

Objective model of professor of mathematics on theory of differential equations

I. Mikhaïlenko*

Department of Higher Mathematics
National Technical University "Kharkiv Polytechnic Institute", Kharkiv, Ukraine
*Corresponding author. E-mail: mirav72@mail.ru

Paper received 16.07.15; Accepted for publication 24.07.15.

Abstract. The article deals with the construction of the objective model of the professor of theory of differential equations, which consists of personal, functional, competence and activity components. Mentioned professor's objective model determines the personal qualities and pedagogical skills of a professor, the level of professional competence and a list of activities to create subject competences in students of technical profile of the theory of differential equations.

Keywords: higher education, professor, differential equations, objective model of professor of mathematics, competence, competence approach

Introduction. In modern times of society development the educationalists and men of science give huge attention to the preparation of specialists of technological field. It is due on the one hand to the increase of demands to the professional personnel of engineering skills of technological field, and on the other hand to the necessity of knowledge, skills and abilities acquirement common to their future professional activity. The formation of corresponding competences among students in the process of education can meet the above mentioned demands that are basically the social procurement to the education system. Implementation of the competence building approach demands the development of special educational technologies that allow to project education learning activity which is modeling future professional activity. Competence combines personal experience and knowledge interrelated with motivation and personal values in integrative way. The result of combination is cognitive and practical skills that allow to estimate the level of person's competence.

Industry standard [1] presents the list of summarized knowledge and skills on mathematics that a graduate of a technical university must have. Knowledge and skills presented in the Standard are summarized. They can be developed in student on different levels.

Brief overview of related publications. Scientific work analysis proves that scientists have cover certain questions concerning the preparation of future specialists of engineering skills, namely: content, forms and methods of organization of professional preparation of future engineers in higher educational institutions (A. Antonov, T. Belousova, I. Markhel and others); specificity of engineering thinking type (M. Zinovkina, S. Kuz'mirchuk, V. Konoplev, I. Lipatova, A. Savchenko, V. Shtyfurak, T. Shcherban'); ways of formation of professional culture and professional competences in future engineers (R. Gurevich, V. Vorontsova, I. Kolesnikova, H. Larionova, N. Krylova and others).

Object of the article. To build objective model of the professor of mathematics of a technical university on theory of differential equations that is based on competence basis and is basic for the creation of effective education technology.

Teaching of the primary material. Implementation of the competence approach in high technical school needs significant efforts of higher-education teaching personnel to form objective competences corresponding to the future professional activity of students. Nowadays high school needs a professor who is able to work individually, creatively and responsibly on a high professional level,

think creatively and act professionally in problematic situation. A professor is a mediator between students and educational material. Acquirement of this material is taking place directly during the process of studying that is why the professor has to be ready to be an advisor, helper, consultant, communicator, partner, tutor and etc.

Under the model (modulus – measure, example, standard) in a broad understanding people understand analog to the original (a part of reality) that is under certain circumstances reproduces qualities of original. In our opinion, a model is a conceptual tool oriented primarily on learning activity management. Concerning our research, professor objective model can be developed on basis of the previous systematic analysis of professor pedagogic activity.

Professor objective model (POM) is compiled on the basis of branch standards of higher education (educative qualification profile, educational and professional program, diagnostic method of specialist training quality), that are obligatory documents for training the specialists in each field of knowledge, determine the regulations to specialists of a certain qualification in the context of knowledge and skills.

Let us consider the **Professor objective model** of mathematics on the example of module "Differential equations".

Top-priority task during development of the POM has to be the analysis of certain personal qualities, social-psychological features and pedagogical skills of a professor the existence of which is the main direction and demand to his professional activity in technical university. All individual peculiarities of a professor structured in a certain way generate peculiar component of Professor objective model.

Chosen systematic approach during studying of the professor pedagogic skills of higher educational institution foresee the following: their consideration as a multiple tier system that has certain hierarchy and structure which is combined with other systems of human personality construction; studying the character of predicament of pedagogic skills of individually-psychological skill of a professor of higher educational institution; consideration of pedagogic skills as a dynamic system that is constantly developing; studying the influence of objective orientation of pedagogic activity and pedagogic experience of higher educational institution professor concerning interrelation and pedagogic skills structure [4].

Stage of the professional becoming, subject orientation of activity of professor of higher educational institution

individual style of his pedagogical activity and individually psychological properties of professor of higher educational institution are those independent variables that determine the development of professionally pedagogical and in detail pedagogical capabilities of professor of higher educational institution, and also character of intercommunications between them. In the result it influences determining appearance on progress of his professional activity. It is necessary to pay attention to the fact that individually psychological properties of personality of professor independently influence on progress of his professional activity. Between pedagogical capabilities from the one hand, and individual style of pedagogical activity and individually psychological properties of professor on the other hand, there is a reverse, in other words two-way communication. [3]

System of pedagogical capabilities of professor of higher educational institution has both general and specific for the representative of concrete specialization of description. A subject orientation of pedagogical activity and certain stage of the professional becoming is here those mediately links which change character of intercommunications and structure of pedagogical capabilities. Their development shows up in complication of type professionally pedagogical and in detail pedagogical capabilities, to the change of parameters separate individually psychological properties. It influences on changing of character of intercommunications both in pedagogical capabilities and between their components, on the one hand, and individually psychological properties of personality of professor of higher educational institution, on the other hand.

Functional component of POM touches general bases of planning and constructing of studies, organization and management of students activity. It must be inherent the professor of any profession, but designed in the plane of object which is laid out, in particular module "Differential equations". The special aspect foresees the presence of mathematical preparedness, knowledge of methods of teaching of separate questions of the module and abilities of their application, etc.

A reflexive constituent is based on re-thinking by the professor of pedagogical experience past and present, collective and personal. Such approach to the organization induces to the change of previous looks, initiator birth of new ideas, arousal a search analytically reflexive, structurally forecasting and other tasks on a management personal professionally pedagogical activity.

Competence component of POM is possible to form in professors through application of technology of context studies, not only subject maintenance of future professional activity is designed in which, but also set it social context. In context studies problem of maintenance of educational material is emphasized, which is offered to the students on lectures, practical classes, in quality of tasks for independent work or for an educational project.

If to take general classification of competences by A. Khutorsky [6] for basis and to select key, base and special a competence, it is possible to assert that a professional competence is nothing else, but the aggregate of key, base and special competences; we examine them as the hierarchical levels-stages of competence. These hierarchical levels-stages appear in all of the tools of structure of professional competence of professor: professionally active, communicative and personally. Thus, the key level of

noted competences needs the man of any profession for the effective functioning in an environment, base – to the professors of any object, and special – to the professors which lay out a certain object.

When considering a professional competence as a unity of theoretical and practical aspects of readiness of professor to realization professional activity, his structure, in accordance with approach by I. Isayev, O. Mishchenko, V. Slas'tonin, E. Shyyanov is presented through pedagogical abilities: ability to «transform» the bridge of objective process of education in concrete pedagogical tasks: research of personality of collective with the purpose of determination of level of readiness to the active capture by knowledge and planning on this basis of process of development; selection the complex of educational, developing and educate tasks; ability to create and bring the logically completed pedagogical system over in an action; complex planning educational-educate tasks; grounded selection of maintenance of educational process; optimum choice of forms, methods and facilities of his realization; ability to select and set intercommunications between components and factors of education, to start them going: creation of necessary terms; activation of personality, development of its activity, organization and development of compatible activity; providing of connection with an environment, adjusting of external not programmable influences and others like that; ability of account and estimation of results of pedagogical activity: self-examination and analysis of educational process and results of activity of professor; determination of new complex of dominant tasks, etc. [5, 42 p.]

Acquisition by the professor of experience of application of constituents of theoretical readiness in practice: through the imitation of future professional activity during role games, through project activity from solving the methodical problems, and during pedagogical practice found the reflection in an active component of POM. This component of POM from the module "Differential equations" examined by us as theoretical and practical readiness to the lead through of employments after this module after different educational materials, that appears in formed of the system didactic-methodical knowledge and abilities from separate sections and themes of the module, separate stages of studies and experience of their application, possibility effectively to decide standard and problem methodical tasks.

The professor of higher school solves various pedagogical tasks which are the reflection of specific of his professional activity. Therefore his professional culture consists of a few independent types of activity. A professor deals with most difficult, invaluable, dearest, that is in life – with a man. Health, mind, character, place and role in life of this man depends on professor and his ability, trade, art, life wisdom [2].

Let us introduce a fragment of the activity component of Professor Objective Model on theory of differential equations.

AC.1. Academic activity.

AC.1.1. Digestion of the fundamental knowledge.

AC.1.1.1. Knowledge of the purpose and intent of differential equations studying.

AC.1.1.2. Construction knowledge of module "Differential equations".

AC.1.1.3. Requirements document knowledge.

AC.1.1.4. Knowledge of method of building of timetable.

- AC.1.1.5.** Knowledge of demands towards mathematic preparation of the students.
- AC.1.1.6.** Knowledge of estimation criterion of educational achievements of the students; of main means, methods and forms of differential equations teaching process organization.
- AC. 1.2.** Ability to analyze and comprehend for the purpose of identifying and estimating relationships among different components and factors that influence the effectiveness of studying the differential equations.
- AC.1.2.1.** Peculiarities and building of the module “Differential equations”.
- AC.1.2.2.** Requirement documents: Government standard, academic and work programs.
- AC.1.2.3.** Requirements to the level of the educational achievements of the students on module “Differential equations”.
- AC.1.2.4.** Estimation criterion of the educational achievements of the students on module “Differential equations”.
- AC. 1.2.5.** Differential equations studying process: main methods, means and forms of educational process organization, potential structures of lectures and practical classes.
- AC.1.2.6.** Content of the module “Differential equations” or its separate parts or topics.
- AC.1.2.7.** Methodic system that are being implemented in current student’s books.
- AC.1.2.8.** Educational innovations when building the lessons or when studying separate topics o module “Differential equations”.
- AC.1.3.** Realize the goal of activity in the form of result that is being expected:
- AC.1.3.1.** Formulation of educative values that are being diagnosed, and studying of differential equations.
- AC.1.3.2.** Forecasting the pedagogical process (educational, developing and pedagogic possibilities of the content of the whole module “Differential equations” or a separate topic of the module, difficulties among students when studying the module).
- AC.1.3.3.** Forecasting of the results of the usage of one or another methods, means and ways of studying.
- AC.1.3.4.** Selection of methods, forms and means of achievement of educational goals and tasks.
- AC.1.3.5.** Imagine processing of the structure and separate components of the differential equations studying process.
- AC.1.4.** Plan the differential equations studying process.
- AC.1.4.1.** Composition of the work program on Advanced Mathematics for each studying year.
- AC.1.4.2.** Specification of the separate stages of the module “Differential equations” studying process and tasks that are peculiar to them.
- AC.1.4.3.** Planning of the expected results of the program for the specific year of studying.
- AC.1.4.4.** Planning of the differential equations studying process, clinging to demands of the mathematic preparation of the students.
- AC.1.4.5.** Planning of the content and types of activities of the participants of differential equations studying process.
- AC.1.4.6.** Specification of the form and structure of the educational process according to the stated tasks and characteristics of the participants.
- AC.1.4.7.** Planning of the individual work with the students for the purpose of on time provision of assistance or development of their abilities.
- AC.1.4.8.** Selection of forms, methods and means of education and pedagogic for acquiring qualitative educational results.
- AC.1.5.** Control and estimation of personal activity.
- AC. 1.5.1.** Estimation of the correctness of the stated goals and their transformation to one or another actions.
- AC.1.5.2.** Estimation of the adequacy of the priority task solution to the needed conditions.
- AC.1.5.3.** Estimation of the accordance to the content of student activity to the stated goals and tasks.
- AC.1.5.4.** Verification efficiency of the methods and means that are used in in learning activity.
- AC. 1.6.** Interpretation of the analysis results in order to form top-priority tasks and finding the best ways of their solution.
- AC.1.7.** Separation of tasks that appear during differential equations studying and developing the way of their solution, proving the ways of their gradual implementation.
- AC.1.8.** Diagnose the differential equations studying process correctly.
- AC.1.9.** Development of the diagnostic procedures according to the students’ educational results estimation criterion on separate topics of module “Differential equations”.
- AC.2.** Scientific and methodological activity.
- AC.2.1.** Creation of the new principles and methods of effective educational process.
- AC.2.2.** Development of the methodological support of module “Differential equations” according to the modern demands towards specialists training.
- AC.2.3.** Improvement of the existing forms and types of classes with students.
- AC.2.4.** Improvement of the contest, organizations and methods of differential equations studying using information technologies.
- AC.2.5.** Development of slides-lections, presentations and elements of remote course on module “Differential equations”.
- AC.3.** Pedagogic activity.
- AC.3.1.** Planning, organization and control of the students’ independent work.
- AC.3.2.** Formation of the creative work, students’ amateur talent activities that is shown in combination of art of teaching with initiative and amateur performance of the students.
- AC.3.3.** Development of the habit of positive thinking.
- AC.3.4.** Activation of the student government; formation of the special microclimate of warmth and trust, benevolence and understanding in all subdivisions and structures of higher educational institutions.
- AC. 3.5.** Systematic formation of peculiarity of the future specialist through the influence of all functioning structures and subdivisions in higher educational institution both during study time and non-study time.
- AC.3.6.** Formation of the professional qualities of modern specialist as a human and personality.

AC. 3.7. Performance of profession-oriented, awareness raising work and cultural and education work among students.

AC.3.8. Individual educational work with student groups.

Conclusions. Professor objective model on theory of differential equations is an informational basis for development of mathematic combined studying technologies on the basis of competency building approach, for control, optimization and organization of all types of learning ac-

tivity. The main goal of this model is to form technological profile of object competences on theory of differential equations among students. Usage of Professor Objective Model during studying of the differential equations gives ability to:

- Speed up the process of formation of the object competences, that are goals of education;
- Individualize the educative process;
- Create scientific and methodological support directed to the acquirement of the teaching material.

REFERENCES

- [1] Branch standard of higher education in Ukraine. Educational qualification Bachelor characteristics. Field of study 0902 Mechanical Engineering / Ministry of Education and Science of Ukraine. – 2002. – 140 p.
- [2] Isaev, I.F. Textbook for students of higher educational institutions / I.F. Isaev. – M.: Publ. Centre «Akademia», 2002. – 208 p.
- [3] Matviichuk, T.V. Psychological characteristics of pedagogical skills of teachers of higher educational institution: avtoref. dis. cand. psych. sc: 19.00.07 / T.V. Matviichuk. – Khmelnytskyi, 2009 – 22 p.
- [4] Pidkaminna, L.V. Psycho-pedagogical model high school teacher and ways of its realization / URL: www.psyh.kiev.ua
- [5] Psychology and pedagogy. Tutorial / ed. A.A. Bodalev, V.I. Zhukov, L.G.Laptev, V.A.Slastenin. – M.: Publishing House of the Institute of Psychotherapy, 2002. – 585 p.
- [6] Khutorskoy, A.V. Heuristic Learning: Theory, methodology, practice / A.V. Khutorskoy. M. – International Pedagogical Academy, 1998. – 266 p.