Methodical preparation as a means of developing prospective mathematics teachers’ ICT competency

Iryna V. Lovianova¹, Andriy V. Krasnoschok², Ruslan Yu. Kaluhn³, Olena O. Kozhukhar³ and Denys S. Dmytriyev¹

¹Kryvyi Rih State Pedagogical University, 54 Gagarin Ave., Kryvyi Rih, 50086, Ukraine
²Kryvyi Rih Educational & Scientific Institute of Donetsk State University of Internal Affairs, 21 Stepana Tilhy Str., Kryvyi Rih, 50065, Ukraine
³Separate structural subdivision "Motor Transport Technical College of Kryvyi Rih National University", 26a Eduarda Fuxa Str., Kryvyi Rih, 50042, Ukraine

Abstract. The purpose of the study is modeling of ICT competence formation of would-be mathematics teachers through the best practice application of effective ICT tools. The objectives of the study are to analyze the possibilities of creating conditions for the formation of competent mathematics teachers using ICT tools. The object of the study is the methodical preparation of students of pedagogical HEIs by means of ICT. The subject of study is the peculiarities of the formation of a competent mathematics teacher in classes on methodological disciplines. The authors of the article analyze, summarize and systematize research on the issue of using ICT tools in the training students’ activities in Universities of Teacher Education. The study determines the role of methodological training in the development of ICT competence of would-be mathematics teachers. The authors of the study developed a model for building competence would-be mathematics teachers, which consists of four components. There is the target, preparatory, procedural, and resulting constituents. The model describes a systematic approach to the organization of students’ training activities in the in teaching the disciplines of professional and practical training. Giving an account of the integration nature of the methodological students’ training, it also considers the organization of distance communication between students and teachers. This paper presents examples of the implementation of the components of the model. The examples describe the implementation by students of course projects and degree projects on teaching mathematics methodologies using ICT tools. A pedagogical experiment was conducted to evaluate the effectiveness of ICT tools in the training of would-be mathematics teachers. The results of the study confirmed the effectiveness of modeling the organization of students’ activities to develop their ICT competency. As the follow-up research directions, we consider summarizing recommendations on the usage of ICT in the preparation of competent socionomic specialists.

Keywords: course project, degree project, ICT tools, training of would-be teachers

© Copyright for this paper by its authors, published by Academy of Cognitive and Natural Sciences (ACNS). This is an Open Access article distributed under the terms of the Creative Commons License Attribution 4.0 International (CC BY 4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.
1. Introduction

The information society requires the ability to see and understand the picture of the world, to identify and analyze various aspects of objects, processes and phenomena. On this background, the goal of educational activities should be to train professionals capable of implementing the transition from industrial to information technology society through innovation in learning. This is emphasized in the state normative documents of Ukraine regulating education (“Law of Ukraine On Higher Education” [21], “National Strategy for Education Development in Ukraine for 2012–2021” [9]). Training of specialists of different groups of professions in the conditions of information technology society requires research on the choice of innovations in order to train qualified competent specialists in the relevant field.

The International Society for Technology in Education (ISTE) has formulated directions for the use of information and communication technologies in the educational process and the main characteristics of ICT competence [8].

Analysis of scientific sources [8, 11, 15] on the definition of ICT competence, allows the ICT competence of future mathematics teacher to understand the ability to use information and communication technologies and resources to carry out tasks in the chosen professional field consciously.

The issue arises: how should the training of future mathematics teacher be organized in order to form his/her ICT competence in the learning process. Currently, much attention is paid to substantiating the issues of involvement ICT tools in the process of training future professionals in various fields. Occupying a certain place in the hierarchy of classification of pedagogical innovations, the involvement of ICT tools in the training of future teachers meets certain goals aimed at improving the indicators of the current state of professional training. For future teachers ICTs serve both as a means of obtaining high professional qualifications and as a goal to master ICTs that are involved in secondary education. This dual role of ICT in the training of future teachers determines the nature of ICT tools using in the learning activities of students of mathematical specialties of pedagogical HEIs, which in turn contributes to the formation of ICT competence of a future teacher of mathematics.

A lot of research in recent years has highlighted various aspects of the problem of training qualified, competent specialists in HEI. Thus, the problems of personnel training for the use of ICT in pedagogical activities are revealed (Bykov [1], Lovianova [5], Vlasenko, Rotaneva and Sitak [17], Vlasenko, Sitak and Chumak [18]); the content and models of formation of ICT competence of primary school teachers (Shishkina and Tataurov [15]), mathematics teachers (Petrenko [11]) are substantiated; in the list of professional competencies in the field of education ICT competencies are distinguished [14, 19]; the process of joint creation of a networked educational community of practicing teachers to support the professional development of information and communication technologies is studied (Watson and Prestridge [20]); the role of the course model, which should help organize the learning process by promoting effective, holistic and focused practice of users (Porter [12]); the use of scientific approaches is emphasized, in particular the principles: systematization, humanity and professional orientation, flexibility, dynamism and variability during modeling (Perogonchuk [10]); among the tools that ensure the professional growth of future teachers scientists include ICT tools and also insist on the importance of involving future teachers in the use of computer mathematics systems in the
educational process of their preparation for teaching (Karsenti et al. [3], Lovianova et al. [7]).

However, in our opinion, the pedagogical modeling of the process of formation of ICT competence of future specialists remains irrelevant for researchers.

The purpose of the article is to describe a model of methods for forming ICT competence of future mathematics teachers.

2. Theoretical fundamentals of research

The use of ICT in the professional activities of a teacher is provided by the comprehensive training: instrumental training (mastering the basics of office technology, multimedia, ICT); psychological and pedagogical training (mastering the psychological and pedagogical characteristics of students of different ages, the use of ICT in modern schools); practical training. This approach allows for a comprehensive mastery of the ICT tools chosen for learning. Training for the use of ICT tools in future professional activities is both direct (content module “Information and communication tools for teaching mathematics” in laboratory classes on methods of teaching mathematics, preparation of presentations for lessons, development of interactive didactic materials during pedagogical practice) and indirectly, for example time of course work in methods of teaching mathematics. The generalizing role in formation of ICT competence of the future teacher belongs to methodical training. During which students in small groups under the guidance of a teacher perform such activities as practical and laboratory classes on methods of teaching mathematics, practice at school, course project.

Thus, it is possible to model the process of formation of ICT competence of the future math teacher.

Descriptive, explanatory or prognostic models are used in pedagogical research, which allow: to formalize the designed processes; make predictions about the relationships, the reasons that affect the events; involve a list of recommendations; give a brief description or abstract mathematical constructions.

According to Shtoff [16], models are simple substitutes for objects. The conditions for creating a model are such that it is separated and enshrined in its major elements and the connection between them significant and necessary links that form a completely appropriate structure.

Modeling is considered as a way of knowing reality, which consists in the reflection and reproduction of the studied object, phenomenon, process with the help of any system. The following features are distinguished in the model: a) imaginary representation or material realization of the system; b) display of the object of study; c) the ability to replace the object; d) study of the model to obtain new information about the object.

The method of modeling is general scientific and is used to study objects of different nature. These can be natural organisms, objects, phenomena, processes, events of reality – both physical and social.

Modeling is also widely used in pedagogy. The specifics of its use in pedagogical theory and practice are revealed in the works of methodologists. In practice, it is used in the vast majority of scientific and pedagogical research [13]. However, due to the extreme complexity of pedagogical reality, no model can be adequate to the simulated phenomenon and fully reproduce the object under study, so when developing a model it is necessary to determine what elements,
properties, dependencies can and should be reflected in it.

Regarding the use of the model in pedagogy, we should agree with Fridman [2], who points out that bearing in mind the pedagogical goals, it is advisable to consider the model and modeling in a broad sense. Presenting the definition of the model in a broad sense, Fridman [2] writes: “The model of some object A (original) is called object B, in some respects similar to the original A, selected or constructed by the subject (person) K at least for one of the following purposes: 1) replacement of A in some mental (imagined) or real action (process), based on the fact that B is more convenient for this action in these conditions (substitute model); 2) creating an idea of object A (actually existing or imagined) with the help of object B (model-conception); 3) interpretation of object A in the form of object B (model-interpretation); 4) research (study) of object A with the help of object B, with the help of study of object B (research model)” [2].

According to Lodatko [4], pedagogical model is a thinking system that simulates or reflects certain properties, characteristics of the object of study or its internal organization or principle of functioning and is presented in the form of a cultural form inherent in a particular socio-cultural practice.

In order for the model to be suitable for the purposes specified, it must meet these target characteristics.

Descriptive, explanatory or prognostic models are used in pedagogical research, which allow:

• to formalize the designed processes;
• to make assumptions about the correlations, the reasons that affect events;
• to make a list of recommendations;
• to provide a brief description or abstract mathematical constructions.

With the help of models it is possible to design this or that area of knowledge, skills, abilities of any participant of the pedagogical system, which they should be in terms of the desired result. It provides knowledge of what needs to be formed. And the comparison of what forms the system with what should be formed, allows you to qualify the existing pedagogical system and make a conscious search for ways to improve it.

From the point of view of the reproduced sides of the original different types of models are distinguished. The main ones are structural, functional and mixed models. Structural models imitate the internal organization of the original. A functional model is a model that imitates the behavior (function) of the original. The use of mixed models is due either to the impossibility of using one basis of modeling, completely abstracting from others, or by the natural feature of the models that the relationship between their nature and the nature of the basis of modeling is not unambiguous, or that most emerging problems are complex, multilinear. This often combines structural and functional approaches. The mixed nature of the models in these cases is determined by the nature of the modeling method itself, which implies by establishing the similarity of the model and the original in one respect, to obtain information about the original in another respect. Thus, by establishing the structural similarity of the model and the original on the basis of information about the functions of the model we obtain information about the functions of the original, or vice versa, establishing the similarity of functions, we obtain information about the structure of the original. Thus, we obtain two subspecies of mixed models of this kind: in the first case – structural-functional model, and in the second – functional-structural.
The initial typology of models according to Lodatko [4] is based on generalized subjects of modeling, which include content, structure, functionality. According to these subjects, the basic types of pedagogical models are: semantic, structural, functional. Derived types of models have a dual subject of modeling and the corresponding types: structural-semantic, structural-functional, functional-semantic.

Modeling in our own research the process of formation of ICT competence of the future teacher of mathematics, we will use pedagogical modeling, while the model will have a double subject of modeling and the type will be structural and semantic.

The component composition of the model of formation of ICT competence of the future teacher of mathematics is interrelated target, preparatory, procedural, effective components.

The target component of the model is determined by the fact that the training of a competitive specialist who confidently and freely owns and can use information technology in their professional activities involves significant adjustments to the modern system of training future mathematics teachers. The target component of the model is aimed at solving the problems of forming a developed competent personality capable of development and self-development in a dynamically changing information space.

Motivational-value and intellectual-cognitive components are the components of the preparatory component, determine the level of motivation of students of pedagogical HEIs to master ICT tools in order to use them in future professional activities and study the level of students’ awareness of ICT tools in education.

As part of the procedural component – content-activity, organizational-activity, control-reflexive components. Thus, the content-activity and organizational-activity components determine: the content, methods, forms and means of forming the ICT competence of the future teacher of mathematics; a set of psychological and pedagogical approaches to the personality of students, aimed at the result, which is a competent in the field of ICT with the appropriate level of training graduate of pedagogical HEIs. The control-reflexive component involves constant two-way communication with the components of the model described above in order to control the process of formation of ICT competence and make appropriate adjustments to this process.

The final component of the model involves establishing the level of ICT competence of the future teacher of mathematics and is in constant dependence on the target component.

The model of formation of ICT competence in the composition of all its components provides respectively: a systematic approach to the organization of educational activities of students in the process of teaching disciplines of the cycle of professional and practical training; organization of remote communication with teachers; integration nature of methodical preparation and reflection of the result in the master’s thesis (figure 1).

3. Methods

We describe the essence of the preparatory and procedural components of the model.

Motivational-value and intellectual-cognitive components of the model provided a study of students’ awareness of ICT learning, the level of their motivation to use ICT in future professional activities. The results of the survey of students who acquire the profession of teacher were as follows: 74.2% of respondents use information and communication tools for
self-improvement in professional activities, at the same time they:

- expect from innovative technologies unique knowledge and experience in project implementation with the help of innovative technologies (51.6%);
- want to expand their knowledge in the field of ICT – 43.5% of respondents;
- want to get an interesting job that requires knowledge in the field of ICT (41.9%).

Data on students’ awareness of certain software and use of mathematical software in their own learning activities, obtained during the survey, are presented in table 1 and table 2.

**Table 1**
Data on students’ awareness of software and its facilities.

<table>
<thead>
<tr>
<th>Software used by students</th>
<th>Number of respondents</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Presentations (PowerPoint, Google Slides)</td>
<td>56</td>
<td>90.3%</td>
</tr>
<tr>
<td>Spreadsheets (Excel, Google Sheets)</td>
<td>45</td>
<td>72.6%</td>
</tr>
<tr>
<td>Electronic manuals</td>
<td>43</td>
<td>69.4%</td>
</tr>
<tr>
<td>Test tasks (Google Docs, Google Forms)</td>
<td>40</td>
<td>64.5%</td>
</tr>
<tr>
<td>Programming environment (Visual Studio, Delphi, Scratch)</td>
<td>28</td>
<td>45.2%</td>
</tr>
<tr>
<td>Virtual laboratory</td>
<td>7</td>
<td>11.3%</td>
</tr>
<tr>
<td>Video (CamtasiaStudio)</td>
<td>7</td>
<td>11.3%</td>
</tr>
<tr>
<td>Software for creating a game product (Construct 2, Unity 3D, Game Editor)</td>
<td>3</td>
<td>4.8%</td>
</tr>
</tbody>
</table>
Table 2
Data on the use of mathematical software in educational activities.

<table>
<thead>
<tr>
<th>Mathematical software</th>
<th>Number of respondents</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>GeoGebra</td>
<td>50</td>
<td>80.6%</td>
</tr>
<tr>
<td>GRAN</td>
<td>31</td>
<td>50%</td>
</tr>
<tr>
<td>MATLAB</td>
<td>28</td>
<td>45.2%</td>
</tr>
<tr>
<td>Mathcad</td>
<td>14</td>
<td>22.6%</td>
</tr>
<tr>
<td>Sage</td>
<td>12</td>
<td>19.4%</td>
</tr>
<tr>
<td>DG</td>
<td>5</td>
<td>8.1%</td>
</tr>
</tbody>
</table>

The obtained results and their analysis prompted the development of the content of the procedural component of the model of formation of ICT competence of future mathematics teachers, which provides a systematic approach to the organization of students' learning activities in the process of teaching the disciplines of the cycle of professional and practical training.

The purpose and objectives of ICT competence of future mathematics teachers: to provide methodological training to mathematics teachers, to form professional competence of graduates, which combines mathematical knowledge of future teachers, psychological, pedagogical and methodological training, personal qualities, ability to organize educational process at the level of modern requirements, a conscious attitude to self-improvement.

ICT competence of the future teacher of mathematics is acquired by students in lectures, practical and laboratory classes, during active pedagogical practice. This is how the content-activity stage of the procedural component is realized.

The organizational-activity stage involves independent work of students and remote communication with the teacher, for example, during active pedagogical practice and writing a course project. Since the writing of course projects is one of the types of independent work of students in the discipline, in our opinion [6], writing course projects on methods of teaching mathematics will be an effective means of methodological training of future mathematics teachers and the formation of their ICT competence which are offered to students will be aimed at highlighting the methodological features of studying the content lines of the school course of mathematics, separate thematic sections, etc. using ICT tools. Moreover, we see the effectiveness of the work in the processing of selected sections of the school course of mathematics according to a certain scheme.

Here is the algorithm of a student actions during the course project on methods of teaching mathematics in the formation of ICT competence:

1. Analysis of programs and textbooks.
2. Highlighting of the basic concepts of the topic (section), conducting logical and didactic analysis of the meanings of those concepts that are considered in the topic.
3. Substantiation of methodical features of studying rules, algorithms, theorems of the considered section.
4. Analysis of exercises aimed at mastering the topics of the section contained in the current textbook.
5. Research of possibilities of realization of interdisciplinary links and use of information and communication technologies of studying in the course of mastering by pupils of subjects of the section.

6. Giving examples of students mastering the topics of the school mathematics course using ICT tools known to students or developing alternatives.

Therefore, there was a proposal during the course project on methods of teaching mathematics to offer students to use both known common and mathematical software, thoroughly processed in previous stages of learning, such as GeoGebra, and those services that they should develop independently at the stage course project, for example, Construct 2 – a designer of two-dimensional games for Windows, or other, at the discretion of a student.

4. Results

Consider examples of implementation of the procedural component of the model of formation of ICT competence of the future teacher of mathematics. Thus, performing a course project on the topic: “Formation of logical thinking of students while solving cutting problems” the student demonstrates the use of dynamic mathematics system GeoGebra.

We will reveal the content of paragraph 6 of the algorithm of student actions when writing a course project. The project presents the problem: Three identical triangles are cut by different medians. Is it possible to make one triangle out of six triangles formed in this way?

To solve this problem, you can prepare a blank for a multimedia board, developed in GeoGebra. This development will be especially effective if students can move and rotate cut triangles on their own. As a result of several attempts, students will be able to get a solution to the problem (figure 2).

![Figure 2](image-url) **Figure 2:** The process and result of solving the problem using GeoGebra.

The student also demonstrated the use of the system of dynamic mathematics GeoGebra to solve the following problems:

1. Rectangle 4×9 cells cut on the sides of the cells into two equal parts, so that they can then be made into a square.

2. What is the smallest number of rectangles you can cut the figure shown in figure 3, if the cuts are allowed only on the sides of the cells?
To work effectively in the lesson, the teacher can prepare models for the tasks in advance. Moreover, it can be electronic dynamic models. Due to the high level of clarity and ease of use, the latter are becoming widespread in the modern educational space. As part of writing a diploma work on “Task approach to the formation of logical thinking of high school students in mathematics”, the student offers to teach students the topics of stereometry using the capabilities of the dynamic mathematics system GeoGebra.

Here is an example of the task: At the base of the pyramid is an isosceles triangle with angle $\beta$ at the vertex and radius $R$ of the circumcircle. The plane of each side face of the pyramid forms an angle $\alpha$ with the plane of the base. Find the area of the side surface of the pyramid.

Methodical commentary on the task. In order to deeply analyze the conditions of the task and the statement to be proved, as well as further generalization, we propose to use the capabilities of GeoGebra. It is convenient to organize work with two canvases of the program – 2D and 3D (figure 4).

Thus, on the plane perform the construction of the triangle underlying the pyramid, determine the position of the center of the inscribed circle of this triangle. At this time, on another canvas
is automatically built the appropriate spatial drawing, on which you can complete the pyramid and conduct research. Thus, organized work with the task allows you to perform a mental comparison operation.

Tasks of course and diploma projects also involve independent mastering of ICT by students, for example, developing the topic: “Organization of didactic games in mathematics lessons by ICT”, the student in the work involves not only known services he mastered during classroom classes, and must independently select ICT tools, justify their use and develop with their help tasks within the course project. The algorithm of the student’s actions should be as follows:

1) to find an ICT service that can be freely used by the teacher in the professional activity;
2) learn to work with the selected service;
3) justify the appropriateness of its use in education;
4) use the service to reveal the topic of their own research within the course project;
5) give examples and recommendations for using the service.

For example, point 3 of the action algorithm provides the following description of the selected service: Construct 2 is an HTML5-based 2D video game engine developed by Scirra Ltd. Construct 2 allows anyone to create 2D games of any complexity and any genre, even without programming skills. Games made on it are easily imported to all major platforms – Windows, Mac OS, Linux, browsers with HTML5 support and others.

The interface of the program is intuitive and easy to master, thanks to the visual WYSIWYG editor. Game logic in Construct 2 is created using a system of events and related actions.

This game designer allows you to easily create game prototypes, demos, presentations and interactive training programs. Since Construct 2 is free and open source, anyone who wants to master it has open access to the world of video game design, with easy learning.

Also, the student gives a detailed description of the creation of a game project for a lesson in mathematics (paragraph 4 of the algorithm).

1. Creating a project. Run Construct 2 and select the menu item “File” → “New”. Let’s make an empty project based on screens with a large resolution. Select the template “New empty HD portrait 1080p project” (the game will work in portrait orientation) and click “Open”. In the properties panel we set the data about the project: name, version, description, author (company name or name and surname of the developer), e-mail address and website address (figure 5).

2. Create a game menu. After creating the project, 2 tabs “Layout” and “Event sheet” appear. The first tab is the layout of the screen or scene that the player will see, the second tab is the event page. The layout model has already been created, so it is used for the game menu. After editing the properties of the menu screen, create a scene with the button “Pass the test”.

3. Creating objects. In the course project, the objects of the game are planets of different colors (three planets correspond to three levels of the game). These objects were created in Adobe Photoshop. After adding an object to the layout, it appears in the “Projects” panel. To add another instance of The Planet to the layout, drag it from the Projects panel to the menu layout. After dragging, there will be two objects on the layout, similarly add a third object. This way, you can create any number of game objects. There are three such
objects in the described course project, these are the planets called “The Planet of Viète”, “The Planet of Archimedes”, “The Planet of Newton”. The next stage is programmed operations that allow you to proceed to the tasks of the game, the calculation of correct and incorrect answers to questions and display this information on the screen.

Figure 6 shows what the first level of the game in action looks like on the screen.

Figure 5: Start creating a project in the Construct 2.

Figure 6: The work of the program “CosmoMath” and the first level of the game.

The program provides additions, improvements and editing. Therefore, the proposed project can be improved by the student at the next stages of learning.

You can diversify the forms of work in mathematics lessons by conducting interactive exercises developed using the online services Kahoot! and LearningApps.org. For example, an alternative to the face-to-face survey may be to conduct an interactive quiz test on “Dihedral Angle”, a
test developed using Kahoot!. To participate in the quiz, students on mobile devices follow the link https://kahoot.it/ to the page with the field for entering the PIN code of the game, which is reported by the teacher. At the end of the quiz, the winners are automatically determined – the participants of the game who gave the most correct answers. The condition of the tasks is demonstrated on the board or computer screen of the teacher, and students use phones as “voting consoles” (figure 7, figure 8).

![Figure 7: Kahoot interface.](image1)

![Figure 8: Expecting new participants in the game.](image2)

In the developments offered by students there is also a proposal to use interactive exercises
for independent homework, for example, such work on the topic “Combinations of bodies” as an interactive exercise developed in LearningApps.org (figure 9).

Figure 9: Home independent work in the service LearningApps.org.

In this way we present the implementation of the procedural component of the model of formation of ICT competence of the future teacher of mathematics.

5. Conclusions

The study allowed us to draw the following conclusions.

The preparation of the future teacher for the use of ICT in professional activities is complex, which allows to model the process of formation of ICT competence of the future teacher of mathematics.

The analysis of possibilities of pedagogical modeling allowed to allocate basic types of pedagogical models: semantic, structural, functional; and derived types of models that have a dual subject of modeling: structural-semantic, structural-functional, functional-semantic. A structural-semantic model was chosen to model the process of forming the ICT competence of a future mathematics teacher.

The constructed model of formation of ICT competence of the future teacher of mathematics will be effective if: to allocate certain means of ICT and to analyze their possibilities in creation of conditions of formation of competent teachers of mathematics; to provide a systematic
approach to the organization of educational activities of students in the process of teaching the disciplines of the cycle of professional and practical training; to determine the generalizing role of methodical training in the formation of ICT competence of the future teacher.

The structural-semantic model of the formation of ICT competence of the future teacher of mathematics is multicomponent in the composition of the target, preparatory, procedural and final components. Each of these components has its own structure and content. The content of the components provides actions aimed at forming the ICT competence of the future teacher of mathematics. The actions of motivational-value and intellectual-cognitive components of the model explore students’ awareness of ICT learning, the level of their motivation to use ICT tools in future professional activities. The content of the procedural component of the model of formation of ICT competence of the future teacher of mathematics is developed on the basis of these researches. Thus, the content-activity component is responsible for building the content of education, the mastery of which contributes to the formation of ICT competence of students and justification of student activities in the learning process. The organizational-activity component is aimed at the implementation in the real educational process of student activities that were justified at the previous stage. The control-reflexive component involves constant two-way communication between the components of the model in order to control the process of formation of ICT competence and make appropriate adjustments to this process, as well as developing algorithms for students to acquire ICT competence. The final component of the model involves establishing the level of ICT competence of the future teacher of mathematics and is in constant dependence on the target component. Examples of the implementation of the procedural component of the model of formation of ICT competence of the future teacher of mathematics are presented, on which the students performed experimental course projects on the methods of teaching mathematics with the involvement of ICT.

The results of the study testify to the effectiveness of the process of modeling the organization of students’ activities in order to form their ICT competence.

The prospect of the study is a pedagogical experiment that will summarize the recommendations for the choice of ICT in the training of competent mathematics teachers and clarify the content of the components of the model of ICT competence of future teachers of other disciplines.

References


