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FEATURES OF DESIGN ACTIVITIES IN THE TRAINING OF FUTURE MATHEMATICS TEACHERS

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Abstract. The article reveals the essence and features of training future mathematics teachers for design. The publication identifies the relationship between the effectiveness of training future specialists in mathematics and the level of their readiness to implement the acquired knowledge, skills and abilities of a certain direction.

The article considers design activity as an effective means of activating students' educational activities during the study of the subject. Qualitatively organized work on a joint project contributes to the timely identification of gaps in their professional training, and therefore will contribute to the optimization of the educational process and, accordingly, the activation of their educational activities. Group work and work with projects are an important means of stimulating students' educational activities. As practice shows, the preparation of one's own project and its presentation directly positively affects the development of leadership qualities and abilities of a specialist in general.

It is demonstrated that in the conditions of integration of education, science and production, the transformation of mathematical training occurs due to the creation of appropriate information environments, a component of which is project activity. In accordance with the above, the author distinguishes the following levels of training of a future mathematics teacher for design: the

methodological level is represented by the categories “activity”, “project”; the theoretical level of categorical-conceptual analysis contains such categories as “pedagogical activity”, “professional training”, “pedagogical projection”, “constructive activity”, “design”; a special level of categorical analysis requires consideration of the categories “design of a mathematics teacher”, “training of a future mathematics teacher”.

The author also considers modern innovative methods and forms of professional training of future specialists, which allow expanding the boundaries of design activity.

The publication indicates the approaches of modern scientists to the issue of design activity. The methods of training future specialists for educational design are characterized, the features of readiness for this type of work are determined. The author studies the methods of using search tasks and projects, gives examples of organizing students to work on projects, performing independent tasks of varying complexity.

Recommendations are offered for the development of skills and abilities of project activities of future mathematics teachers.

Key words: future mathematics teachers; design; training; skills; system; higher mathematics; professional training of specialists; information technologies.

Problem statement. Socio-economic, cultural and educational transformations in Ukrainian society determine the reformation processes in the national education system. First of all, their priorities concern urban renewal, forms and methods of professional training of specialists in the high school, which will provide the spheres of production, service, education and science and the like. In this context, the training of future mathematics teachers endowed with all the defining characteristics of a competitive specialist and personality becomes an urgent need of the present.

In a number of works, the idea of a research approach using information technologies is traced. In the context of the problem of implementing a professional and competency model of mathematical training for students of economic specialties, we note that the successful implementation of the corresponding model is closely related to the possibility of using project activities.

Turning to the problem of transforming the content of mathematical education taking into account the professional orientation of higher educational institutions, we note that it is necessary to shift the emphasis from mastering specific methods and techniques to mastering general methods of analysis, design and implementation of pedagogical activities to developing a research position.

In order to create information environments, implementing integrative connections between theoretical and applied knowledge, we have developed a system of combining qualitative four-level research tasks: level 1 – recognition of studied objects and methods of activity; level 2 – application of learned information to solve typical tasks; level 3 – application of learned information to solve atypical tasks and obtain new information; level 4 – transformation of learned information to solve professional problems with typical computational and experimental tasks of an interdisciplinary nature.

Analysis of recent researches and publications. The rationale of the indicated problem has become the subject of study of many scientists. There is also special importance of philosophical understanding of projection (A. Anoshkin, L. Tondl, I. Peisha, V. Rozin, G. Shchedrovitsky and others); scientific works devoted to analysing certain types of projecting (I. Babin, M. Boiko, V. Kondratyuk, I. Konovalchuk, A. Padalka, A. Nisimchuk, I. Chechil, V. Yusupov); theoretical works of general scientific bases for the implementation of projecting (J. K. Jones, J. Dietrich, N. Zotova, A. Kryukova, A. Novikov and others); researches where projection is considered in the aspect of formation of relevant skills of a future teacher (A. Akimov, Y. Babansky, S. Vitvitskaya, V. Ginetsinsky, A. Dubasenyuk, N. Kuzmina, M. Potashnik, V. Slastenin and others)

The research of the problem of preparing a future teacher for educational projection has been going for a long time, but the issue of the peculiarities of preparing a future teacher for projecting hasn't been revealed yet. The aim of the article is to define the essence and reveal the peculiarities of preparing future mathematics teachers for projecting.

Presentation of the main content. According to the methodological approaches of S. Honcharenko, we have developed a hierarchy of basic research categories, which includes the following levels:

1. The methodological level is represented by the categories "activity", "project".

2. The theoretical level of category and conceptual analysis includes such categories as "pedagogical activity", "professional training", "pedagogical projection", "constructive activity", "projecting".

3. The special level of category analysis requires consideration of the categories "projecting of a mathematics teacher", "training of a future mathematics teacher".

Activity is an active interaction of a person with the surrounding reality where a person acts as a subject, influencing the object purposefully and satisfying his needs. Activity can be considered as a way of person's relation to the outside world, consisting in its transformation and subordination to certain goals. Since the activity is based on the laws of existence of the objects involved in it, therefore it can be called "objective" (Andriievskyi, 2014).

S. Rubinstein, the founder of the activity-based approach in psychological and pedagogical science, defines the essence of a person's activity in pedagogical science in such way that it is possible to determine what it is; the orientation of its activity can be determined and formed by itself. The scientist distinguishes the following semantic components of activity: goals, motives, actions, operations and the like. At the same time, it is worth noting that there is no established definition of pedagogical activity as

a category of modern pedagogical science.

N. Kuzmina distinguishes the following functional components of teaching activities: the subject of pedagogical influence; the object of pedagogical influence; the subject of their mutual activity; study goals; means of pedagogical communication. The concept of 'projection' is derived from the word "project" which was known in the 18th century from the Latin word "projektus", which means "pulled", "stretched out", or "thrown forward". Thus, the category "project" implies the creation of an ideal intended image of the result: a realistic idea, a plan for realising a desired future; a set of documents (calculations, drawings, layouts) for creating some product containing a rational justification and a specific way of implementation; a method of study based on setting a socially significant goal and its practical achievement. According to V. Rozin, the background of projecting in various branches of human knowledge and practical activity was in the times of antiquity (Haran, 2023).

Project technology assumes the presence of a problem that requires integrated knowledge and research search for its solution. The results of the planned activity must have practical, theoretical, cognitive significance. The main component of the method is the student's independence. Structuring the substantive part of the project with an indication of phased results is also very important. The use of research approaches in the project is a kind of cornerstone of the technology. Moreover, the sequence of these methods can be put in the following series: defining the problem (defining the tasks arising from the study) – puttingg forward a hypothesis for solving the tasks – discussing research methods – drawing up the final results – analyzing the data obtained – summing up – adjusting – conclusions (Zhernovnykova, 2020).

A necessary component of the methodology for implementing project activities is the compilation of a general model, which is considered as a conditional image, a scheme of the final result of the project.

The scientist considers that the basis for the development of projecting was the system of signs related to a particular science distinguishing it from another, that is, creating an internal "philosophy" of the scientific branch. According to V. Rozin the development of this philosophy was the first projecting in the field of science methodology. The scientific understanding of the project as a category and method of activity occurred in the XX – XXI century, when the projecting categorical apparatus and the basics of the methodology and methodology of projecting were created. In the 20-30s, the founders of projecting in pedagogical science were A. Makarenko and other famous teachers of that time, who believed that all the best in a person, the formation of a strong, rich personality must be projected in a special way. Taking into account the fact that the project can be considered as a result of projecting and, at the same time, as a form of organisation of mutual activity of participants of the educational

process, V. Dokuchaeva distinguishes the following categories of projection: it has an industrial origin; due to its search and research character, it acquires an intersectoral, universal significance; in a meaningful, procedural sense, it is a category of psychology, since it reflects transformation at an ideal level, in the form of modelling (mental creation) of future objects; in an essential, semantic aspect, it manifests itself as the delineation of new, qualitative changes (Kaliuzhna, 2017).

The significance and timeliness of projecting as a tool and desired result of professional training of a future teacher consist in the following: it initiates non-standard solutions in the pedagogical activity of a mathematics teacher; it is practice-oriented, i.e. it assumes the presence of a tangible and observable pedagogical result; in the search it includes the maximum possible internal resources of both an individual student and a whole group (in the case of group project). On the basis of analysis of scientific literature, we define pedagogical projection as a special purposeful activity of the teacher to create a project that should reflect the process of acquiring knowledge or a system of professional activity with its predictable result. The categories "project", "projection", "projecting" are used widely in modern pedagogical science.

The specificity of using this category is not to replace the pedagogical process with a pedagogical project. Pedagogical projection is one of the methodological approaches in modern education. This approach is based on understanding the values of the pedagogical profession, pedagogical process and pedagogical phenomena accompanying the professional pedagogical activity of any teacher, including a teacher of mathematics (Makedonska, 2017).

Projection as a methodological approach coordinates pedagogical theory with the worldview positions of the future mathematics teacher, allows to project, his own professional and visual sphere, taking into account social and personal visions of the educational process, including the process of teaching mathematics in secondary school. In conclusion, an individual style of professional pedagogical activity of a mathematics teacher forming during professional training in a higher pedagogical educational institution, is also a kind of project that includes his/her own knowledge, skills, abilities and personal-value sphere.

Within the category of pedagogical projection there has been a categorical diffusion over some time, as a result of which didactic projection has emerged as a separate independent category of modern pedagogical science. We distinguish didactic projection as a separate type of professional activity of a teacher, which consists in the development of models of didactic systems of different levels of complexity, as well as models of implementation of these systems in the real educational process (in our case – in the process of studying a course of mathematics in a secondary school). At the same time, the preparation of a mathematics teacher for the implementation of

didactic projection should rely on the formation of a system of relevant knowledge, which should perform two main functions – explanatory and motivational; practical skills provide the implementation of the semantic chain "analysis (diagnosis) – prediction – projecting – project implementation – analysis (reflection)". As T. Yakovenko notes, "the purpose of didactic projection is the development of didactic project of teaching at a particular level. The object of projecting is an educational and pedagogical situation that should be changed in the process of implementation of the didactic project" (Tarasenkova, 2022).

Considering the projecting of a mathematics teacher as a scientific category at several main levels - methodological, technological and procedural – we came to the conclusion that the essential characteristics and professional-pedagogical result of training a future teacher to implement projecting in the conditions of a comprehensive school can change. It depends on the point of consideration. It should be noted that the projecting of a mathematics teacher is based on the principles of personally oriented teaching and is deeply motivated, highly organised and aimed at increasing the level of mastering of mathematical knowledge, skills and abilities by students on the basis of the projection of the educational process and the use of the appropriate project technology.

The preparation of the mathematics teacher for projecting is the system of purposeful actions to form readiness for implementation of projecting on the basis of system technology, which provides for the implementation of a set of interrelated components and ensures the formation of projecting knowledge, skills and abilities in the process of study at the pedagogical university.

The projecting of a future mathematics teacher can be considered in several ways, and this is the main difficulty of considering this phenomenon, as it is multilevel and complexly organised – as a process, as a method, and as a phenomenon. Therefore, projecting considered as a mean of creating one's own project of professional activity of a mathematics teacher (during higher education, and during the accumulation of individual professional experience); as a basic activity in the system of professional work of a future teacher of mathematics (along with organisational, analytical, predictive, etc.); as an innovative teaching method to be learnt by the future teacher of mathematics during professional training and reproduced later in professional activities; as a mean of activation of cognitive activity of students, forming their basic knowledge of mathematics during their study at secondary school (Tarasenkova, 2022).

The preparation of the future mathematics teacher for the implementation of projecting includes:

1. The separation of the whole process of mathematics teacher training into stages and the focus of each of them on the formation of motivational, substantive and

operational components of readiness for the implementation of projecting.

2. The identification of organisational and pedagogical conditions of activation of learning and cognitive activity of future mathematics teachers in accordance with the goals and specifics of each stage of projecting.

3. The formation of special professional competence in the field of pedagogical projection in mathematics.

The result of preparation of the future mathematics teacher for the implementation of projecting is readiness, which implies the presence of a system of knowledge, skills and practical skills in this field. Future mathematics teachers should know: goals and features of pedagogical projection as a field of pedagogical activity; methodological bases of projection, including activity, system, technological, personality-oriented approaches to professional activity in the sphere of projection of educational process; target settings of mathematical education in the modern system of general secondary education; didactic and methodical possibilities of innovative technologies in teaching mathematics with the use of didactic and methodological possibilities of innovative technologies in teaching mathematics with the use of projection of the educational process; basics of the technology of projecting in the conditions of general education school (Fonariuk, 2020).

Students, future maths teachers, should be able to: define educational goals of pedagogical projection; evaluate the disadvantages and advantages of individual variants of the projection of the study process, based on the real conditions of studying a course of mathematics; to predict the results of studying a course of mathematics, based on the results of applying the projection of the educational process; to implement the projection of the content, forms, methods and means of teaching mathematics. As a result of preparing future teachers for implementation of their projecting students should have relevant skills: to know the basics of pedagogical projection technology; skills of using the project method in teaching pupils mathematics; mastering the methodology of project-based learning using its technology and taking into account the age and individual characteristics of schoolchildren; skills of evaluating didactic and methodological possibilities of projection as types of professional activity of a mathematics teacher; skills of reflection of your own projecting.

Work on the project includes the student’s awareness of the goal, the design of the idea, the development of an organizational plan, work according to the plan, and summing up in the form of a written report.

Project learning can be considered problematic and developmental, since it forms motivation to create and transform oneself.

“Project activity acquires personal significance, since in the process of mastering it, the ability to take into account and overcome obstacles to achieving the goals of the

project is manifested, a stable subordination of motives is formed, while active self-activity in the educational process contributes to the creative and social development of the individual. The degree of satisfaction received when achieving the set goal affects a person's behaviour in similar situations in the future" (J. Johnson).

The project method in competency-based education is a tool that creates unique prerequisites for key competencies (social, multicultural, informational, communicative, etc.) and student independence in understanding the new, stimulating his natural curiosity and creative potential.

The advantages of the project method are that it is a method of combining:

- theory with practice, based on the creative searches of students;
- teaching and upbringing with the child's life and the environment.

Project technology involves systematic and consistent modelling of problem situations that require participants in the educational process to make search efforts aimed at researching and developing optimal ways to create projects, their mandatory defence and analysis of the results.

The project method is focused on independent activity of students (individual, paired, group) in the time allotted for it (from several minutes of the lesson to several weeks, and sometimes months). This is the task of personally oriented pedagogy (Chobitko, 2016).

Conclusions and prospects for further research. Thus, based on the analysis of scientific literature, we define pedagogical projection as a special purposeful activity of a teacher to create a project, which should reflect the process of acquiring knowledge or a system of professional activity with a predictable result.

As for the peculiarities of mathematics teacher training for projecting, it is a system of purposeful actions to form readiness for implementation of projecting on the basis of system technology, providing realization of a set of interrelated components and ensuring the formation of projecting knowledge, skills and abilities in the process of training in a pedagogical university: projection of pedagogical systems, projection of learning and educational processes (the process of acquiring mathematical knowledge); projection of studying situations (situations of solving a particular mathematical problem, mastering a particular topic in the course of secondary school mathematics, etc.). We see the prospect of research in the further scientific substantiation of didactic conditions that will contribute to the effective preparation of future mathematics teachers for the projection of educational activities of high school students.

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ОСОБЛИВОСТІ ПРОЕКТУВАЛЬНОЇ ДІЯЛЬНОСТІ У ПІДГОТОВЦІ МАЙБУТНІХ УЧИТЕЛІВ МАТЕМАТИКИ

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Анотація. Стаття розкриває сутність та особливості підготовки майбутніх учителів математики до проектування. У публікації визначено взаємозв'язок між ефективністю підготовки майбутніх спеціалістів математичного профілю із рівнем їх готовності до реалізації набутих знань, умінь і навичок певного напряму.

У статті розглянуто проектувальну діяльність як ефективний засіб активізації навчальної діяльності студентів під час вивчення предмету. Якісно організована робота над сумісним проектом сприяє вчасному виявленню прогалин у їх фаховій підготовці, а отже сприятиме оптимізації навчального процесу і відповідно активізації їх навчальної діяльності. Групова робота та робота з проектами є важливим засобом стимулювання навчальної діяльності студентів. Як показує практика, підготовка власного проекту та його презентація безпосередньо позитивно впливає на розвиток лідерських якостей та здібностей фахівця в цілому.

Продемонстровано, що в умовах інтеграції освіти, науки та виробництва трансформація математичної підготовки відбувається за рахунок створення відповідних інформаційних середовищ, складовою яких є проектна діяльність. Відповідно до зазначеного автор виокремлює такі рівні підготовки майбутнього вчителя математики до проєктування: методичний рівень представлений категоріями «діяльність», «проєкт»; теоретичний рівень категоріально-концептуального аналізу містить такі категорії, як «педагогічна діяльність», «професійна підготовка», «педагогічна проекція», «конструктивна діяльність», «проєктування»; особливого рівня категоріального аналізу потребує розгляд категорій «проєктування вчителя математики», «підготовка майбутнього вчителя математики».

Також автором розглянуто сучасні інноваційні методи та форми професійної підготовки майбутніх фахівців, які дозволяють розширити межі проектної діяльності.

У публікації зазначено підходи сучасних науковців до питання проектної діяльності. Схарактеризовано методи підготовки майбутніх фахівців до навчального проектування, визначені особливості готовності до даного виду роботи. Автором вивчено методи використання пошукових завдань та проєктів, наведені приклади організації студентів до роботи над проектами, виконання самостійних завдань різної складності.

Запропоновано рекомендації для розвитку умінь та навичок проектної діяльності

майбутніх учителів математики.

Ключові слова: майбутні вчителі математики; проєктування; підготовка; уміння; система; вища математика; професійна підготовка фахівців; інформаційні технології.

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