American Journal of Applied Science and Technology

VOLUME Vol.05 Issue 11 2025
PAGE NO. 178-181
DOI 10.37547/ajast/Volume05Issue11-34

Innovative Approaches To Assessing Medical Students' Knowledge And Professional Competence In A Competency-Based Educational Model

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Received: 30 September 2025; **Accepted:** 23 October 2025; **Published:** 28 November 2025

Abstract: The article analyzes the results of applying the competency-based approach in the higher education system. The role of biochemistry as a fundamental academic discipline in the formation of basic and professional competencies of future medical workers is considered. Examples are given that the main integral tool for monitoring the results of students' educational and cognitive activities is the rating assessment system.

Keywords: Professional competence, theoretical knowledge, practical skills, professional skills, active play techniques, student portfolio.

INTRODUCTION:

The traditional educational paradigm no longer meets the requirements of modern education set by society [1–3]. Today, a university graduate must be competitive in the labor market, capable of working independently and in a team, able to apply acquired knowledge in practice, and able to objectively evaluate the results of their own professional activity. Therefore, one of the most important directions in modernizing the educational system of our country is the implementation of a competency-based approach in the training of specialists.

Currently, in education, there exists a problem of terminological inconsistency in defining the concepts of competence and competency, as well as in assessing and objectively measuring them within pedagogical practice [2,4].

Professor M.A. Choshanov, Doctor of Pedagogical Sciences at the University of Texas, states that "competency is not only a person's knowledgeability, but also the continuous renewal of that knowledge." According to M. Aronov, competency reflects a specialist's readiness for a specific type of professional activity.

O.Ye. Lebedev argues that competency is the ability to act effectively in uncertain situations. I.A. Zimnyaya writes that competency is grounded in an individual's intellectual, personal, social, professional, and life activity. A.V. Khutorskoy distinguishes between the two concepts as follows: competence is the integrative combination of personal qualities (knowledge, skills, experience, and methods of activity) that enables an individual to perform effectively in a specific domain; whereas competency represents the set of competences required for a person to demonstrate an adequate and responsible attitude toward different types of activity.

As seen from the above, discussions regarding the essence and societal role of competence continue among scholars. Understanding the components of universal key competences in education remains one of the central issues of modern pedagogy. Opinions vary widely on whether competence criteria should be based on international pedagogical experience or derived from traditional Uzbek pedagogical norms, and many questions in this field remain unresolved.

According to L.T. Khurvalieva, a pedagogical scholar of the Avloniy Institute for Teacher Professional Development, "Competence is the manifestation of knowledge, skills, abilities, attitudes, personal values, and qualities, and the ability to apply qualification effectively."

METHODOLOGY

For our research, defining the concept of professional competence is of great importance. Professional competence can be understood as the willingness and ability to act purposefully in accordance with job requirements, to independently and systematically perform tasks and solve problems, as well as to objectively evaluate the results of one's own activity. A specialist's professional competence is manifested in their ability to adequately solve both standard and, especially, non-standard tasks in various professional situations.

The issue of professional competence/competency has been examined within the context of various studies conducted by educators and psychologists, including activity theory (L.S. Vygotsky, A.N. Leontiev, S.L. Rubinstein), cognitive activity of the individual (K.A. Abulkhanova-Slavskaya, V.G. Afanasyev), learner-centered education (V.V. Kraevsky, V.S. Lednev, I.Ya. Lerner, V.V. Serikov, I.S. Yakimanskaya), and problem-based and modular learning approaches (K.Ya. Vazina, V.V. Guzeev, J. Dewey, A.M. Matyushkin, M.I. Makhmutov, W. Okoń). Analysis of the literature shows that most studies focus on general pedagogical issues, with far less attention given to methodological aspects of instruction.

Our research is devoted to developing a methodological system that ensures the formation of students' competencies in various areas of biochemistry education.

According to experts in the history of science, at present there is virtually no theoretical or applied field of biology or medicine that is not fundamentally connected to biochemistry. Modern biochemistry lies at the crossroads of numerous natural sciences, including medical chemistry, organic chemistry, physical chemistry, pharmacy, anatomy, physiology, immunology, and microbiology. Biochemistry may be considered the fundamental language of all-natural sciences, as it studies the structural and metabolic principles common to all living organisms.

At the same time, biochemistry serves as the theoretical basis for medicine, agriculture, biotechnology, genetic engineering, and several industrial sectors. Biochemical analysis methods–particularly various chromatographic and electrophoretic techniques–serve as essential tools for scientific research and are widely used in environmental monitoring, food quality control, and laboratory diagnostics. Therefore, biochemistry is a core and fundamental subject in biology, ecology, chemistry, medicine, and agricultural education, and its instruction must be organized in a way that enables students to achieve the required level of learning and cognitive skills.

To achieve this, it is necessary to develop an appropriate methodology for enhancing student competencies, incorporating targeted, content-based, procedural, and evaluative-effectiveness components.

What innovations does a competency-based approach introduce into learning objectives? It becomes clear that learning objectives must be expressed through planned outcomes–namely competencies. Requirements should not be described in procedural terms but should be formulated as objective, action-oriented indicators. Based on these considerations, it is advisable, in our view, to use the taxonomy proposed by M.V. Rizhakov. According to this taxonomy, cognitive objectives are formulated in the form of requirements representing different levels of complexity.

Despite its apparent simplicity, this classification of cognitive objectives is highly informative, as each requirement encompasses an entire range of learning processes and has a generalized character. Within the framework of a competency-based approach, M.V. Rizhakov's taxonomy opens new possibilities for assessing students' educational achievements. Educational competence refers to the set of characteristics that define a student's preparedness, expressed in their readiness and ability to apply knowledge, skills, and abilities to a specific range of tasks.

Thus, student competency implies the manifestation of the full range of personal qualities relative to competence. Clearly, some competencies are more universal or more broadly applicable than others. This raises the issue of classifying and hierarchizing competencies.

Analysis of pedagogical literature shows that many researchers build upon A.V. Khutorskoy's classification system developed for general education. According to this system, key, general subject, and subject-specific competencies are distinguished. Subject-specific competencies are understood as those that possess unique characteristics and can be developed within the framework of particular academic disciplines, in contrast to the broader two categories [5].

RESULTS

In the context of professional education, several approaches exist regarding the classification of competencies. According to the new educational standards, the final outcome of university studies is the development of a set of general cultural and

professional competencies in graduates that corresponds to the state educational standard of higher professional education and the required level of training.

The technology of competency formation involves compiling a list of educational competencies that may be developed within a specific academic discipline, taking into account their social and personal significance for students. When designing students' competencies in biochemistry, it is essential to consider the contribution of this discipline to the formation of the future specialist's general cultural and professional competencies.

As a core academic discipline, biochemistry is characterized by relatively stable content, as its cognitive component plays a crucial role. Understanding the nature of intracellular metabolic reactions, their interconnections, and the mechanisms of regulation and energy supply of vital processes is necessary for any future biologist or ecologist in their professional activity. Therefore, while ensuring that students achieve the required level of disciplinary competence in biochemistry (which undoubtedly presupposes deep scientific knowledge), it is equally important to emphasize the interdisciplinary nature of biological chemistry and its close relationship with nearly all fields of modern biology, ecology, and medicine.

The use of modular learning technologies allows the process of forming students' competencies in biochemistry to become more manageable and flexible. A module is understood as a logically complete segment of the discipline's content, the study of which must be completed with an appropriate form of assessment that verifies the disciplinary competencies acquired by students through mastery of the module.

Changes in the requirements for organizing the educational process necessitate a revision of instructional forms and methods. Implementing a competency-based approach requires that teaching methods promote the accumulation of personal experience in applying competencies and foster emotional and value-based engagement in learning activities. In our view, these requirements are best met by creative activities, game-based learning, situational analysis, and laboratory work, particularly those involving the solution of cognitive problems.

In our study, the evaluative and effectiveness components of the methodology for developing students' disciplinary competencies are assigned a central role. According to most scholars, this component—the objective diagnostic assessment of the level of knowledge, skills, and competencies acquired by students—is simultaneously the most challenging and the most essential element of the methodology. The assessment system must evaluate the degree to which planned learning outcomes are achieved, contain clearly defined criteria understandable to all participants in the educational process, and encourage students to engage in systematic independent work throughout their studies. In our view, a rating-based assessment system serves as an integrated tool for monitoring students' academic and cognitive performance.

Our experience in developing and implementing a rating assessment system in the educational process, along with the analysis of theoretical and practical research on rating-based assessment and the study of best practices among several educators, shows that assessing students' academic achievements through a rating system increases the overall effectiveness of the educational process. It motivates students to complete various tasks on time, enhances their interest in the subject, stimulates their creative activity, and improves their ability to engage in self-monitoring [6–7].

Rating-based assessment is effective when it is grounded in the accumulation and accounting of points earned for various student activities: completing laboratory work (including research components), active participation in lectures and laboratory sessions, independent mastery of knowledge and skills, preparing presentations on selected topics, creating crosswords, and engaging in group projects and other creative tasks. In this way, a student portfolio is formed.

The rating system increases the student's role in the outcome-oriented educational process, initiates creative activity, activates learning processes, promotes the development of informational, communicative, educational, and cognitive competencies, and reveals students' personal potential while strengthening their self-esteem and self-control.

For the instructor, this system provides an opportunity to approach assessment objectively, track the dynamic progress of each student's academic activity, and make timely adjustments to the instructional process based on intermediate results.

A comprehensive set of assessment tools should be used to evaluate competencies, including:

– standardized tests;
– subjective scaling and self-assessment

methods;

– active learning techniques (e.g., blitz games).

CONCLUSION

We have developed a set of standardized tests in biochemistry, including entry and exit assessments, situational tasks of various complexity levels, and didactic blitz games for more objective and integrated evaluation of disciplinary competencies. Students' accumulated points for all types of work within each module are summarized, taking into account timely completion, early submission, active participation in lectures and laboratory sessions, and additional points for creative work related to their interests. In our view, such a system of monitoring academic and cognitive activity enables the future specialist to become an active participant in the educational process, fosters educational motivation and self-regulation, and contributes to the development of both professional and general cultural competencies.

Thus, we identify the following didactic conditions necessary for forming students' competencies in biochemistry: defining the structure and levels of disciplinary competence, utilizing a comprehensive set of assessment tools, and implementing rating-based evaluation of students' academic achievements using the elements listed above.

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