PROBLEM OF MEASURING AND EVALUATING COMPETENCIES IN HIGHER PROFESSIONAL EDUCATION

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Abstract. Evaluation of the results of educational activities is one of the most discussed, controversial and unresolved problems in education. The purpose of this article is to analyze the methods and technologies for measuring the formation of competencies and assessment of the educational results. To introduce a competency-based approach, serious adjustments to the educational process are required, which should be associated with changes in teaching and assessment methods. The assessment of the quality of training of students involves assessment of the level of mastering disciplines and assessment of students' competencies. The criteria-based approach and operational approach are used to build the system of assessment of individual educational achievements of students. The development of a competency model is necessary to determine a set of abilities and characteristics of a student, clustering and profiling competencies. The competence model identifies the planned levels of professional competencies formation and the criteria for their assessment. A meaningful description reflects structural elements of competence according to its levels, based on the categories of B. Bloom's taxonomy of learning goals. As professional competencies cannot be observed directly, the educational activities are employed that will allow one to draw reliable conclusions about the level of formation of students' professional competencies. Situational, integrated and practice-oriented complex tasks are considered for the formation and assessment of professional competencies of students in this article. Modern software tools automate the processing of data; their work is based on the use of a Rasch model. A system for assessing the levels of competence formation consists of principles, assessment tools, and forms of assessment. The assessment process for competencies can be represented as a sequence of interrelated stages: development of a competency model, requirements for competency levels, and assessment tools and assessment technologies. It is also important to ensure the reliability and validity of assessment procedure.

Key words. Competence-based approach, implementation of competence-based approach in higher school, competence, learning outcomes assessment, measurement of the formation of competence, validity, competency assessment, assessment tools

Basic provisions

The system of competencies in Higher Professional Education is a systemic goal-setting factor, a planned, formalized and concretized result of mastering the educational program, which determines the direction, nature and actual results of the educational process of the university. Formation of competencies and assessing the levels of

formation of competencies differ significantly from traditional assessment systems; it includes a comprehensive diagnosis of problematic situaional and activity tasks.

As part of the discussion of issues of competence-based approach, general methodological provisions were formed:

- the most important characteristics of the competence-based learning is shifting the focus of attention in the results of education from knowledge, skills to competencies, abilities, motivation and personal qualities to carry out successful activities; it is associated with the possibility of solving a professional problem, getting out of professional situations of varying degrees of difficulty;

- the interdisciplinarity of competence as a result of education does not correlate with a specific academic subject, but with a group of disciplines;

- universities have received the right to redefine the set of competencies with the formation of a variable part of the educational program.

Evaluation of the results of educational activities is one of the most discussed, controversial and unresolved problems in connection with the continuously changing requirements of society for the results of education, the development of pedagogical and psychological sciences [1].

Difficulties in assessing competencies are associated with their complex component composition, interdisciplinary nature, deeply latent nature, and the delayed nature of their complex manifestation in professional activities.

Introduction

Assessment measures the effectiveness of teaching methods. Assessment in training plays an exceptional role: there are characteristics of readiness of university graduates, to fulfill professional duties, and employers pay attention to them in the first place. Therefore, methods for adequately measuring the formation of competencies are of such great importance [2].

In recent years, quite a lot of experience has been accumulated in the implementation of the competency-based approach, including the content and essence of the basic concepts of "competence", "competency", "professional competencies" etc., technologies and methods of formation of competencies of bachelors, specialists of different directions and profiles of training, and the problems of the formation and assessment of competencies.

Problems of competence-based education, as a theoretical and methodological basis for effective practical solutions in educational process, have been developed by scientists Kunanbaeva S.S., Chaklikova A.T., Khutorsky A.V., Zimnyaya I.A., Verbitsky A.A., Larionova O.G. and others. They assume the complexity, multidimensionality and ambiguity of the interpretation of the concept of *competence* and the methods of assessing the level of its formation. The formation of competence is defined as the readiness and ability for specific actions, the search for a new way of acting in a non-standard situation [3].

At the same time, teachers experience significant difficulties due to a certain blurring of ideas about the essence and structure of competencies, and, therefore, about the methods and means of their control and evaluation. Based on the materials of

sociological research, many teachers often replace the subject of assessment: instead of competencies, traditional knowledge, skills and abilities are subjected to diagnostics. Moreover, this takes place at all stages of control: current, rating and final. As a result, a situation arises when the designed system of higher education is focused on the formation of students' competencies, and in the real process traditional knowledge, skills and abilities are formed and actually diagnosed at the output.

Comprehensive measurement and objective assessment of competencies is a new educational task that cannot be solved exclusively by traditional methods of control and assessment. At the moment, there are no methodological guidelines, unified recommendations for the formation and assessment of competencies[4].

Thus, the competence-based approach becomes dominant, turns into the conceptual basis of a new strategy in the educational sphere. However, despite the fact that a lot of time has passed since the announcement of the transition to competence-based training, the knowledge approach still dominates, and the formation and assessment of competencies in most cases is associated with the development of didactic units of program material. In addition, assessment methods are widely used that do not reflect the dynamics of the formation and development of competencies, the existing system of assessing the formation of competencies in terms of the amount of acquired knowledge is preserved.

Materials and methods

The method of analysis was applied by the authors to study the publications on measurement and objective assessment of competencies. The conducted analysis of pedagogical and methodological literature showed that the transition to competence-based training radically restructures the education system. The content, educational technologies, and the system of assessing students are changing. Competency assessment in the competency-based paradigm differs from traditional assessment. This is a new task of higher education, which cannot be solved only with the help of traditional methods of control and assessment tools. Competences can be assessed only during the activity of the students, and therefore, in order for them to manifest themselves, an appropriate organization of the educational process is needed, which differs in technologies, means and methods of assessment from cognitive (knowledge) learning outcomes [5].

The implementation of the competency-based approach requires the construction of a competency profile of graduates. When competence is considered as an object of assessment, the issues of isolating such constituent elements in its structure that could be subjected to objective diagnostics and assessment come to the fore. Our analysis allowed us to identify the approaches to determining the structure of competence.

For the formation and assessment, first of all, it is necessary to build a competency model that comprises planning the result of mastering competencies, identification of the structure of competencies and levels of achievement; formation of a set of assessment technologies for specific stages of student learning, methods for assessing the levels of mastering competence [6].

To assess the competence, it is necessary:

- to systematize the existing definitions of competencies in order to identify their differences from traditional ideas about the results of higher education;

– to identify requirements for competency assessment tools and procedures for developing these tools;

- to ensure the content and validity of competency assessment tools in the field of higher education.

O. Zlatkin-Troichanskaya, H. Pant and others aim to develop a new generation tool aimed at measuring components of competencies as critical thinking, written communication, civic engagement, etc. As part of their project, scientists are working on scenario-type tasks developed within the framework of a holistic approach and the ECD (Evidence-centered Design) methodology [7].

Common to all approaches of measuring the formation of competencies is the need for a sufficiently large data set that adequately describes the process of mastering competencies. It is generally accepted that estimates are largely debatable in nature, and therefore a significant number of observations are needed to achieve acceptable reliability. To test various hypotheses and study the statistical characteristics of the proposed indicators of the formation of competencies, the control scores that students receive during the examination sessions are completely insufficient. And vice versa, the study of assessments of current performance for each educational task performed in the process of studying disciplines will significantly improve the reliability of measurements. Another reason for the active use of assessments of current performance is the possibility of a detailed study of the process of formation of competencies, provided that each assessment is associated not only with a discipline, but also with a competence. Not only the fact of connection is important, a meaningful description of the corresponding task and evaluation criterion is also necessary. Only in this case it is possible to describe in sufficient detail the process of its formation for each competence.

Professional competencies cannot be observed directly, they can only be concluded on the basis of the activities carried out. In this regard, when assessing, it is necessary to determine a set of types of educational activities that will allow one to draw reliable conclusions about the level of formation of students' professional competencies. The use of integrated methods makes it possible to simultaneously evaluate several components of competence in accordance with the developed criteria and performance evaluation indicators.

In this regard, the best way to measure and evaluate the level of formation of competence among students is to provide them with the opportunity to find solutions, or rather, to analyze a specific situation. For example, T. V. Ledovskaya and N. E. Solynin consider the use of the case method as a diagnostic tool for assessing the level of formation of students' competencies. This method allows assessing formation of competencies of students and to adequately apply theoretical knowledge and skills, personal practical experience, and social abilities to solve practical problems. The method helps to evaluate the independence in taking decisions, the ability to take into account an alternative point of view, to express one's opinion with reason, reveals

analytical and evaluative skills, teamwork skills, finding the most rational solution to the problem and many other components of practical intelligence [8].

Portfolio can be used to evaluate the results of the practice. Portfolio is a selection of certified achievements, the most significant works and reviews on them. The main idea of a portfolio as a form and method of evaluating a student is a shift from authoritarian assessment to self-assessment. It involves what students can do on a given topic. It integrates quantitative and qualitative assessments.

#	Criteria				Total
	Presentation of information in the form of a problem	Suggestion of a way to solve the problem	Justification of the way to solve the problem	Demonstration of a way to solve the problem	
	(from 0 to 20 points)	(from 0 to 20 points)	(from 0 to 20 points)	(from 0 to 20 points)	100
Task 1					

Table 1 Measurement of competencies using practice-oriented tasks

Situational, integrated and practice-oriented complex tasks have great potential for the formation and subsequent assessment of general professional competence of students. Situation analysis involves the formation of skills and abilities to systematize and critically evaluate information. Practical tasks are aimed at developing the students' skills to apply theoretical knowledge of problem solving in practice. In the process of working on the task, the formulation of the presented information in the form of a problem, a proposal, justification and demonstration of a way to solve the problem are assumed. To evaluate practice-oriented tasks, the following criteria can be proposed, given in the Table 1.

Thus, in the course of the study, we found that the problem of measuring the competence of university students is relevant and requires a practical solution. Since competence cannot be directly diagnosed, measurement tools should be used that are of an activity nature and have a high degree of motivation to demonstrate competencies.

Results

At present, a certain typology of assessment tools has developed, the first group of which is based on quantitative, the second on qualitative levels of measurement (see Fig. 1).

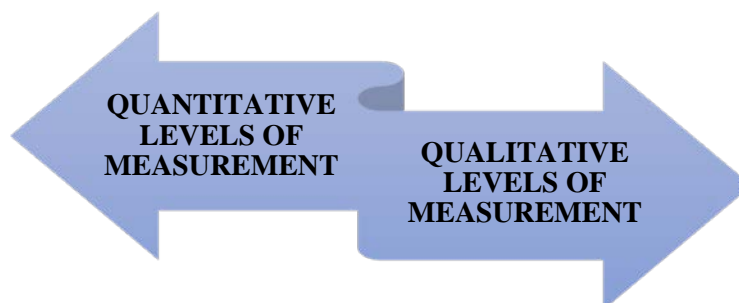QUANTITATIVE LEVELS OF MEASUREMENT

QUALITATIVE LEVELS OF MEASUREMENT

Figure 1 - Levels of competence measurement

The combination of quantitative and qualitative means of measurement is dictated by the fact that the competencies formed by the student are integral, complex characteristics of the level of his universal and professional qualifications. At the quantitative level of measurements, standardized tests and questionnaires with multiple choice of answers are used, which are processed automatically with the formation of statistical norms and rating scales. The qualitative level of measurements involves expert methods of evaluation, which will introduce a certain amount of subjectivity. If the majority of university teachers are more or less aware of the traditional means of assessment, then the development of case meters, portfolios and competency tests is relatively recent. These innovative funds are presented as promising, requiring their inclusion in the funds of evaluation funds.

The assessment of the quality of training of students is carried out in two main directions:

- assessment of the level of mastering disciplines;
- assessment of students' competencies.

The system for assessing the level of formation of competencies and learning outcomes has the following sequence:

1. Create a model of a system for assessing the levels of competence formation and learning outcomes.

2. Identify criteria, indicators for assessing the level of competence formation;

3. Develop means of assessing competencies (tests, project activities, cases, observation, questioning, portfolio, etc.).

4. Associate the formation of competence with learning outcomes through a system of descriptors.

5. Develop a system for monitoring the formation of competence [9].

In general, the assessment of competence formation is a latent variable, i.e. a hidden variable that cannot be obtained explicitly. As a rule, mathematical methods and modeling are used to process and analyze the obtained data. In this case, I.N. Eliseev proposes to use the Rasch logistic models, which have great potential. The score is determined by the probability of a correct decision. The higher the probability of a correct decision, the higher the level of competence, but lower for more complex tasks. This model allows you to get an estimate of the probability of correct completion of the task by students based on two parameters: the complexity of the task and the level of training of the student. These parameters are evaluated by a set of estimates obtained using statistical methods [10].

Modern software tools automate the processing of data; their work is based on the use of a one-parameter dichotomous and polytomic Rasch model.

In order to assess the components of competencies, it is advisable to use the following diagnostic tools:

- V.M. Rusalov's questionnaire for diagnosing personality traits that characterize temperament;

- Eysenck questionnaire for measuring personality temperament and etc.

There is also a block of software products that allow an assessment of the student's professional competencies, as well as give some recommendations on what competencies currently need to be developed and how this can be done:

− LinkedIn is a professional social network. Access mode: http://ru.linkedin.com/;

− products of the company "Educational Bureau "Soling". The company "Educational Bureau "Soling" develops software products for assessing competencies. The Internet application allows a step-by-step assessment of competencies.

Universities can create their own competency assessment service on the basis of the platform "Competency Server" of the Soling company. It is assumed that the functionality of the competency assessment service will be available from the electronic cabinet to all university students. The electronic cabinet is a web application that provides access to information about students and teachers. Its main function is to monitor the current progress of students. Students can take the test and find out the following:

− what competencies they have and which they should actively develop;

− what roles are recommended for them to perform in projects;

- in which scientific field they should choose a project.

They will also be able to take part in meta-games that develop project skills and receive a list of recommended online seminars and resources for studying based on the results of assessing the level of various competencies.

Discussion

The introduction of a competency-based approach in higher education involves the process of accumulating experience in this area, its comprehension, research, scientifically based developments to create a holistic psychological and pedagogical theory of competency-based learning. But such a cardinal shift in higher education has not yet taken place.

It is obvious that the formation of professional competencies among students is not only difficult, but also very responsible, since deep mental cognitive processes, social attitudes and personal formations are involved here, such as volitional regulation, self-organization, responsibility and many others.

The transition to competence-based learning radically changes the education system, including the system of student assessment. Competence assessment is an integral part of the educational system and performs the function of monitoring the achievement of an educational result - the level of competence formation in the process of mastering the educational program. Modern methods of assessing achievements in higher education usually consist of authentic tasks that reflect real life: decision-making and problem-solving situations are taken from various areas of professional and everyday life. Compared to other types of assessment, such as multiple choice items, current achievement assessment methods have a high validity.

The development of such assessment system implies the simultaneous construction of three main interdependent blocks: competency measurement, competency assessment, description of measurement and evaluation tools.
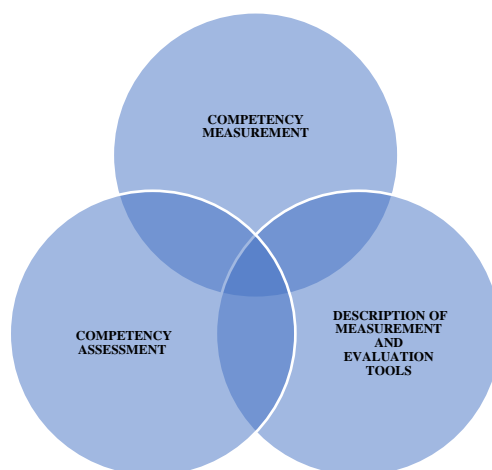
Figure 2 - Three main interdependent blocks of assessment system

The general assumptions that result from different studies become the basis for the principles of assessment. Principles for assessing the level of competence formation are consistency, reliability, clarity, validity, accessibility of assessment results (see Fig.3).
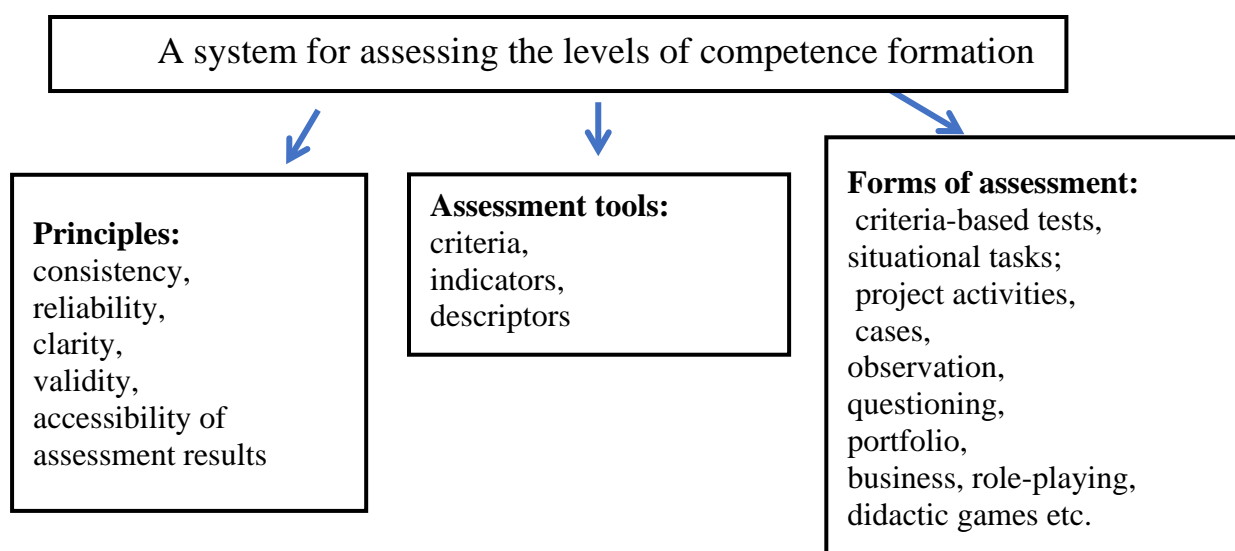

Figure 3 - Model of a system for assessing the levels of competence formation and learning outcomes

The following approaches were used to build the system of assessment of individual educational achievements of students:

- criteria-based approach (determining for a unit of measurement one of the signs (manifestation) of the characteristics of the result of education),

- operational approach (defining a correctly performed operation of an activity as a unit of measurement).

The competence model prescribes the planned levels of its formation and the criteria for their assessment. A meaningful description reflects structural elements of competence according to its levels, based on the categories of taxonomy of learning goals (B. Bloom): "knowledge and understanding", "application and analysis", "synthesis and evaluation".

Levels of formation	Descriptors
Threshold	The student has systematized knowledge and skills of solving standard problems. However, he experiences difficulties when faced with real tasks in his practical activities.
Advanced	The student has the ability to think outside the box that allows him to cope with quite difficult tasks even with a lack of knowledge and skills.
High	The student can independently cope with difficult real tasks, finding the correct method of solving them.

Table 2 - Levels of competence formation and the criteria for their assessment

Thus, the approach to assessing the formation of competencies, proposed by a number of researchers consists of multi-stage criterion-oriented measurements that allow us to obtain reasonable estimates of the level of competence formation.

Conclusion

Despite the relatively recent interest in the formation and evaluation of such complex constructs as competences, there has already been accumulated some experience in their evaluation in the education system. Assessing and measuring competencies is not an easy task for everyone. The university sets indicators for the achievement of competencies in the educational program independently. The set of planned learning outcomes in disciplines (modules) and practices should ensure the formation of all the competencies established by the educational program. High-quality tools are needed for the evaluation of complex competences: valid, reliable, with tasks close to the real life of the respondents.

Thus, the assessment process for competencies can be represented as a sequence of interrelated stages: development of a competency model as a necessary set of abilities and characteristics of a student, clustering and profiling competencies; determination of requirements for competency levels; choice of assessment methodology, planning and organization of assessment activities; development of assessment tools and assessment technologies. It is important to ensure the reliability and validity of milestone and final assessments. This is facilitated by the existence of standards for valuation procedures; standardization of pedagogical meters; statistical substantiation of indicators, criteria, norms and evaluation scales; creation of real or quasi-real conditions of activity when assessing students' competencies; ensuring the storage and accumulation of educational statistics, as well as the availability of assessment results to subjects of education for analysis and interpretation, use for self-control and self-analysis of achievements.

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ЖОҒАРЫ КӘСІБИ БІЛІМ БЕРУДЕГІ ҚҰЗЫРЕТТІЛІКТІ ӨЛШЕУ ЖӘНЕ БАҒАЛАУ МӘСЕЛЕСІ

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Аңдатпа. Оқу іс-әрекетінің нәтижелерін бағалау білім берудегі ең көп талқыланатын, даулы және шешімін таппаған мәселелердің бірі болып табылады. Бұл мақаланың мақсаты құзыреттіліктің қалыптасуын өлшеу әдістері мен технологияларын талдау және білім беру нәтижелерін бағалау болып табылады. Құзыреттілік тәсілді енгізу үшін білім беру процесіне елеулі түзетулер қажет, олар оқыту мен бағалау әдістеріндегі өзгерістермен байланысты болуы тиіс. Студенттерді даярлау сапасын бағалау пәндерді меңгеру деңгейін бағалауды және студенттердің құзыреттерін бағалауды қамтиды. Студенттердің жеке білім беру жетістіктерін бағалау жүйесін құру үшін критериалды тәсіл мен операциялық тәсіл қолданылады. Құзыреттілік моделін әзірлеу студенттердің қабілеттері мен сипаттамаларының жиынтығын, кластер және профильді құзыреттіліктерді анықтау үшін қажет. Құзыреттілік моделі кәсіби құзыреттілікті қалыптастырудың жоспарланған деңгейлерін және оларды бағалау критерийлерін анықтайды. Мазмұнды сипаттама құзыреттіліктің құрылымдық элементтерін оның санаттарына негізделген деңгейлеріне сәйкес көрсетеді. Кәсіби құзыреттіліктерді тікелей байқау мүмкін болмағандықтан, студенттердің кәсіби құзыреттіліктерінің қалыптасу деңгейі туралы сенімді қорытынды жасауға мүмкіндік беретін білім беру іс-шаралары қолданылады. Бұл мақалада студенттердің кәсіби құзыреттіліктерін қалыптастыру және бағалау үшін ситуациялық, интеграцияланған және тәжірибеге бағытталған кешенді тапсырмалар қарастырылады. Заманауи бағдарламалық жасақтама деректерді өңдеуді автоматтандырады; олардың жұмысы Раш моделін қолдануға негізделген. Құзыреттілікті қалыптастыру деңгейлерін бағалау жүйесі принциптерден, бағалау құралдарынан және

бағалау нысандарынан тұрады. Құзыреттіліктерді бағалау үдерісін өзара байланысты кезеңдердің тізбегі ретінде көрсетуге болады: құзыреттілік моделін, құзыреттілік деңгейлеріне қойылатын талаптар, бағалау құралдары мен бағалау технологиялары әзірлеу. Бағалау процедурасының сенімділігі мен негізділігін қамтамасыз ету де маңызды.

Тірек сөздер: Құзыреттілік тәсіл, жоғары мектепте құзыреттілік тәсілді енгізу, құзыреттілік, оқу нәтижелерін бағалау, құзыреттіліктің қалыптасуын өлшеу, жарамдылық, құзыреттілікті бағалау, бағалау құралдары

ПРОБЛЕМА ИЗМЕРЕНИЯ И ОЦЕНКИ КОМПЕТЕНЦИЙ В ВЫСШЕМ ПРОФЕССИОНАЛЬНОМ ОБРАЗОВАНИИ

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Аннотация. Оценка результатов образовательной деятельности является одной из самых обсуждаемых, дискуссионных и нерешенных проблем в образовании. Целью данной статьи является анализ методов и технологий измерения сформированности компетенций и оценки образовательных результатов. Для внедрения компетентностного подхода требуются серьезные коррективы в образовательный процесс, которые должны быть связаны с изменениями в методах преподавания и оценивания. Оценка качества подготовки студентов предполагает оценку уровня освоения дисциплин и оценку компетенций студентов. Для построения системы оценки индивидуальных образовательных достижений учащихся используются критериальный подход и операционный подход. Разработка модели компетенций необходима для определения набора способностей и характеристик учащегося, кластерных и профильных компетенций. Компетентностная модель определяет планируемые уровни формирования профессиональных компетенций и критерии их оценки. Содержательное описание отражает структурные элементы компетенции в соответствии с ее уровнями, основанными на категориях таксономии целей обучения Блума. Поскольку профессиональные компетенции невозможно наблюдать непосредственно, используются образовательные мероприятия, которые позволят сделать достоверные выводы об уровне сформированности профессиональных компетенций студентов. В данной статье рассматриваются ситуационные, интегрированные и практико-ориентированные комплексные задания для формирования и оценки профессиональных компетенций студентов. Современные программные средства автоматизируют обработку данных; их работа основана на использовании модели Раша. Система оценивания уровней сформированности компетенций состоит из принципов, инструментов оценивания и форм оценивания. Процесс оценивания компетенций можно представить в виде последовательности взаимосвязанных этапов: разработка модели компетенций, требований к уровням компетенций, инструментов и технологий оценивания. Также важно обеспечить надежность и обоснованность процедуры оценки.

Ключевые слова: Компетентностный подход, внедрение компетентностного подхода в высшей школе, компетенции, оценка результатов обучения, измерение сформированности компетенций, валидность, оценка компетенций, инструменты оценки