

Artículo de investigación

The methodical projects as a method for learning future teachers

Los proyectos metodológicos como método para el aprendizaje de futuros maestros
Os projetos metódicos como método para aprender futuros professores

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Abstract

The search for the effective means of improving the training of a mathematics teacher led to the idea of creating projects by the students demonstrating the methodology of the teacher's work with the student on the task, theorem or textbook text. The article summarizes the results of the experimental study.

The methods of collective subjective experience and visual modeling were considered as basic. The project presentation form was a computer presentation, the animation effects of which allow consistently creating graphic images, as well as organizing a pause in the teacher's dialogue with the students.

The conditions for ensuring the students' success in the project development are as follows: 1) observance of the stages of the collective subject experience method; 2) formulation of the task to the methodical project, reflecting the requirements for the results of its creation; 3) reasonableness of methodical decisions by the requirements of the activity approach and the personally oriented training. The requirements of the activity approach are as follows: 1) the existence of the goal as a planned activity result; 2) use of indicative bases of activity, formulated in a generalized form; 3) development of individual steps of activity. The requirements of the personally oriented training are as follows: 1) training orientation to enrich the students' subject experience (Yakimanskaya, 2014). 2) ensuring the leading position of the students in cognitive

Resumen

La búsqueda de los medios efectivos para mejorar la formación de un profesor de matemáticas condujo a la idea de crear proyectos por parte de los estudiantes demostrando la metodología del trabajo del profesor con el alumno en la tarea, el teorema o el texto del libro de texto. El artículo resume los resultados del estudio experimental.

Los métodos de experiencia subjetiva colectiva y modelado visual se consideraron básicos. El formulario de presentación del proyecto fue una presentación en computadora, cuyos efectos de animación permiten la creación consistente de imágenes gráficas, así como la organización de una pausa en el diálogo del docente con los estudiantes.

Las condiciones para asegurar el éxito de los estudiantes en el desarrollo del proyecto son las siguientes: 1) Observancia de las etapas del método de experiencia colectiva del sujeto; 2) Formulación de la tarea al proyecto metódico, que refleje los requisitos para los resultados de su creación; 3) Razonabilidad de las decisiones metódicas según los requisitos del enfoque de la actividad y la capacitación orientada personalmente. Los requisitos del enfoque de actividad son los siguientes: 1) La existencia del objetivo como un resultado de actividad planificado; 2) Uso de bases indicativas de actividad, formuladas en forma generalizada; 3) Desarrollo de pasos individuales de actividad. Los requisitos de la capacitación orientada a la

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and reflexive activity; 3) compliance with the requirements for the organization of the training dialogue (motivation of the questions, their general nature, connectedness, focus and stage-by-stage nature of the dialogue, recording of the personal experience of the students, initiative of the students and possibilities of the polylogue).

Keywords: training, mathematics, task, theorem, text, visibility, modeling, dialogue, project.

persona son los siguientes: 1) Orientación de capacitación para enriquecer la experiencia de los estudiantes en el tema (Yakimanskaya, 2014). 2) Garantizar la posición de liderazgo de los estudiantes en la actividad cognitiva y reflexiva; 3) Cumplimiento de los requisitos para la organización del diálogo de formación (motivación de las preguntas, su naturaleza general, conectividad, enfoque y naturaleza del diálogo etapa por etapa, registro de la experiencia personal de los estudiantes, iniciativa de los estudiantes) y posibilidades del polílogo).

Palabras claves: Entrenamiento, matemática, tarea, teorema, texto, visibilidad, modelado, diálogo, proyecto.

Resumo

A busca de meios eficazes para melhorar a formação de um professor de matemática levou à ideia de criar projetos pelos alunos demonstrando a metodologia do trabalho do professor com o aluno na tarefa, o teorema ou o texto do livro didático. O artigo resume os resultados do estudo experimental.

Os métodos de experiência subjetiva coletiva e modelagem visual foram considerados básicos. O formulário de apresentação do projeto foi uma apresentação de computador, cujos efeitos de animação permitem a criação consistente de imagens gráficas, bem como a organização de uma pausa no diálogo do professor com os alunos.

As condições para garantir o sucesso dos alunos no desenvolvimento do projeto são as seguintes: 1) Observância das etapas do método de experiência coletiva do sujeito; 2) Formulação da tarefa ao projeto metódico, que reflete os requisitos para os resultados de sua criação; 3) Racionalidade das decisões metódicas de acordo com as exigências do foco da atividade e do treinamento orientado pessoalmente. Os requisitos da abordagem de atividade são os seguintes: 1) A existência do objetivo como resultado da atividade planejada; 2) Uso de bases indicativas de atividade, formuladas de forma generalizada; 3) Desenvolvimento de etapas de atividades individuais. Os requisitos da formação orientada para as pessoas são os seguintes: 1) Orientação de treinamento para enriquecer a experiência dos alunos no assunto (Yakimanskaya, 2014). 2) Garantir a posição de liderança dos alunos na atividade cognitiva e reflexiva; 3) A conformidade com os requisitos para a organização da formação diálogo (motivação das perguntas, a sua natureza geral, conectividade, o foco ea natureza da fase de diálogo e estágio, registrando a experiência pessoal dos alunos, a iniciativa estudante) e possibilidades do polylogo).

Palavras-chave: Treinamento, matemática, tarefa, teorema, texto, visibilidade, modelagem, diálogo, projeto.

Introduction

The problem of the quality of methodical training of the future teacher will always be topical, since the change of any training conditions requires finding new ways to solve it. One of the means to increase the effectiveness of methodical training is the development of a methodical project by the student that meets the modern requirements for student learning: implementation of the system-activity approach in teaching students; personally oriented teaching of students by the academic subject

means; usage of the information and communication technologies (ICT) in training.

A computer presentation was chosen as the means of demonstrating the visual modeling of a methodical solution (Smirnova and Yaroslavl, 2010). The process of its development based on the requirements of the student teaching methods to solve the problems and to study the theorems in conjunction with the individual creative work and in correlation of their methodical decisions with their influence on the training consequences allow making a conclusion

that such methodical projects can be considered as a method of training future teachers.

The article (Holmqvist) substantiates the study result, in which the teachers improved themselves when they developed the learning study lessons (Holmqvist, 2011). A similar effect is observed when the future teachers develop the teaching methodical projects.

The article (Goos) proves the use of cultural-historical theory by L.S. Vygotsky on the example of teaching mathematics in Australia (Goos, 2004). We identified the fundamentals of reforming education from the instructional practices to learning outcomes through the inclusion of students in communication, the search for ways of reasoning and the problem solving-might. This approach corresponds to the work stages on mathematical tasks in the methodical projects and the inclusion of students in the educational dialogue.

The paper considers the various types of knowledge: knowing-that, knowing-how, knowing-why, knowing-about and justifies that knowing-to act in the moment passes through all these types of knowledge (Mason and Spence, 1999). Analysis of the relationship between the subject knowledge of the teacher and the achievements of the students is devoted to the study of Choshanov et al (Tchoshanov et al, 2017). It is drawn an attention to the need to actualize one's own experience as an incentive to action. In the Russian method of teaching mathematics, this motivator to action is called motivation. In the methodical projects of the students, the requirement for motivation applies not only to the actions of students, but also to the actions of a teacher, for example, any question of dialogue should be motivated, i.e. the students should understand why this question is asked; at the stage of summing up the results of mathematical activity, all the methods that motivate a particular action/reasoning should be discussed.

The paper (Koehler and Mishra) offers an approach where the teachers work together in small groups to develop the technological solutions for using digital technologies to solve genuine pedagogical problems (Koehler and Mishra, 2005). The paper (Fisher) studies the issue of teaching teachers using digital technologies, and it is proposed to consider the vision, motivation, reflection, community and capability of teachers (Fisher et al, 2006). The same requirements are also taken into account

when using the methodical projects in the training of future teachers.

Methods

-Collective subject experience method. The collective subjective experience methods developed by us includes eight stages, their observance ensures the project success:

1. It is actualized the subject experience of students in working with a mathematical object (task, theorem, textbook text).
2. The method of visual modeling studies the issues of general methodology of working with a mathematical object: work stages, implementation of the activity approach, personally oriented learning.
3. In the collective work, the theory is applied to the analysis of developments/samples of specific fragments of the lesson under the teacher's guidance.
4. It is offered the group independent work of students on the development of specific fragments of a lesson.
5. It is carried out the correction and enrichment of a group experience.
6. It is offered an independent work on the development of specific fragments of the lesson with the subsequent verification by the teacher in an individual manner.
7. It is carried out the correction and enrichment of an individual experience of each one.
8. It is formed the collective subjective experience in the form of a set of presentations in the university training electronic system. It is also recommended that the students prepare the publications that generalize their subject experience.

Let us present the formulation of tasks for the development of methodical projects, reflecting the requirements for the results of its creation, and indicate the purpose of their subsections.

Task for developing a project on the methodology for working with a mathematical task:

1. To determine the type of tasks to be solved (presentation header) (determination of the type

of tasks targets the students to develop common methods for solving them).

2. To distinguish the theoretical basis for solving the tasks of this type and to take into account the activity of the students when working with the theoretical material (the first slide) (one of the reasons for the students' learning difficulties is related to their ignorance of the theoretical foundations or methods of their application in the tasks; therefore, it is desirable to foresee the students' problems and find the ways of their liquidation).

3. To disclose the dialogue with the students in four stages of working with the task: analysis of the condition with the simultaneous compilation of a short entry; search for a solution resulting in a decision plan; decision execution; summarizing the work results on the task (a separate slide for each stage) (one of the reasons for the teacher's difficulties in developing the methodology for teaching students to solve the tasks is associated with the skipping or mixing of individual work stages on the problem, so the division into slides under "the stage changes - the slide changes" principle is necessarily).

Task for developing a project on the methodology of working with a theorem:

1. To define the theorem title (presentation header) (it is important to determine the place of a theorem in the student knowledge system, therefore it is recommended to give the names to the theorems).

2. To disclose the dialogue with the students in six working stages with the theorem (a separate slide for each stage):

-Theorem motivation (the stage of motivation of a particular theorem is not presented neither in textbooks, nor in methodical literature, hence, the search for the ways of motivation is one of the creative tasks of a student);

-Analysis of the theorem formulation with simultaneous drawing construction;

-Search for a way of proof, which ends with the drawing up of a plan of proof (the questions "How to guess that it is necessary to perform an additional construction, to use a particular method, a particular theorem?" require methodical reflection, which in turn affects the methodical thinking of the students);

-Work with the text of proof in the textbook (it is important to learn to see the students'

problems associated with the texts of proof in textbooks in order to learn how to overcome these problems);

-Proof formulation (it is important to learn how to structure the proof, presenting both the proof stages and the logic of each conclusion);

-Summing up the work results on the theorem (the stage is aimed at enriching the students' experience with regard to studying the theorem, problem construction "in one step", demonstrating the basics of its use in the specific situations).

Task for developing a project on the methodology for working with the mathematical text:

1. To define the educational problem of the text (presentation header) (the text's educational problem is the core around which the cognitive and reflexive activities of students are built).

2. To divide the text into parts using the rule: "the goal changes - the stage changes" and to take into account the activity of the students when working with splitting the text into parts (the first slide) (the ability to determine the purpose of each piece of text is important to both the student and the teacher).

3. To disclose the dialogue with the students on each part of the text around such questions as: "What is the part dedicated to?", "What did you learn from this part?" (a separate slide for each part of the text). (The questions presented help to rework the text in the direction of its understanding).

The role of the educational text in the intellectual education of students is disclosed in the paper (Holodnaya and Gelfman, 2016).

The preparation of the methodical comments to each slide by the students, in which it is recommended to indicate the purpose of the students' activities and the methods that ensure their independent success in achieving this goal, helps to increase the use of the methodical project as a method of teaching future teachers. This allows project developers rethinking their methodical solutions. At the same time, it is used a dialogue with the teacher using e-mail.

Results

Collective project: "Learning and Teaching to Solve Geometric Problems", including student

computer presentations, became the winner of the 1st Bryansk Network Competition for the best educational materials "Application for success" in the nomination "The best methodical development of the mathematics lesson using ICT" in the framework of Intel "Learning for the Future" program in Russia, in 2007.

The methodical projects of the students of the following years are presented in the university training electronic system.

A number of students summarized the results of their research in the framework of conferences on contemporary problems of teaching mathematics in Russia and Ukraine.

The projects were tested within the framework of the VIII Republican Summer Mathematical School for Teachers (Vladikavkaz) (Abaturova and Malova, 2017).

The conclusions reflecting the collective experience and related to projects for working with the text, planimetric or stereometric problems, on the study of theorems are presented in the paper (Smirnova and Yaroslavl, 2010).

Discussion

Let us define a number of problems that require further research.

- Time problem. The development of a methodical project requires considerable time-consuming efforts both on the part of the student and the teacher for its analysis.
- The problem of project use in the teachers' practice. The following options were tested: a student uses his/her project or project of another student in the practice of teaching students; the projects are used by teachers in the course of their participation in the methodical game; the projects are recommended for the independent use. The analysis of these and possible other options requires a research.
- Dialogue problem. The educational dialogue assumes both the variability of the students' answers, and the length of pauses between the question and the answer, which is not always possible to stipulate in a computer presentation.

Summary

The methodical projects should be devoted to those issues of mathematics, which cause difficulties to the students (complex problems, proofs of theorems, semantic analysis of mathematical text, etc.)

The level of methodical projects should correspond to modern requirements of the activity approach, personally oriented training, ICT usage.

The inclusion of students in the creation of methodical projects is the effective means of training teachers.

Conclusions

The long-term experimental work shows that the methodical projects solve three problems: 1) motivate the independent development of a methodical product; 2) provide effective mathematical assistance to students, as they contribute to ensuring their independent success, as well as methodical assistance to the student (teacher) in developing a modern methodical solution; 3) enrich the methodology of teaching mathematics to new developments.

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