

Project Method as a Means of Developing the Research Competence of the Mathematics Education Master Students

B. R. Kaskatayeva*, J. Tastanova, R. Abdullaeva

Kazakh State Women's Teacher Training University, Almaty, Kazakhstan

*Corresponding author: Kaskataeva@yandex.ru

Abstract The article defines the concept of research competence and a method of projects as a means of the development of the research competence of mathematics education master students. The article details on the essence of the project method and singles out the stages of its actualization in the educational process.

Keywords: *research competence, method of projects, search method*

Cite This Article: B. R. Kaskatayeva, J. Tastanova, and R. Abdullaeva, "Project Method as a Means of Developing the Research Competence of the Mathematics Education Master Students." *American Journal of Educational Research*, vol. 3, no. 12B (2015): 26-30. doi: 10.12691/education-3-12B-6.

1. Introduction

The independence of the Republic of Kazakhstan, the changes in the socio-economic development of Kazakhstan since the 90s, calling for reform in all areas, caused a radical change in the education system. The tasks set before the universities by the President and the Government of the Republic of Kazakhstan require improving the vocational training quality and reaching international standards. In this connection it is necessary to prepare competitive teachers with the necessary qualities, skills and knowledge, able to independently and quickly adapt to the ever-changing information and technological environment, i.e. have professional competence, one of the components of which is the competence of the research [1,2].

Modern school is in need of professionally qualified teachers. In this regard, the main objective of higher education is to train a new generation of teachers and researchers who would be focused on innovative activities.

The purpose of the study is to give an exposure to a method of projects as the main means of developing research competence.

The object of study: Development of students' research competency through the use of the method of projects.

Research methods: the study and theoretical analysis of Russian and foreign literature on the problem of research; monitoring; analysis and generalization of the advanced pedagogical experience.

We also applied a method of projects which is one of the main methods of the formation of research competence of the education students for the realization of specific tasks.

2. The Main Functions of Math Teachers' Professional Competence

Educational programs should equip the master students with the knowledge of the principles, forms and methods of scientific research.

On the part of the teacher it is required:

- the ability to select the most interesting of the projects;
- the possession of a sufficient arsenal of research, search and retrieval methods,
- the ability to arrange independent research of the undergraduates;
- assistance in developing the research skills.

2.1. The Content of Functions and Typical Problems

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

The word "competence" originates from the Latin word "*competens*", which means a cluster of related abilities, commitments, knowledge, and skills that enable a person (or an organization) to act effectively in a job or situation, it's a good subject orientation, high level of literacy, readiness for proper action. Thus, competence indicates sufficiency of knowledge and skills that enable someone to act in a wide variety of situations and allows of judgment on a definite subject [3].

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

There are many disputes on this issue in pedagogical circles. Competence is approached as a «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» [[3], P.18].

A.V. Hutorskoy notes that the competence-based approach is an approach which focuses on education, and the outcome of education is not the amount of the assimilated information, but the person's ability to act in various problem situations [[4]; P. 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 outside the education system, it postulates a teacher to be flexible, mobile, to have research skills, allowing them to adapt their professionalism to the conditions of uncertainty and rapidly changing environment.

Competence-based approach attempts to contribute a personal component in the educational process. «Personal knowledge, as well as personal understanding, is not only the use of the body of knowledge, read as some «values», but knowledge and understanding in the sense of the participation of the body of knowledge and of somebody possessing this body of knowledge in one's life» [[4]; P.11]. Personal component of knowledge helps a person to make competency-based decisions, thereby - to comply with the life requirements. Thus, the competence-based approach in educational activity meets the requirements of the socio-political life of the country.

A.V. Hutorskoy builds the correlation between the concepts as follows: competence includes a set of interrelated qualities of a person (knowledge, abilities, skills, and methods of activity), tasked in relation to a specific group of objects and processes; competence - ownership, person's possession of a competence, including his personal attitude to it and the subject of it [[4], P.13].

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 the mobility of a specialist in the labor market.

Research competence manifests itself in the theoretical literacy, possession of methods of psychological and pedagogical research, the ability to aggregate empirical data, draw conclusions, and present the results of the study. «Research competence» from the standpoint of the procedural-technological approach (A.V. Hutorskoy) is considered as possession of a proper research competence, which interprets knowledge as a result of cognitive activity of a person in a particular field of science, methods and techniques of research he would the humans have to master in order to carry out research activities, and the motivation and position of the researcher, their value orientations [[4], P. 327].

An education student should possess the following characteristics: independence and initiative, ability to overcome stereotypes, a high level of self-esteem so that

the teacher can generate ideas, instead of waiting for them from outside. Education students and teachers are not only to be endowed with creative potential, but they are to actualize it.

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

Research competence, according to many scholars (V.A. Bolotov, I.A. Zimnyaya, Y.V. Krivenko, S.I. Osipova, A.A. Ushakov E.V. Feskova, and A.V. Hutorskoy), is the key one. In confirmation of the rightness of their position, they argue the following: research competence is formed on the basis of innate quality of humans (called 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 [4].

In the framework of the competence-based approach, this concept would include functional activity and personal (quality of a teacher) aspects. As follows from the above, the research competence of a teacher has the initiative-based character and cannot be seen or 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) [3, P.38].

Y.V. Ryndina determines research competence as integral characteristics of the education students manifested in their readiness to take an active research position and to transfer the semantic context of the activity from functional to transforming [5].

V.A. Slastyonin [6] emphasizes that the structural components of the research competence must coincide with the components of research activities, and the unity of theoretical and practical research skills make up the model of the research competence of a teacher.

Research competence in the classification A.V. Hutorskoy is viewed as an integral part of cognitive competence 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 competence aimed at mastering the methods of intellectual and spiritual self-development [4, 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 [7]:

- 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);
- multi-dimensionality (includes a range of intellectual skills, knowledge, methods, activities, personal qualities).

In the classification of key competencies by I.A. Zimnyaya, the research competency is characterised as a competence component related to human activities [8].

In the classification of A.V. Barannikov, the research competence is given an independent role alongside with academic, social and personal, communicative, learner-adaptive competencies and the competence in the field of organizational activities and cooperation [9].

Thus, 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.

2.2. Main Requirements to the Results of the Study

The project should meet the requirements not only as to the volume of information on the subject, but should also be a manifestation of creative abilities and the ability to synthesize the received information. The master students are to solve problems heuristically, without the use of standard algorithms.

The purpose of the projects method is to create the conditions under which the graduate would be able to:

- Independently and readily acquire the missing knowledge from different sources;
- Use the acquired knowledge for solving practical problems and cognitive tasks;
- Acquire communication skills by working in different groups;
- Develop research skills (information gathering, surveillance, experiment, analysis, creation of hypotheses, and generalization);
- Develop systemic thinking.

Thus, higher education institutions should not be limited to educational functions, they should facilitate research activities.

2.3. Body of Knowledge in the Formation of the Research Competence in Higher Education Institutions:

- the ability to solve the current problems in the specialty;
- the ability to prove the relevance of the topic chosen for the study containing scientific novelty and practical significance;
- the ability to make decisions based on current theoretical, methodological, and technological achievements of science and practice;
- the ability to carry out the work using modern research methods;
- awareness that the study should contain (methodological and practical) sections on the main provisions of defense;
- awareness that the decision should be based on the best international experience in the relevant field.

2.4. A Set of Skills in the Formation of the Research Competence in Higher Education Institutions

Considering the characteristics of the key competencies in relation to research it can be stated that a student, in their research activities, solves problems through heuristic approaches, and not using standard algorithms.

The student, engaged in research work, is able to endure a research approach in different spheres of activity and in different situations, and it confirms multifunctionality, versatility, and subjectness of research competence. The multidimensionality of research competence is confirmed. Students use analytical, critical and other skills, their personal qualities, as well as common sense and sound reasoning.

2.4.1. Skills and Qualities that Allow the Formation of the Research Competence of Master Students:

- Manifestations of creative activity in choosing topics according to their interests and demands of the teacher;
- Selection of literature on the subject;
- Time management of the project;
- Initiative and imagination;
- Skills design work;
- The defense of the diploma project.

Let's consider the pedagogical process, aimed at the formation of the research competence of future teachers of mathematics at the Department of mathematics of the Kazakh State Women's Teacher Training University.

Research competence can be formed only in research activities. Teaching staff of the Department works on scientific projects with the involvement of the master students of the Department. The key concepts defining the necessary conditions for the organization of such activities of the education students in the Kazakh State Women's Teacher Training University are the following: search, independence, initiative, practical action, experiment, collaboration, contradictions, and accepting different points of view.

The educational process is not built on the logic of educational material, it is constructed according to the logic of activities which have some personal meaning for the learner, and the meaning enhances their motivation in teaching. An individual pace of work on the project provides undergraduates development.

Thus, the essence of the design training consists in it that learning in the course of work on the educational project comprises real processes.

To correlate the activities of the teacher and the master student it is important to identify the stages of the project development.

The obligatory requirement is: each stage of work on the project has to have the concrete final product.

We present a system of activities performed by the teacher and the students at different stages of the project.

At the first stage the project subject is defined, the necessary sources of information are selected, the project plan is developed.

To achieve the expected result, the teacher should abreast the students with the definitions, requirements to the contents, and the expected results of the project. The feeling of an involvement into the statement of a problem and designing the ways for the actualization of the tasks set promotes the formation of motivation.

The subjects of the projects can be various. The projects do not only help in the enrichment of the knowledge of the courses "New Technologies of Teaching Mathematics", "Theory and Technique of Teaching Mathematics under Conditions of Informatization", etc. and in understanding the specifics of research activity, but also in understanding oneself as a part of the active search work. The student

who has an experience of work on a certain project in future will be able to organize research work themselves [10].

At the seminars "Method of projects" we launched the project under the title: "The development of mathematical abilities of schoolboys in problem-modular training".

2.5. Peculiarities of the Method of Projects

Project Plan:

I. Development of project tasks.

1) Choosing a project theme.

The teacher selects and offers possible topics to their students for discussion

A group of students chooses topics. Students discuss the topic.

The teacher is involved in the discussion.

2) Allocation of sub-themes and subjects of the project.

The teacher isolates previously sub-themes and offers students for a choice.

Each student chooses a sub-theme or offers a new sub-theme.

The teacher takes part in the discussion on the sub-themes of the project.

Students actively discuss and offer options of sub-themes.

3) Formation of creative groups.

4) Preparation of materials for the research work: preparation of the questions that are to be answered, posing problems for the teams, and the selection of literature

The teacher develops the challenges and issues for the search activity of students and provides a list of references.

Group discussions.

5) Arranging the presentation of the results of project activities.

The teacher takes part in the discussion.

Students discuss forms of the representation of the research results: video, movies, album, natural objects, etc.

II. Development of the project.

The teacher advises, coordinates work of students, and stimulates their activity. Students carry out search activities.

III. Registration of results.

The teacher advises, coordinates work, and stimulates their activity. The students manage the results according to the agreed rules.

IV. Presentation.

The teacher will organize an examination. The students report on the results of the work.

V. Reflection.

The teacher evaluates the results of the activities, sums up the work; expresses wishes, teacher and students discuss the assessment of the work.

In the summary it is necessary to emphasize that the project technology is aimed at the development of the person through the development of the space of search activity.

Experience allows us to draw some methodical recommendations for the organization of the independent research activity of students:

- The researcher should clearly know the aim of the research, know how and when to achieve the final result. Master students should be able to produce new knowledge,

apply to practice methods of scientific research to obtain new scientific knowledge, possess modern methods of primary data collection, their processing, work with the maps, schemes, diagrams, calculation of indicators and indices.

- The manager should motivate students and create the conditions necessary for the successful actualization of their creative abilities.

- When developing the research competence of the students the teacher should also take into account the psychological component of pedagogical interaction. As a master student and the teacher (professor) are respectful to each other, then we can speak of a favorable psychological climate.

The teacher may encounter specific individual characteristics of a student which are manifested in:

- 1) the choice of the research topic;
- 2) students' self-organization features;
- 3) dynamics of working activity during the year;
- 4) presentation of work results.

2.5.1. The choice of research topic. One of the first and, in our opinion, the most significant difficulties in the research activity is selection of topics.

The topic should be of interest 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.

There is an important circumstance, which challenges the choice of topics: 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.

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.

2.5.2. Students' Self-organization Features

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 their work; the assignments are given by a teacher. The efficiency of research as a means of personal development has a reverse side - the inability of the master student to plan and implement their own actions. It is important for a teacher, not to ruin the student's interest in work, to maintain faith of students in their own capabilities and resources.

2.5.3. Dynamics of Working Activity during the Year

The next problem is the dynamics of the labor activity of students during the academic year. Usually, at the beginning of the year, students display enthusiasm, and then there is a decline in it. Then again, students show a high level of activity. It is explained by an unusual form of activity, lack of templates, algorithms, routine of numerous repetitions of experiments, processing the sociological polls data, study of scientific literature, etc. Here the project manager should encourage the students by summing the interim results and determining what was achieved in the course of work, particularly highlighting the success of the students in their research, even if these

data so far do not comply with the anticipated outcome; pay attention to the success of the development of a student as a researcher; note the development of their research skills. An interim presentation of the project could be a success.

2.5.4. Presentation of Work Results

A significant problem is the presentation of the results of the research work of the students; they should be prepared to it. Experience of participation in scientific-practical conferences and competitions of the research papers of young researchers shows that the standard form of the organization of these events (report - evaluation of the jury - awards) gives rise to some problems. Master student faces strict requirements to the presentation of their work: the minimum time (usually 5-7 minutes) should be enough to fully present the body and the effectiveness of the research. The worry before the presentation is strengthened by the appraisal orientation and the competition among the participants of conferences and competitions. In this situation, of course, 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 kind of rehearse with a master 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 at the beginning and the end of presentation, methods of regulation of nervousness, location in relation to the audience and the jury, and other things. Participation in conferences and competitions has another important value in the formation of the research competency of a student - the possibility to analyze the performance of works and speeches of other participants of these events.

3. Conclusions

Thus, in the result of the theoretical analysis of domestic and foreign literature on the problem of the study we may conclude that the 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 them to become more flexible, competitive, helps to be more successful later in life.

The student, performing the research activities, is able to endure a research approach to different spheres of activity and different situations. This fact confirms the multi-functionality of the research competency.

The method of projects is one of the main methods of formation of research competence of the education master students. The method of projects allows of the organizing of their independent research activity.

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

Thus, as a result of observations and generalizations of our experience we conclude that the formation of the research competence of the mathematics education master students in the educational process will be effective provided there are the following pedagogical conditions:

- the content of education is focused on the formation of the readiness of the students for research activity and it satisfies the principle of reality, directed at the development of universal methods of cognitive activity;
- organization of educational process puts a student in an active position of the researcher, lets them acquire universal methods of cognitive activity, engages master students in critical analysis, selection and design of research activities;
- the teacher is a manager of the research activities of the master students.

The subject of further research may be the features of the process of becoming a teacher-researcher who is in demand in any country of the world, who is 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.

References

- [1] The message of the President of the Republic of Kazakhstan - the Leader of the nation N. A. Nazarbayev to the people of Kazakhstan "Strategy 'Kazakhstan 2050'". Astana, Akorda. 2012. [Online]. Available: http://strategy2050.kz/page/message_text.
- [2] State obligatory standard of postgraduate education of RK. Astana. do.ektu.kz/laws/goso/17ru.pdf 2011.
- [3] Kaskatayeva, B. R., *Formation of methodical competency of future teachers of mathematics: Monograph*, "Kazakh State Womens Teacher Training University", Almaty. 2009. 344.
- [4] Hutorskoy, A.V., «Key competencies as a component of the personality-oriented paradigm of education», *Russian Journal "Education, 2"*, 55-61, February, 2003.
- [5] Ryndina, Y. V., «Research competency as a psychological and pedagogical category», *Russian Journal «Young scientist, 1»*. 228-232, January. 2011.
- [6] Slstenin, V. A., *Pedagogy: a textbook for students of pedagogical training*. «School Press», Moskva, 1998, 512.
- [7] Council of Europe: a Symposium on «Key competencies for Europe», Doc. DECS / SC / Sec. (96) 43, Bern, 1996.
- [8] Zimnyaya, I. A., Key competencies as effectively target basis of competency approach in education, Moskva, 2004, 19.
- [9] Barannikoff A.V. Content of General education [Text]: competency approach, Moskva, 2002.
- [10] Kaskatayeva, B. R., *Technique and technology of training in mathematics*. Tutorial. "Kazakh State Womens Teacher Training University", Almaty, 2011, 303.