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Cognitive Competence of Students in the Credit-Module System: Content and Structure

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Abstract:

This article examines the use of project-based methods and interactive technologies in developing the cognitive activity of future technology teachers. It highlights the role of cognitive processes in enhancing the effectiveness and quality of the educational process, identifies the levels of cognitive activity, and analyzes the structure of cognitive activity as reflected in scholarly research. The study also presents an innovative educational project.

Keywords: Cognitive Activity, Education, Training of Personnel, Competence, Competency, Qualification, General Education, Professional Education, Specialization, Upbringing, Resource Efficiency, Ecological Culture.

Introduction

The Law "On Education" legally establishes the competency-based approach as a purposeful and effective foundation of modern education. This approach is reflected in such key concepts as education, training of personnel, qualification, general education, professional education, specialization, and upbringing [1]. The issues related to competency-based education are being actively studied in pedagogical science. A significant contribution to the development of the organizational and methodological framework for implementing the competency-based approach has been made by local researchers O. A. Koysinov, M. Vakhobov, B. Khodjayev, A. Askarov, M. Parayeva, and others, as well as by scholars from CIS countries, including Baydenko, V. A. Bolotov, E. F. Zeyer, I. A. Zimnyaya, G. K. Selevko, V. V. Serikov, A. V. Khutorskoy, and others.

The transition to a competency-based approach in teaching students of higher education institutions is driven by the need to ensure that their level of professional training meets both

employers' requirements and individual educational needs [2].

From the perspective of modern education, the goal of the competency-based approach is to overcome the gap between students' theoretical knowledge and its practical application. Therefore, the contemporary educational process should not focus on providing students with knowledge that is difficult to apply in practice; rather, it should aim to demonstrate how such knowledge can be used to solve relevant professional problems, as well as to create conditions that enable students to independently solve such problems within the learning process.

If, since the period of J. A. Comenius' pedagogy, the objective of education and personnel training was oriented toward the formation of knowledge, skills, and abilities (KSAs) in individuals, today the core essence of being a professional is interpreted primarily in connection with the concepts of competence and competency [3]. Knowledge, skills, and abilities represent educational goals and socio-cultural values, whereas competence and competency, in contrast, constitute the functional units of professional activity in accordance with the requirements and principles of a market economy.

Literature Review

The research works of national pedagogical scholars such as A. Abdukodirov, R. Kh. Jorayev, Z. K. Ismoilova, E. R. Yuzlikayeva, M. B. Urazova, and K. D. Riskulova reflect the scientific and theoretical foundations of a range of issues, including the intensification of education in higher education institutions, the use of modern pedagogical and information technologies in the educational process, teachers' competence and the didactic requirements imposed on it, the essence of this concept, its structural components, stages of formation, as well as modern approaches to the role of motivation in ensuring educational effectiveness [4].

Various aspects of fostering professional competencies of specialists have been investigated by O. Musurmonova, B. Khodjayev, L. Zaripov, O. Koysinov, Kh. Mamatkulov, B. Torayev, Sh. Oroqov, A. Abduazizov, L. T. Akhmedova, G. Bakiyeva, J. Jalolov, K. Korayeva, G. Makhkamova, K. Riskulova, F. Saidova, and A. Sattorov.

Methodology

The research design used a qualitative and pedagogic analytical approach based on the competency-based education paradigm centred on the development of students' cognitive competence within the credit module system. The methods of the research were determined by an extensive analysis of normative legal acts such as the Law On Education and the State Educational Standards for Higher Education to define competency-oriented learning outcomes and professional requirements for specialists in the future [5]. A comprehensive reassessment of both national and international pedagogical literature was also undertaken in order to systematise theoretical definitions of cognitive competence, cognitive activity, and reflective learning, with special attention to the writings of those scholars who conceptualise competence as an integrative personal and professional construct.

The research used pedagogical observation and analysis of the students' own learning by participation in project-based interactive learning activities in several technology education courses as the empirical data [6]. They are allowed to determine the structural elements of cognitive competence: learning readiness, motivation, reflexion and the ability to use knowledge in the context of practical and problem-solving activity. By comparing traditional approaches and competency-oriented ones, we examined whether or not differences exist in students′ cognitive engagement and independence.

The reflective analysis was also used as a methodological tool to evaluate individual students

on self-regulation, goal setting, and self-assessment while carrying out the learning activities. Data synthesized by logical generalisation and abstraction to derive a conclusion about the effectiveness of interactive and project-based methods for developing cognitive competence [7]. This combined methodology allowed for valid conclusions, which contributed to a comprehensive view of cognitive competence development at the tertiary level.

Results and Discussion

The State Educational Standard for Higher Education defines the competencies that graduates are required to possess. These include general and professional competencies, which are intended to serve as a foundation enabling graduates to navigate the labor market and to be prepared for continuing their educational activities [8].

The general objective of the Technology subject is defined as developing students' ability to apply the knowledge, skills, and abilities acquired in technical and technological processes in independent practical activities, to foster resource efficiency and ecological culture, to provide career guidance, to encourage the expression of creativity, and to develop the capacity to generate new ideas and find effective solutions to them.

The objectives of the Technology subject define the content of education and its key requirements, reflect the social demands of the state, and create a foundation for national development. Based on the above principles, the following learning objectives have been established:

1. Development of practical competencies and compliance with occupational safety regulations (ensuring that students acquire practical skills and abilities applicable in everyday life and the labor market, as well as adhere to occupational health and safety regulations in production activities).
2. Fostering work culture, independent thinking, and communicative competencies (developing students' sense of discipline, responsibility, effective time management, teamwork, and commitment to quality as core elements of work culture; cultivating skills of independent decision-making, planning one's own work, taking responsibility for results, cooperating within a team, listening to others' opinions, and engaging in effective communication) [9].
3. Development of technological creativity (enhancing students' technological thinking and cognitive abilities, fostering a creative approach, and expanding cognitive development through practical activities).
4. Formation of social responsibility and professional interest, and preparation for life(stimulating interest in labor activities, guiding students toward future career choices, preparing them for social life, and providing systematic, gradual, and continuous career guidance based on principles of social responsibility).
5. Development of independent action skills (promoting self-awareness, physical development, planning abilities, and independent task execution through practical assignments and project-based activities).
6. Understanding, applying, and utilizing modern technologies (teaching students to use modern tools, equipment, and technologies in practical activities; developing creative thinking aimed at generating new ideas and products through the application of technology and innovation [10]; optimizing labor activities through the use of information and communication technologies and digital tools).
7. Development of national folk crafts and universal human values, and preservation of cultural heritage (cultivating respect for national labor traditions and universal values, and transmitting

cultural heritage to future generations through training in national folk crafts and vocational skills).

8. Development of adaptability to the market, entrepreneurship, and resource efficiency skills (developing skills related to market adaptability, entrepreneurship, and resource efficiency through the creation of competitive products, and teaching the initial stages of establishing small businesses).
9. Development of research, design, construction, and modeling competencies (forming and enhancing abilities to analyze problems, collect data, conduct experiments, draw conclusions, and implement practical solutions, as well as developing technical, creative, and engineering skills).
10. Development of eco-technological culture (forming skills related to environmental protection, rational use of technologies, conservation of nature in the labor process, and raising awareness of environmental issues) [11].

By focusing on the development of students' practical skills in the Technology subject, their willpower, creativity, adaptability, and ability to collaborate with others are enhanced. Technology lessons are aimed at developing students' technical creativity, abilities, and thinking, as well as providing career orientation by teaching technologies for processing natural, metallic, and non-metallic materials. In addition, students acquire knowledge, skills, and abilities related to folk crafts, household skills, and electrotechnical work, and develop the capacity to apply them effectively in real-life situations.

In Western countries, research in the field of cognitive competence was initially focused on the business sector. D. G. Winter, D. C. McClelland, and A. J. Stewart developed the concept of "managerial competence." At the same time, primary attention was given to understanding situations, assessing opportunities, and the necessary scope of knowledge, that is, to developing comprehensive strategies for influencing others [12]. A key component of managerial competence is independent situational awareness based on observation and data. Therefore, conceptual and analytical thinking (through intellectual capacity) and the ability to apply knowledge in work-related contexts were assessed, and a measurement scale for cognitive skills was developed (D. C. McClelland).

Although the concept of "cognitive competence" appears in the classifications proposed by a number of scholars, including J. A. Mardonqulov, A. A. Ibragimov, G. A. Nafasov, J. S. Otepbergenov, K. Kudratov, E. F. Zeyer, I. A. Zimnyaya, A. V. Khutorskoy, A. Gilev, E. V. Vyazova, N. I. Samoylova, and O. V. Kharitonov, its substantive content has been insufficiently studied. For this reason, the present research seeks to provide a more comprehensive analysis of the concept of cognitive competence, as well as to elaborate on its essence and content [13].

When considering the cognitive subject in relation to educational activity, the approach that "cognitive competencies determine an individual's abilities, readiness, and motivation" corresponds to the key principles outlined in J. Delors' Report of the International Commission on Education for the Twenty-first Century (Table 1).

Table 1. Cognitive educational paradigm.

Learning to know	Learning to become a cognitive subject and to engage in cognitive activity.
Learning to create	Learning to engage in creative activity.
Learning to live together	Learning to organize the environment and to function effectively within it.
Learning to be	Learning to realize one's potential and capacities.

In this study, students' cognitive competence is understood as their readiness to acquire knowledge, skills, and abilities, their capacity for cognitive development, as well as their personal potential and need for self-development.

According to many scholars, cognitive competence ensures the effectiveness of developing both professional and general competencies, which makes its development one of the priority tasks of modern education.

I. A. Zimnyaya characterizes competence in cognitive activity as the ability to pose and solve cognitive problems in the process of research and intellectual activity, using productive and reproductive cognition, to find non-standard solutions, and to create and resolve problem situations [14]. She places particular emphasis on competencies related to self-improvement, self-regulation, self-development, as well as personal and intellectual reflection.

A. V. Khutorskoy defines learning and cognitive competence as the ability to set goals, plan, analyze, reflect, and conduct self-assessment, as well as students' creativity, understood as mastering ways of acquiring knowledge from the surrounding reality and acting in non-standard situations when solving learning and cognitive problems.

E. F. Zeyer, in discussing cognitive (gnostic) competence, notes that "this competence involves the ability to process and structure information, engage in independent learning, transfer learned methods to new situations, establish interdisciplinary connections, and locate information sources."

S. G. Vorovshikov interprets learning and cognitive competence as learners' self-regulated activity, emphasizing that this competence is formed through skills necessary for acquiring, processing, and applying knowledge.

The competencies listed above can be regarded as manifestations of cognitive competence as a form of competency. This view is supported in the studies of B. Xodjayev, A. A. Ibragimov, J. S. Otepbergenov, E. V. Vyazova, and L. A. Osipova.

Reflection enables an individual to anticipate the actions required, to select and formulate goals, to analyze their significance and ways of achieving them, to organize activities according to specific methods, and to develop new ways of carrying out actions [15]. It also facilitates self-knowledge, allows the monitoring of actions based on certain criteria, the creation of one's own criteria, and supports the observation and evaluation of actions. In reflecting on this concept, J. Dewey defines reflection as a characteristic of a thinking individual who is capable of investigating and analyzing personal experience and who continuously strives for self-development, describing such a person as a "lifelong learner of one's own profession."

Reflective control makes it possible to identify the causes of "gaps" in the flow of activity, to recognize the ineffectiveness of the chosen mode of action, and to perceive the limits of one's own knowledge. V. V. Davydov identifies three processes of reflection:

- Reflection related to the implementation of the activity and focused on its processes and outcomes;
- Reflection aimed at ensuring the coordination and organization of interaction among partners;
- Reflection directed toward the development of self-awareness.
- According to v. V. Davydov, these processes of reflection correspond to the following mechanisms underlying the emergence of reflection:
- The interruption of object-oriented activity in situations created by the teacher (where various types of information serve as the objects of cognitive activity);
- Discussion and reflective interaction during the joint solution of a class or group problem (task);

- The cultivation of internal reflection.

Reflection develops students' abilities to find correct and prompt solutions in complex and problematic situations, to rely on their experience, and to stimulate research-oriented and creative processes. As a cognitive process, reflection determines the level of self-awareness and cognition (including willpower, emotions, character, needs, habits, and experience), as well as the ability to set goals within one's own activity and to analyze that activity.

The concept of "readiness" is interpreted by many psychologists as a special psychological state that should be understood as a complex, goal-oriented manifestation of personality. L. V. Shkerina writes that readiness for a particular type of activity includes previously acquired attitudes, knowledge, skills, and abilities necessary for carrying out that activity. She also identifies factors that hinder the formation of readiness, such as a passive attitude toward tasks, indifference, the absence of an action plan, and the failure to make maximum use of one's own experience.

In this study, cognitive competence is understood as an integral personal quality that ensures an individual's readiness for self-education, independent learning, and personal and professional development. The mechanism of self-education includes the subject's selection and acceptance of the goals of their own activity, a personal attitude toward preparing an action program, self-control, self-assessment, and the analysis of one's own activity.

Based on the analysis of the definitions presented above, we propose the following formulation of cognitive competencies. Cognitive competencies manifest themselves in the process of cognitive activity associated with processing information in order to solve tasks. They include formal knowledge, skills, and abilities acquired in the educational process, as well as additional knowledge based on personal experience and self-development.

Conclusion

To sum up, the research reveals that cognitivist adequacy is a central integrative trait showing out students' preparedness for independent work, self-growth, and proficient behavior under the competency-oriented higher medical training system. The results indicate a strong correlation between study results and the systematic utilisation of project-based learning, interactive technologies, and reflexive practices to increase the level of students' cognitive activity, development of problem-solving skills, and ability to transfer deep theoretical knowledge into practical activities. It further points out the importance of reflection, motivation, and self-regulation as core elements that bolster general and professional competencies, especially concerning technology education. These findings suggest that faculty at higher education institutions can better respond to labor market and societal needs by providing instructional strategies aligned with state educational standards, with a focus on competencies. More work is needed to provide empirical evidence on the medium to long-term effect of cognitive competence development on graduates' professional performance, especially relating to accounting, and the use of digital and interdisciplinary approaches to develop cognitive competence across a range of fields of study.

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