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ДО ПРОБЛЕМИ ФОРМАЛІЗАЦІЇ МОДЕЛІ ПРОФЕССІЙНОЇ КОМПЕТЕНТНОСТІ ПЕДАГОГІЧНОГО ПРАЦІВНИКА

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Вивчення особливостей використання методів математичного аналізу в педагогічних дослідженнях, присвячених різноманітним аспектам професійної компетентності педагогічних працівникв дозволило виявити методологічне протиріччя між компетентнісним підходом до опису структури та знанієвим підходом, що використовується для опису показників професійної компетентності. В статті запропоновано спосіб уникнення даного протиріччя шляхом створення системи дескрипторів на основі таксономії Б.Блума.

Ключові слова: компетентнісний підхід; знанієвий подхід; сутність професійної компетентності; структура професійної компетентності; таксономія Б.Блума; система дескрипторів.

Артемьева И.Л., Ивашнёва С.В. К проблеме формализации модели профессиональной компетентности педагогического работника. / Дальневосточный федеральный университет, Российская Федерация, Владивосток

Изучение особенностей использования методов математического анализа в педагогических исследованиях, посвященных различным аспектам профессиональной компетентности педагогических работников позволило виявить методологическое противоречие между компетентностным подходом для описания структуры и знаниевым подходом, используемым в исследованиях для описания показателей профессиональной компетентности. В статье представлен способ устранения данного противоречия путем создания системы дескрипторов на основе таксономии Б.Блума.

Ключевые слова: компетентностный подход; знаниевый подход; сущность профессиональной компетености; структура профессиональной компетентности; таксономия Б.Блума; система дескрипторов

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The article presents the results of the study describing the application of mathematical analysis methods in pedagogical research on various aspects of professional educator competency. The study shows the methodological contradiction between the competency approach used in research for describing the structure and the knowledge approach used in research for describing indicators of professional competency. The article demonstrates how to eliminate this contradiction by developing a system of descriptors based on Bloom's taxonomy.
Keywords: competency approach; knowledge approach; essence of professional competency; structure of professional competency; Bloom's taxonomy; system of descriptors.

Introduction. Construction of mathematical models of real world phenomena and processes is one of the major methods of scientific cognition. This is due to computerization, informatization and new technology that influence the development of the society to a great extent nowadays. Applying mathematical models in pedagogical research is caused by the systems approach to the study of various phenomena, the necessity of comparing objects of research before and after the forming experiment, analysis of the data obtained.

The study of the methodological basis of pedagogical research on advanced professional training for educators shows that their mathematization is mainly limited to the application of statistical method analysis to assess objects of research before and after the experimental treatment.

The present paper aims to address major problems of formalization of professional educator competency model and to indicate solutions to these problems.

The topic is important today because there is growing interest in mathematical models for the use in humanitarian research due to informatization of all spheres of human activity.

Applying mathematical models in pedagogical researchis complicated by verbal descriptions of states (both real and planned.) To prepare them for further mathematical processing means to assign values to certain verbal states of the subject. Moreover, there is also unavoidable subjectivity when both developing and applying the scale of states for identifying the current state of a subject under examination. The changes in the states are qualitative therefore we consider the quantitative comparison of the qualitative changes. Formalization of these changes is one of the major problems of pedagogy the solution of which will put pedagogical research to a new level.

Verbal descriptions of the same object of pedagogical research (e.g. the structure of professional educator competency) are often different and provoke dispute among scientists and scholars. There is vast literature on development of professional educator competency in Russia: A.P. Akimova, V.R. Vesnin, I.D. Bagayeva, A.P. Voychenko, M.A. Gavrilova, R.Kh. Gil'meyeva, S.A. Druzhilova, L.M. Kalninsh, L.V. Krasil'nikova, V.Yu. Krichevskiy, N.V. Kuz'mina, D.S. Savel'yev, S.A. Khazova and others. The same issues are studied in Ukraine (B.A. D'yachenko, L.V. Kondrashov, V.V. Maslov, V.V. Oleynik, V.I. Putsov, N.V. Skripchuk) and other European countries (K. Baumgärtner, I. Diedrich, H. Messner, K. Reusser, W. Hissnauer.)

These works cover the period from 1980 till present and demonstrate a new level of disputes due to the changes in the education paradigm and transition to the competency approach in education. They also show a certain methodological contradiction as they claim they use the competency approach when describing components/goals and results of advanced professional training for educators but instead they do use the knowledge approach when describing knowledge and skills to be acquired by a specialist.

Being the cornerstone of most research, the model of professional competency usually consists of three or five components (e.g. cognitive, technological (or operational), personal (motivational/affective.) Despite these terminological differences, this theoretical model generally demonstrates the components specified by teachers and professors which make it possible to consider this structure fundamental. In most works, levels of the professional competency are determined by the linguistic variables ‘low’, ‘middle’, ‘high’.

The analysis reveals that some researchers being focused on the quality of solution of a professional task that is specialized and contextual leave the proportion of that task in the professional activity and the impact of the results on the whole educational influence out of account. Such an approach leads to an increase in the number of research on health saving, communicative, information and communication, multicultural, administrative, professional and educational, subject-specific and methodological competences of an educator. One of the reasons for this, from our point of view, is unsolved problems of formalization in pedagogical research.

In interviews and questionnaires, educators specify three main components of the professional competency (subject they teach, methods they use, attitude to their professional activity.) They also point out that there are some differences in the professional activity depending on the subject, methods of teaching and individual features of an educator. Respondents also point out structural elements common for all educators (general pedagogical competence, communicative competence, psychological competence.)This classification lets us isolate invariant (common for all educators) and variative (specific for certain target groups) constituents of the professional competency. In practice, it is difficult to distinguish between some competences (e.g. ‘communicative competence’ and ‘foreign language competence of a foreign language teacher’, ‘linguistic competence’ and ‘subject competence’.) Thus, one needs such a structure of the model that shall represent the most important interrelationships, mutual arrangement of constituents, organized nature of the system.

Description of the essential content of this structure is provided by descriptors. The term ‘descriptor’ (L.L. descriptor, fr. L. describo) generally means a lexical unit (a word or a word combination) describing the main semantic content.

The major problem of formalization of educational processes and their results seem to be in developing a system of descriptors based on the competency approach and excluding the terms ‘to know’ and ‘to be able to.’ At present, retreat from the knowledge paradigm declared by most educational systems of the world and transition to the competency model is not supported by a corresponding system of descriptors which is still in the initial stage. This statement based on the analysis of methodological literature is supported by other researchers (Messner and Reusser, 2000.) It is also confirmed by the fact that in descriptions of results of training of educators there are terms specific for the knowledge paradigm.

It is necessary to note that the very usage of the terms ‘knowledge’, ‘skill’, ‘ability’ seems not to contradict the competency approach. Since ‘skill’ is generally defined as a capability to pursue an action according to the optimal parameters of an action and ‘ability’ is defined as a capability to perform an operation according to the optimal parameters (Leontiev, 2010; Passov, 1989), when determining levels of competency it is necessary to take into account that an ability is a basic level of the professional competency that has been formed before graduating from a higher education institution. The further changes in the professional competency may be diagnosed according to specific indicators of each component of the professional competency. Thus, the terms ‘know’ and ‘to be able’ are inherent to the so-called pre-competency level of professionalism.

For the purpose of eliciting these specific indicators, we conducted a survey the results of which were analyzed and systematized. In accordance with the structure of the professional competency shown above, in the system of descriptors there are verbal assessments (lexical variables) featuring different manifestation levels of specific components of cognitive, technological, personal competences. When creating descriptors, we took into account Bloom’s taxonomy (Bloom, 1956) that describes educational objectives and levels of cognition. This made it possible

to structure the manifestation levels of specific components of competences in the down-top direction. Bloom's taxonomy defines knowledge as the basic level of cognition on the basis of which through the activity the following levels are formed: comprehension, application, analysis, synthesis, evaluation. Since the basic level of an educator's competency includes application (i.e. according to the terms of the knowledge paradigm, forming an ability), the following levels, according to Bloom (Bloom, 1956) and others (Anderson, 1999; Anderson and Krathwohl, 2001; Tavares and Tavares, 2010; Callister 2012), are analysis, synthesis, evaluation. The latest three levels properly reflect the growth of professional educator competency through the whole period of the professional activity: isolating and borrowing the most effective methods and techniques used by more experienced colleagues (the 1st level), creating one's own methods and techniques (the 2nd level), assessing one's colleagues (the 3rd level.)

This structure and its essential content are considered to be optimal as they correspond to the three levels of the professional competency (or applying the terms of attestation commissions, the first category, the second category and the third category.) They also reflect changes in the levels of the competency related to the transition from simpler (basic) responsibilities to more complicated (expert) ones and eliminate the contradictions between the competency approach in education and the knowledge approach in describing learning objectives. Bloom's taxonomy makes it possible to solve the problem of the selection of descriptors which are based on the professional activity per se. Each specific indicator corresponding to a certain function or solution of a professional task requires three descriptors that correspond to the three levels of the competency. Each descriptor is based on three verbs relating to a certain level of the competency (analysis/synthesis/evaluation.) To determine an actual level of the professional competency of a certain educator means to choose a descriptor from the offered ones that describes the real states of each element of the structure the most precisely. This model can be amended: it is possible to add and change professional tasks that face a specialist in a particular educational institution (a school component) or in a particular region (a regional

component.) It will be also possible to adjust both the number of specific indicators of a certain component of the professional competency and their descriptors. It is compulsory that the descriptors correspond to the levels of Bloom's taxonomy (analysis – synthesis – evaluation.)

Conclusion. The three-component three-level model with a system of the descriptors can be used for development of an automated system evaluating the level of the professional educator competency. Further research should be devoted to clarification of the variative constituent of the professional competency model, determination of relationship between the actual level of the professional educator competency and content of his/her advanced professional training and automation of the evaluation processes of the actual level of the professional competency and design of an individual educational path.

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