the vocational education system using information and design

technologies [7–15], an information–project technology model was developed that yields positive results in forming learners' general and professional competencies in vocational education institutions.

The developed model consists of four blocks: target, theoretical-methodological, content-process, and organizational-resultative. Within this model, under the guidance of the teacher, learners' general and professional competencies are formed and developed through the systematic organization of professionally oriented project-based activities in an electronic information educational environment (EIEE) using EIEE resources.

During the development of the model, the following conditions were taken into account [4–6]:

- conceptual pedagogical principles of educational activity were selected and substantiated;
- educational approaches were determined through a set of principles reflecting the specific features of the implemented activities;
- the structure and content of electronic educational and methodological complexes (EEMCs) for basic, general professional, and professional module subjects were defined;
- information–project technology for education was developed;
- stages of joint activity between the teacher and learners in applying information–project technology were identified;
- a criteria-diagnostic framework was developed to assess the level of formation of learners' general and professional competencies (motivational, cognitive, activity-based, and evaluative-reflexive criteria).

Based on the developed model, pedagogical experimental work was conducted.

Experiment

To examine the formation and development of students' professional competencies during the teaching of the subject "Informatics and Information Technologies" in the vocational education specialization "Computer Graphics and Design Operator" using information and design technologies, pedagogical experimental and pilot studies were conducted and their results were analyzed. The experimental work was carried out based on the integrity of pedagogical processes and relied on competency-based, activity-based, interdisciplinary, systemic, and information-communication approaches.

The experimental study was implemented in three stages (exploratory, theoretical-experimental, and experimental-testing) over the 2020–2023 academic years. For conducting the experiment, the necessary didactic materials, methodological guidelines for each lesson, and an electronic educational-methodological complex for the subject "Informatics and Information Technologies" were developed. In addition, the performance of practical tasks using specialized software was integrated into the educational process. To assess the level of formation of students' professional competencies, a criteria-diagnostic method (motivational, cognitive, activity-based, and evaluative-reflexive criteria) was applied.

Based on the acquired theoretical knowledge and practical skills developed through teaching the subject using modern information and communication technologies, the degree of formation of students' professional competencies through information-project technologies was evaluated according to low, medium, and high levels and corresponding indicators.

The experimental and pilot studies were conducted in vocational education institutions of the Republic of Karakalpakstan (Nukus City, Vocational Education Institution No. 1), Kashkadarya Region (Kamashi District, Institution No. 2), and Tashkent Region (Urtachirchik District, Institution No. 1).

In order to determine the effectiveness of the experimental work, academic groups were selected based on the criterion of similarity in students' initial knowledge levels. In the experimental (E) groups, the educational process for the subject "Informatics and Information Technologies" was organized using a methodology aimed at forming students' professional competencies through information-project technologies, while in the control (C) groups the subject was taught using traditional methods. The results of the experimental and control groups were systematically analyzed at the end of each academic year, compared, and relevant conclusions were drawn.

This study presents an analysis of the results of pedagogical experimental work conducted during the 2020–2023 academic years at Vocational Education Institution No. 1 in Nukus City, Republic of Karakalpakstan. A total of 45 students participated

in the experimental groups and 44 students in the control groups. During the experimental process, the levels of formation of students' professional competencies in teaching "Informatics and Information Technologies" using information and design technologies were determined according to predefined criteria and levels. The effectiveness of the experimental work was evaluated using mathematical and statistical analysis, and appropriate conclusions were drawn.

According to the results of the mathematical-statistical analysis of pedagogical experimental work conducted at Vocational Education Institution No. 1 (technical college) in Nukus City during the 2020–2023 academic years, the levels of formation of professional competencies among students in the experimental groups were as follows: the high level increased from 11.1% at the beginning of the experiment to 22.2% at the end; the medium level increased from 22.2% to 48.9%; and the low level decreased from 66.7% to 28.9%.

In the control groups, where the subject "Informatics and Information Technologies" was taught using traditional methods, the levels of formation of professional competencies were as follows: the high level increased from 6.8% to 13.6%; the medium level increased from 18.2% to 25%; and the low level decreased from 75% to 61.4%.

The table and diagram below present the results of the pedagogical experimental work conducted at Vocational Education Institution No. 1 (technical college) in Nukus City during the 2020–2023 academic years.

Results of the pedagogical experimental and pilot studies conducted at Vocational Education Institution No. 1 (Technical College) in Nukus City

"The level of students' professional competencies formed through information–project technologies"	"Experimental group (E)"				Control group (C)			
	At the beginning of the experiment, there were 45 students in the experimental group.		At the end of the experiment, there were 45 students in the experimental group.		At the beginning of the experiment, there were 44 students in the experimental group.		At the end of the experiment, there were 44 students in the experimental group.	
	The number	%	The number	%	The number	%	The number	%
High level	5	11,1	10	22,2	3	6,8	6	13,6
Average	10	22,2	22	48,9	8	18,2	11	25,0
Low	30	66,7	13	28,9	33	75,0	27	61,4
total	**45**	**100**	**45**	**100**	**44**	**100**	**44**	**100**

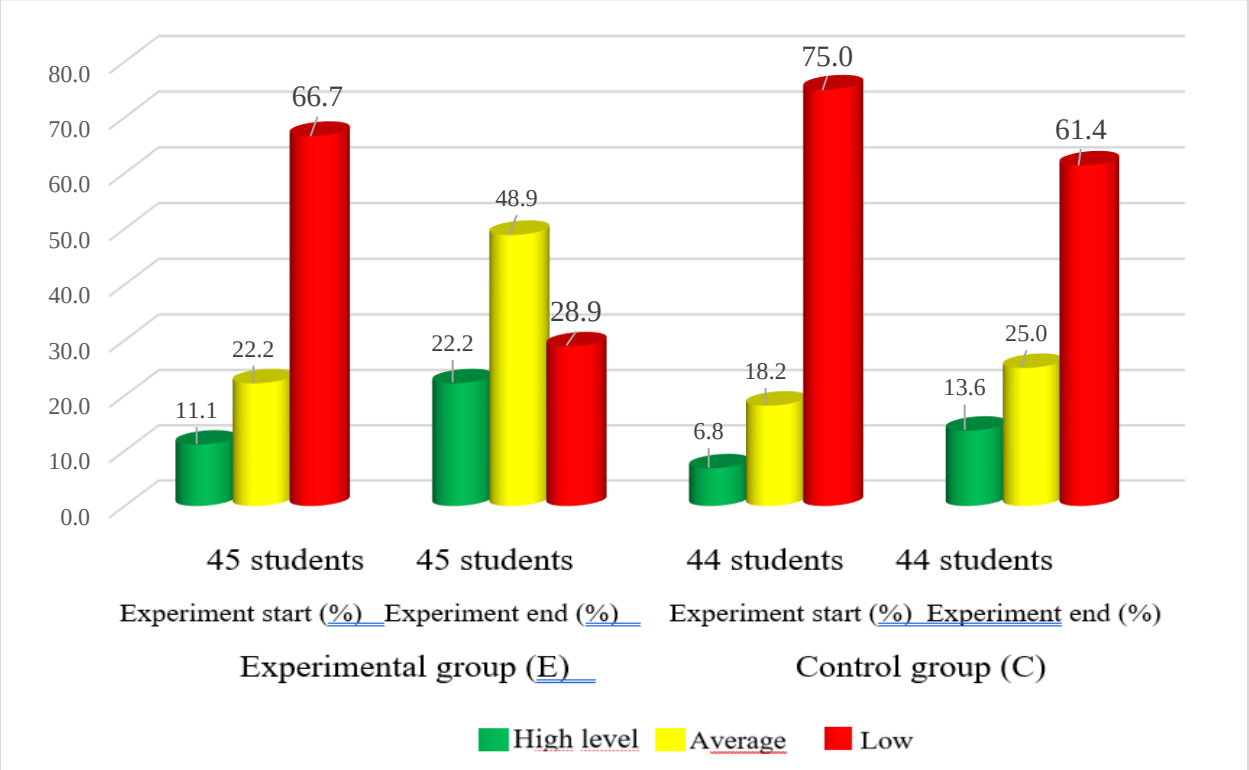

Diagram of the results of the pedagogical experimental and pilot studies conducted at Vocational Education Institution No. 1 (Technical College) in Nukus City

According to the analysis of the results of the conducted experimental and pilot studies, it was determined using mathematical-statistical methods that the level of formation of professional competencies in students of the experimental groups, who were taught the "Informatics and Information Technologies" course in the "Computer Graphics and Design Operator" vocational direction using information-design technologies, was 12% higher compared to students in the control groups.

Translation:

The proposed information-project technology expands and systematizes the previously used project-based method. It represents a synthesis of the modern project method and information technologies and can be considered as an educational system in which learners gradually acquire knowledge and skills through planning and completing increasingly complex practical project tasks. Interdisciplinary connections are strengthened. Students' abilities for independent learning are developed, and their creative activity increases significantly. As a result, the effectiveness of the formation of students' professional competencies is significantly enhanced.

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