

Pedagogical conditions for forming the research competency in future teachers of mathematics

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Abstract: In this article: (1) the necessity of studying the theoretical aspects of such phenomenon as «the research competence of the future teacher and the relevance of identifying pedagogical conditions of its formation; (2) defined the concept of the research competence of a student-mathematician, as a holistic, integrated characteristic of future teachers of mathematics, manifested its readiness to take an active research position in relation to the educational mathematical activity and to provide the best research results on the basis of theoretical analysis domestic and foreign literature on the problem of research; (3) identified pedagogical conditions of forming the research competence masters for the further development of a technique of formation of the research competence of the future teachers of mathematics, create an integrated system of professional training of a teacher. Research competence is the key basis for the development of other, more specific and subject-specific competences, as it helps students to study, allows you to become more flexible, competitive, helps to be more successful later in life, and this determines the importance of its formation.

Keywords: scientific research, research competence, pedagogical conditions.

Introduction

The independence of the Republic of Kazakhstan, the changes in socio-economic development of Kazakhstan since the 90s, calling for reform in all spheres, caused radical changes in the education system. Tasks set by the President and the Government of the Republic of Kazakhstan for universities require raising the professional training quality, reaching the world standards level. In this connection there is a necessity of preparation of competitive teachers having the required qualities, knowledge and skills, capable to independently and quickly adapt to the ever-changing information and technological environment, i.e. possessing professional competence, one of the components of which is the research competence (Назарбаев, 2012).

Modern school needs professionally competent teachers, «capable of thinking creatively», «finding non-standard solutions», «taking initiative», who are ready to teach students to search independently for information, project and research. In this regard, the main task of the higher school is to train a new generation of teachers-researchers oriented on innovative economy of knowledge. Accordingly, teaching students methods of gathering and processing of scientific information through independent research practices within the competence approach becomes the topical issue of the higher professional school.

Such a task requires purposeful formation of the research competence in Master's students conducive to the release of initiative-like activity in people, the strengthening of their needs in knowledge, as well as creating conditions for increasing the research competence of future teachers through the organization of research, innovation and research activities, introduction of modern pedagogical technologies in educational process at the Institute of Master's and PhD program.

In the previous study were developed pedagogical conditions, model, methods and tools, technologies and methods of formation of methodical competence of the future teachers of mathematics bachelor degree in (Каскатаева, 2009). The subject of further research is the process of the formation of the research competence of students in the masters, who are ready to create their methods of organization of scientific work with mathematically gifted students with the purpose of development of scientific potential of the Republic of Kazakhstan.

The aim of our study is to identify pedagogical condition of formation of the research competence graduate pedagogical University.

The hypothesis of the study: if will be identified pedagogical conditions of forming the research competence graduate pedagogical University, it will allow to develop a model, methods and tools, technologies, and method of formation of the research competence of the future teachers of mathematics to create an integrated system of professional training of a teacher.

Methodology

Research methods. To solve the set tasks was used a range of complementary methods of research, study and analysis of psychological, pedagogical, methodical literature; empirical methods (pedagogical observation, interviews, questionnaires, testing, assessment and analysis of the educational programs); modeling.

Results and discussion

The main task of the Master's programs at pedagogical university is the deepening of specialization in a specific professional direction. Training in magistracy is an important step to becoming a professional researcher, a step leading young scientist to dissertation research. That is why research is important for students enrolled in Master's program at pedagogical university.

However, the current educational practice is not conducive to the maximum encouragement of research orientation in teaching work of the future specialist, thus causing the need for the study of the theoretical aspects of such phenomenon as “the research competence of future teachers and pedagogic conditions of its formation”.

Appeal to the vocabulary sources shows that they are the terms «competent», «competence», «competence».

If originated from the Latin word “competere”, which is translated into Russian by such verbs as “to seek”, “to approach”, “comply”, then under “competence” it is to understand the terms of reference of someone or the range of issues which someone is knowledgeable in. In the second case, the concept is considered as the thoroughness of knowledge, special abilities of man; it's a good subject orientation, high level of literacy, readiness for proper action. The essence of the concept of «competent» in this case is revealed when using the value of such verbs as «to legally require», «to have a right to such statements or actions», «to correspond to performing a specific job». As a result, speaking on the competence it should be emphasized that this is the possession of knowledge that allows a person to judge about anything...» (Каскараева, 2009).

There are many disputes on this issue in pedagogical circles. Competence is considered as «complex of operations, actions, knowledge, skills, activity, independence and other qualities of a person in decision-making process», presenting by itself the «highest level of skills to develop professional activity». Competence «is the ability to realize one's capacity in life (knowledge, skills, experience, personal qualities and other) for successful creative activities in a professional and social sphere», it is a «constitutive quality of the individual or the set of characteristics, minimum experience in the given sphere» (Каскараева, 2009, 18).

A.V. Hutorkoy notes that the competence-based approach is an approach, which focuses on education, and the outcome of education is not the amount of the learned information, but the person's ability to function in various problem situations (Хыторской, 2003, 55-61). A set of these situations depends on the specifics of life and educational situations. Competence-based approach is an approach in which the results of education are recognized significant outside education system, it requires a teacher to be flexible, mobile, to have research skills, allowing him to adapt his professionalism to the conditions of uncertainty and rapidly changing environment.

Competence-based approach attempts to contribute personal meaning in the educational process. «Personal knowledge, as well as the personal understanding, is not only the use of learning, read as some «values», but knowledge and understanding in the sense of participation of learned in one's life»

(Хуторской, 2003, 11). Personal meaning of knowledge helps a person to take competency-based solutions, thereby comply with the conditions of life. Thus, the competence-based approach in educational activity meets the requirements of socio-political life of the country.

A.V. Hutorsky builds the correlation between the concepts as follows: competence includes a set of interrelated qualities of the person (knowledge, abilities, skills, methods of activity), tasked in relation to a specific group of objects and processes, and necessary for quality productive activity in relation to them; competence - ownership, person's possession of a competence, including his personal attitude to it and the subject of it (Хуторской, 2003).

Thus, under competence we mean the set of requirements, as under the competency - experience in implementation of activities for implementation of the specific competence. Competence is a synthesis of two components: the possession of studying person of specific set of competencies; the prevailing personal quality of a person, who had completed certain level of education, which clearly expressed the «ability to act effectively, to achieve results - effectively solve the problem» and mobility of a specialist in labor market.

Research competency manifests itself in the theoretical literacy, possession of methods of psychological and pedagogical research, the ability to aggregate empirical data, draw conclusions, to present the results of the study. «Research competency» from the standpoint of the procedural-technological approach (A.V. Hutorsky) is considered as possession by a person of suitable research competence, which interpretes knowledge as a result of cognitive activity of a person in a particular field of science, methods, techniques of research he would have to master, in order to carry out research activities, as well as motivation and position of the researcher, his value orientations (Хуторской, 2003, 327).

The future teacher should have the following characteristics: independence and initiative, ability to overcome stereotypes. Here it should be noted the need for a high level of self-esteem so that the teacher can generate ideas, instead of waiting for them from outside. He needs not only have his creative potential, but to realize it.

As seen from the above, the personality of the teacher-researcher has very high requirements, which are manifested in complete commitment.

Research competence, according to many teachers (V.A. Bolotov, I.A. Zimnyaya, Y.V. Krivenko, S.I. Osipova, A.A. Ushakov E.V. Feskova, A.V. Hutorsky) is the key one. In confirmation of correctness of their position, they argue the following: research competence is formed on the basis of innate quality of all living beings (including humans), called the research behavior (S.M. Bondarenko, A.N. Poddyakov, V.S. Rotenberg, A.I. Savenkov and others), as well as a complex of elements, contained in different key educational competences (Хуторской, 2003).

In the framework of the competency-based approach, this concept would include functional activity and personal (quality of a teacher) aspects. As follows from the above, the research competency of a teacher has initiative-based character and cannot be seen or be evaluated outside of pedagogical activity.

If we consider the research competency from a systems perspective, it can be argued that it is a component of professional competency» (V.A. Adolf, L.A. Golub, A.A. Derkach, V.S. Lazarev, T.A. Smolina and others), as an integral component of General and professional education» (B.S. Gershunskiy, V. Laptev and others) (Каскараева, 2009, 38).

Y.V. Ryndina determines research competency as a whole, integral characteristics of future teachers, manifested in their readiness to take an active research position in relation to their activities and to themselves as its subject in order to transfer the semantic context of the activity from functional to transforming one (Рындина, 2011).

V.A. Slastyonin (Сластёнин, 1998) emphasizes that the structural components of the research competency must coincide with the components of research activities, and unity of theoretical and practical research skills make up the model of the research competency of a teacher.

Thus, we define the concept of «research competency» as follows: «the research competency of a Master's student studying mathematics is a coherent, integrated characteristic of future teachers of mathematics, expressing their willingness to take an active research position in relation to the educational mathematical activity and allow obtaining the best research results».

The formation of the research competency in the field of future professional activity is one of the most important objectives of all modern programs of higher professional education. «Higher education institutions should not be limited to educational functions ... should improve research activities» (Назарбаев, 2012) and it should:

- meet the topical issues of the specialty for which master's thesis is to be defended;
- be relevant, contain the scientific novelty and practical significance;
- be based on modern theoretical, methodological and technological achievements of science and practice;
- be performed with the use of modern scientific research methods;
- contain research (methodological, practical) topics for basic provisions to be defended;
- be based on best international experience in the relevant field of knowledge (Государственный общеобразовательный стандарт послевузовского образования РК, 2011).

For our study, it is important to determine the research competency's place in various classifications of key competencies.

In the classification of key competencies by I.A. Zimnyaya, the research competency is included as a component of competency related to human activities (Council of Europe, 1996).

In the classification of A.V. Barannikov, the research competence is given an independent role alongside with academic, social and personal, communicative, learner-adaptive and competency in the field of organizational activities and cooperation (Баранников, 2002).

Research competency in the classification A.V. Hutorskoy is seen as an integral part of cognitive competency which includes «methodological elements, above-subject, logical activity, methods of organization of goal-setting, planning, analysis, reflection». It also serves as a component of personal self-improvement competency, aimed at mastering methods of intellectual and spiritual self-development (Хуторской, 2003, 55-61).

In a framework of the international project «Definition and selection of key competencies», implemented by the Organization for economic cooperation and development and the national institutes of educational statistics, Switzerland and the United States identified important, from our point of view, characteristics of key competencies (Баранников, 2002):

- non-algorhythmicity (i.e. the ability to solve complex non-standard tasks requiring heuristic approaches);
- multifunctionality (i.e. the ability to solve complex non-standard tasks in situations of daily life);
- universality and above-subjectness (i.e. the ability to solve complex non-standard tasks of different domains of human activity);
- multidimensionality (includes a range of intellectual skills, knowledge, methods, activities, personal qualities).

Considering the characteristics of key competencies in relation to research one it can be stated that a student, carrying out research activities, solves problems through heuristic approaches, not using the known algorithms. This expresses a non-algorhythmical research competency. The student, engaged in research work, is able to endure a research approach on different spheres of activity and apply in different situations, that confirms multifunctionality, versatility and above-subjectness of research competence. The multidimensionality of the research competency is confirmed by students use of analytical, critical, communication and other skills, personal qualities, as well as common sense. This competency is mobile, mobile, variable in any situation and in any material subject.

Thus, in the result of the theoretical analysis of domestic and foreign literature on the problem of the study we conclude that research competence is the «key», the basis for the development of other more specific and subject-specific competences, as it helps students to study, allows you to become more

flexible, competitive, helps to be more successful later in life, and this determines the importance of its formation.

Consider the pedagogical process, aimed at the formation of the research competence of future teachers of mathematics at the Department of Informatics, mathematics and Informatization of education of the Institute of master and PhD program at Kazakh National pedagogical University named after Abai.

Research competence can be formed only in research activities. Teaching staff of the Department works on scientific projects with the involvement of graduate students and doctoral students in the Department. Key concepts that define the necessary conditions for the organization of such activities of the future teachers in the KazNPU named after Abai, the following: search, independence, initiative, practical action, experiment, collaboration, contradictions, different points of view. Weekly, the Department held a scientific seminar to discuss research projects.

It is revealed that high-quality work in the development of the competences determined, first of all, professional skills of the Manager. Mainstreaming became a student research, teacher education program should provide the following task - to teach undergraduates methods, principles, forms and methods of scientific research, the fundamentals of scientific knowledge and scientific knowledge, to give an opportunity for self-actualization to the students, through the decision of tasks of a scientific nature on an individual theme. The researcher should clearly that he should receive, how and when will achieve the end result. For inclusion in the independent study of магистранты you must learn to be able to produce new knowledge, to be able to apply in practice methods of scientific research to obtain new scientific knowledge, have a modern methods of primary data collection, their processing, receipt of the original maps, schemes, diagrams, calculation of indicators and indices.

Before you begin to organize research activities undergraduates as an innovative productive technologies of training, the Manager must determine not only does he have motivated undergraduates, but does he have the possibility to create necessary conditions for the successful realization of their creative abilities. In the organization of the activities of the formation of the research competence of a student should also take into account the psychological component of pedagogic interaction. Only if the relationship, when a graduate student and head of the work on equal and respectful of the "scientific" positions of each other to create a favorable psychological microclimate, positive impact on the personality development of the student and the results of its fulfillment.

In many pedagogical and methodological works the investigation is considered almost as a pedagogical panacea, allowing to overcome many problems of modern mathematical education - from formation of a new level of understanding of educational material to the professional orientation and personal self-determination of pupils. However, own experience of educational research organization identifies a number of difficulties related to the individual characteristics of a student, that every teacher faces in the course of such activities. These are the following issues:

- investigation topic choice;
- students' self-organization features;
- dynamics of working activity during the year;
- presentation of work results.

One of the first and, in our opinion, the most significant difficulties research activity is selection of topics. I think that the choice of research topic to be approached seriously. The topic should be very interesting for both the student and the supervisor, it is desirable to even consider whether it will attract attention of a future audience during the presentation of the results. Identifying research topic causes difficulties not only for the master's student but for the teacher. These challenges can be explained by little experience of research activity of the student, and the specific features of traditional study of scientific material, when the content is presented in finished form as valid an absolute knowledge, and for the researcher it is important not only approved of knowledge, but issues, ambiguities and questions. Yet there is an important circumstance, which impairs the choice of topics, - the topical issue of work is correlation of scientific novelty and practical significance of work. Often the chosen topic is by no means new, but it is important from the position of the education and

personal development. For me, as a scientific supervisor, assistance in determining the direction of research is always a responsibility, since at this stage not only the choice of the theme of self-education and self-development of the student and the teacher is formed, but the stage for the further choice of a student is being set, which determines the desire to continue their research.

The problem of self-organization is associated with the need for a student to independently build their work. In a traditional university education the student is not planning his work, writing assignments given by a teacher. The efficiency of research as a means of personal development has a reverse side the inability of the master's student to plan and implement their own actions. It is important for a teacher, while not missing the child's interest to work because "I don't know, don't know how, I have never going to be able to do it", to maintain faith of students in their own capabilities and resources. In this situation it is helpful for students, in order to remove the fear of worthlessness, to organize regular weekly (and, if necessary, daily) public meetings and consultations, in addition effectively forming a plan of action with the definition of the indicative timelines, breakdown of each phase of the research activities on specific tasks.

The next problem is the dynamics of the labour activity of students in the course of the year. As a rule, at the beginning of the year, there is a working enthusiasm, followed by a smooth recession ended crisis, then the "plateau" activity before spring conferences, when students re-acquire high level of industry. This feature of the activity is determined by an unusual form of activity, lack of templates, algorithms, routine in many repetition of experiments, processing of sociological polls data, study of scientific literature, etc. Here again the important role is of project Manager as a motivational factor: it should be determined what was achieved in the course of work, particularly highlight the successes of the students in their research, even if these data do not comply with anticipated outcome, pay attention to the success of the development of a student as a researcher, note the development of his skills of scientific activity. Very positive effect in a moment of crisis could be participation of a student in the events, where they can share intermediate results of their study. For example, presentation at the workshop, participation in the evaluation of the results of the other master's studies. In particular, there is an opportunity now to do it on websites, presenting the discussion of the research work.

A significant problem is the presentation of results of research work of the students. An important stage in the research activity is worthy presentation of the work results, the key to success can only be a serious preparation. Experience of participation in scientific-practical conferences and competitions of research works of young scientists shows that the standard form of the organization of these events (report - evaluation of the jury - awards) gives rise to some problems. Master's student is faced with strict requirements to the presentation of their work: the minimum time (usually 5-7 minutes) should be possible to fully present the substance and effectiveness of research. The worry before the presentation is strengthened by appraisal orientation and competition in the relations between the participants of conferences and competitions. In this situation, of course, the personal experience in public speaking is important, one can know the theoretical foundations of oratory, but it is their own feelings and skills of work with the audience that allow to be successful at this final stage of the research. A teacher should review with Master's student all the moments of the performance: the text, intonation, stress, pause, possible questions from audience and answers to them, appearance, management of multimedia presentation on a computer, phrases beginning and the end of presentation, methods of regulation of nervousness, location in relation to the audience and the jury, and other. Participation in conferences and competitions has, in my opinion, another important value in the formation of research competency of a student - the possibility to analyze performance of works and speeches of other participants of these events. While listening it is useful to write, mark the interesting research topics, methodology, liked the form of speeches, and, later on, in normal circumstances, calmly discuss all aspects of their presentation and defends of other master's students' works.

Conclusions

Highlighting the significance of this research it should be noted that Master's student, carrying out research activities, solves set-out issues through heuristic approaches, not using known algorithms. That is how a non-algorithmic nature of research competency is expressed. The student, performing research work, is able to endure a research approach on different spheres of activity and apply in

different situations, and this fact confirms multifunctionality, universality and beyond-subject-type research competency. The multidimensionality of the research competency is confirmed by students' use of research, analytical, critical, communication and other skills, and personal qualities. This competence is mobile, variable in any situation and in any material subject.

In conclusion, we emphasize that the research competence is the basis for the development of other more specific and subject-specific competences, as it helps students to study, allows you to become more flexible, competitive, and this determines the importance of its formation.

Thus, as a result of observations and generalizations of our experience we conclude that the formation of the research competence graduate mathematicians in the educational process will be effective, if you created the following pedagogical conditions:

- the content of education is focused on the formation of readiness of Master's students studying mathematics for research activity and satisfies the principle of reality, directed to development of universal methods of cognitive activity;
- organization of educational process puts a student in an active position of the researcher, acquiring universal methods of cognitive activity, engages in critical analysis, selection and design of student-significant content of research activities;
- Teacher carries out supervision of the research activities of Master's students studying mathematics and psychological and pedagogical support based on his formed readiness for such work.

The subject of further research may be the features of process of becoming a teacher-researcher in demand in any country of the world, who are ready to create their methods of identifying scientific issues, and organization of scientific work with mathematically gifted students with the purpose of developing scientific potential of the Republic of Kazakhstan.

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