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Introduction of Mathematical Methods in Teaching Humanities Students

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***Abstract*-The article considers the forms and methods of applying graph modeling in the teaching of students of social and humanitarian specialties. A course of graph modeling methods was read to the students of "Social Educator" specialty. The main goal of this project is to develop and consolidate the skills of structuring the problem, establishing links between the elements of the structure. As a test work, students should build a graph model of the problem they considered in their graduate work. The article gives examples of the most interesting test papers. The result of this approach was a clear statement of the purpose and objectives of the graduate work, the choice of the optimal method for its solution, a system analysis of the results obtained.**

Keywords-active learning, graph models, students, social and humanitarian specialties

I. INTRODUCTION

Education system is focused on the formation of personal and professional competencies in order to prepare specialists in demand by the society. Indicators of the quality of professional higher education are the demand for the knowledge acquired and the ability of graduates to self-dependent creative activity in solving specific professional problems.

The modeling method, as one of the methods of simulation situations, is a part of the cognitive process and is one of the active methods of teaching. Teaching technologies with modeling elements contribute to the development of logical thinking, form in the students the skills and abilities of intellectual activity. The essence of the cognitive process is that the trainee builds the image of the studied object, shows the composition and hierarchy of functional elements aimed at achieving the goal. Fixing such an image with its basic properties and relationships is more convenient to perform in mathematical form, using structural or functional models. In structural models, quantitative relationships between elements are not displayed, but various structural relationships between them are considered (hierarchy of tasks and forms, causes and effects, etc.) [1].

In recent years, the principles of modeling have been developed, using graph models in the activities of both the teacher and the students. Graph theory provides a simple and powerful tool for constructing models and solving problems of ordering objects. The graph approach provides the ability to present objects and processes under research in an accessible for analysis and understanding form, to avoid many logical errors. Researches have shown that human memory stored about 10% of what was heard, 50% of what was seen, and 90% of what was done by himself. Especially impressive results are given by attempts to introduce mathematical methods into the sciences of the humanitarian profile. They bring with them a clear description of the structure, conciseness and visibility of the representation of objects and phenomena, new opportunities in systematization and forecasting.

At the St. Petersburg Institute of culture, students majoring in "Social Pedagogue" speciality were offered a course on the use of simulation methods in professional activities. As a test work, the student should build a graph model of the problem considered in his graduate work. Graphs, because of their clarity, are an ideal tool for exploring the techniques of building models. The construction and study of graph models helps to avoid formalism in knowledge, when the student does not see the connection of mathematical concepts and facts with the real world. The main goal of this project is to develop and consolidate the skills of structuring the problem, establishing links between the elements of the structure [2,3]. In the classes we have discussed various methods of graph simulation. In the test work, students had the freedom to choose a particular method in the construction of a model of situations arising in their professional activities. As a result, students, at first, more clearly saw and understood the problem considering in the graduate work, and the second, saw additional perspectives of solving this problem, and the third, realized that mathematics can not only be understandable, but it can also be applied with the interest. Let us consider some models proposed by students.

II. SYSTEMS WITH A HIERARCHICAL STRUCTURE

A very common type of systems the system with a hierarchical structure. Hierarchical structure naturally occurs when objects or some of their properties are in relation to subordination (attachment, inheritance). Graphical structuring produces a graph similar to a tree that grows from top to bottom, so hierarchical graphs are sometimes called trees. The resulting tree-type graph has only one vertex that is not subordinate to any other and is located at the top of it. The hierarchical model (Fig.1)

reflecting the forms and methods of work in Art Studio is built in the graduate work (graduate work Demidova I. N.).

The vertex of the zero level - Art Studio classes in the Lyceum № 101.

Vertices that are in direct subordination from the vertex of the previous level are different forms of work.

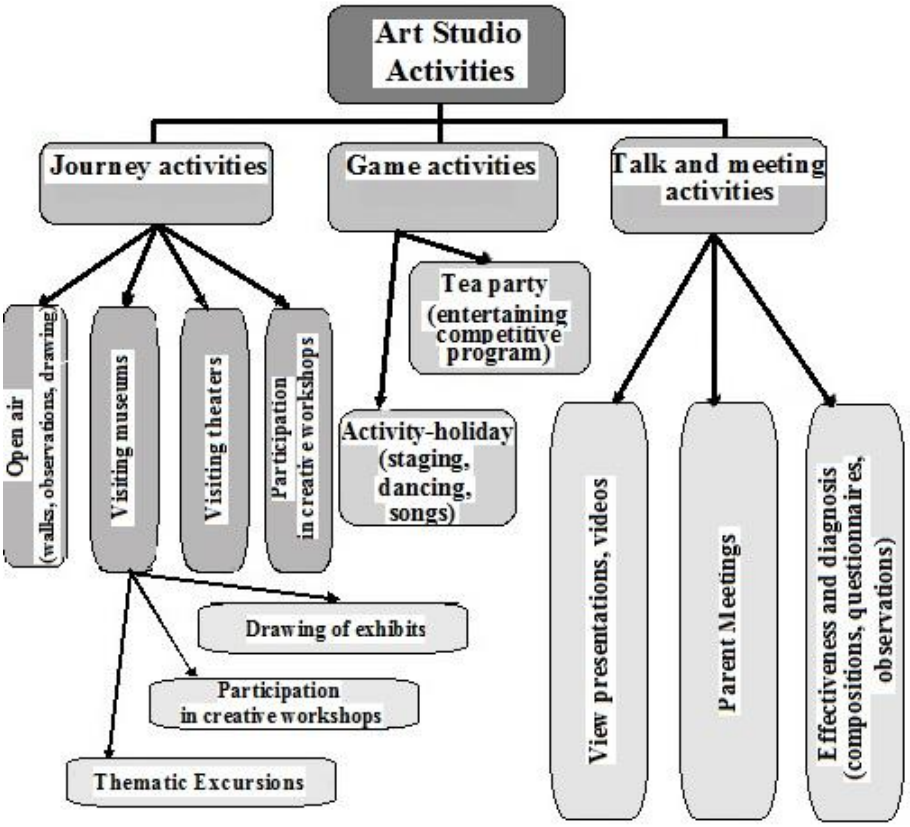

Fig. 1 Model, reflecting the forms and methods of work in art studio

It can be seen from the figure that the model is constructed in a clear hierarchical sequence, and the complete image of the research object is visually represented.

The next type of data model is the network model. A network model of data is understood as a logical data model in which all objects can be associated with all, that is, in addition to vertical links, connections between objects of the same level are possible. Most often this type of model is used in planning.

III. A NETWORK MODEL

A network model is a set of methods based on the use of the mathematical apparatus of graph theory and the system approach for mapping interrelated works, actions or activities to achieve the goal. The main tool is the network schedule, which depicts the list of project activities, the order of their implementation, the duration of each work and the entire project. The network graph reproduces the planned process, links and dependencies of individual operations using two basic elements: work and event. The event indicates the moment of transition from one job to another, that is, serves as a link between the works. One of the methods of network planning is a diagram called "top-work". In the English version, the model is abbreviated as AoN (Activity on Node). The method is simple and clear. At the vertices of the chart, not events, but works, are placed. The relations of the precedence between them are denoted by arrows. The network graph clearly reflects the sequence of the individual works and their logical interrelation, clearly distinguishes those works that can be done in parallel. If there are no numerical estimates in the network model, then such a network is called a structural one. The distribution of work on time (Fig. 2) is clearly visible in the research "Technology of preventing psychological and social disadaptation of teenagers" (graduate work of a student Zakharova I.I.). Speaking the language of the network method, it is necessary to produce the following set of works:

1. Identification of the problem (advice on the prevention of violations).

2. Acquaintance with the teenager, with a characteristic of him.

3. Conversation with the teenager.

4. Individual conversation with the mother and grandmother of the teenager.

5. Observing the teenager.

6. Individual consulting of a teenager by a school psychologist.

7. Visiting individual developing classes.

8. Visiting a family at home by a social teacher and class teacher.

9. Conversation with the inspector of a children's room of militia.

10. Studying the teenager's medical record.

11. Observing the nature of the teenager's work in the class.

12. Analysis of the products of its learning activities.

13. Observing by teachers the behavior of teenager.

14. Questionnaire for teachers.

15. Visit by the teenager the group trainings in the center of psychological, pedagogical and medico-social support.

16. Diary of observations.

17. Involvement of a teenager in leisure activities (entry in a free sports section, taking into account the interests of the teenager).

18. Development of an individualized program of corrective-developing training and education of a teenager, ensuring an adequate interrelated development of cognitive and speech activity, emotional-volitional motivational sphere and personal growth of the child with subsequent adaptation to the usual learning conditions.

The above list of works does not determine the sequence of their implementation, that is, their temporal interdependence. This is achieved in the next stage - with a graphic representation of all stages.

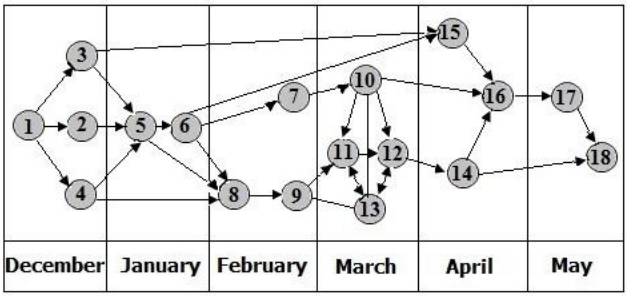

Fig. 2 Network timetable of the distribution of work stages by time

With the help of the network model, the entire course of the work is visible. In turn, since work in the network schedule is interlinked in time, it makes it possible to monitor the progress of work.

IV. ISHIKAWA DIAGRAM

When solving the problem of analyzing the possible factors associated with the process under investigation, it is expedient to order them, to classify them, and to reveal their possible number. It is also important to have a visual representation of the problem. The application of the Ishikawa diagram allows us to solve these questions quite well. The diagram is a means of graphically arranging the factors influencing the object of research, so we applied it to the research of the problem of "Creating a Children's Folk Theater on the basis of a preschool institution" (graduation work of a student Alekseeva Yu.A.). The main thing in the construction of the diagram was to ensure the correct subordination and interdependence of factors, as well as clearly design the scheme, so it looked good and easy to read (Fig. 3). Before the construction, the main criteria for using the theatrical game were identified, as a means of successful socialization of preschool children, the disclosure of their creative abilities:

Objective of the project:

Creation of the Children's Folk Theater on the basis of a pre-school institution, as an additional form of leisure activities.

Tasks:

1. Study and systematization of repertoire material

2. Creation of the teaching staff of the theater

3. Creation of the program of the Children's Folk Theater:

4. Involving parents in the theater.

The idea of the project:

The key word is "folk", since the future theater

1. will be amateur, which was originally the Folk Theater,

2. children, its main participants, are identified as a separate social group

3. The repertoire of the future theater will, mainly, be based on folklore material, as the most vivid and easily remembered. All work on the repertoire is supposed in the form of theatrical games.

Characteristics of the target audience:

Participants of the Children's Theater will be children at the age from 5 to 7 years, as well as their parents and teachers and organizers.

Staff support of the project.

Information and methodical support of the project.

Material and technical support of the project.

Financial plan of the project.

The main areas of work with children.

Criteria for effectivity estimation.

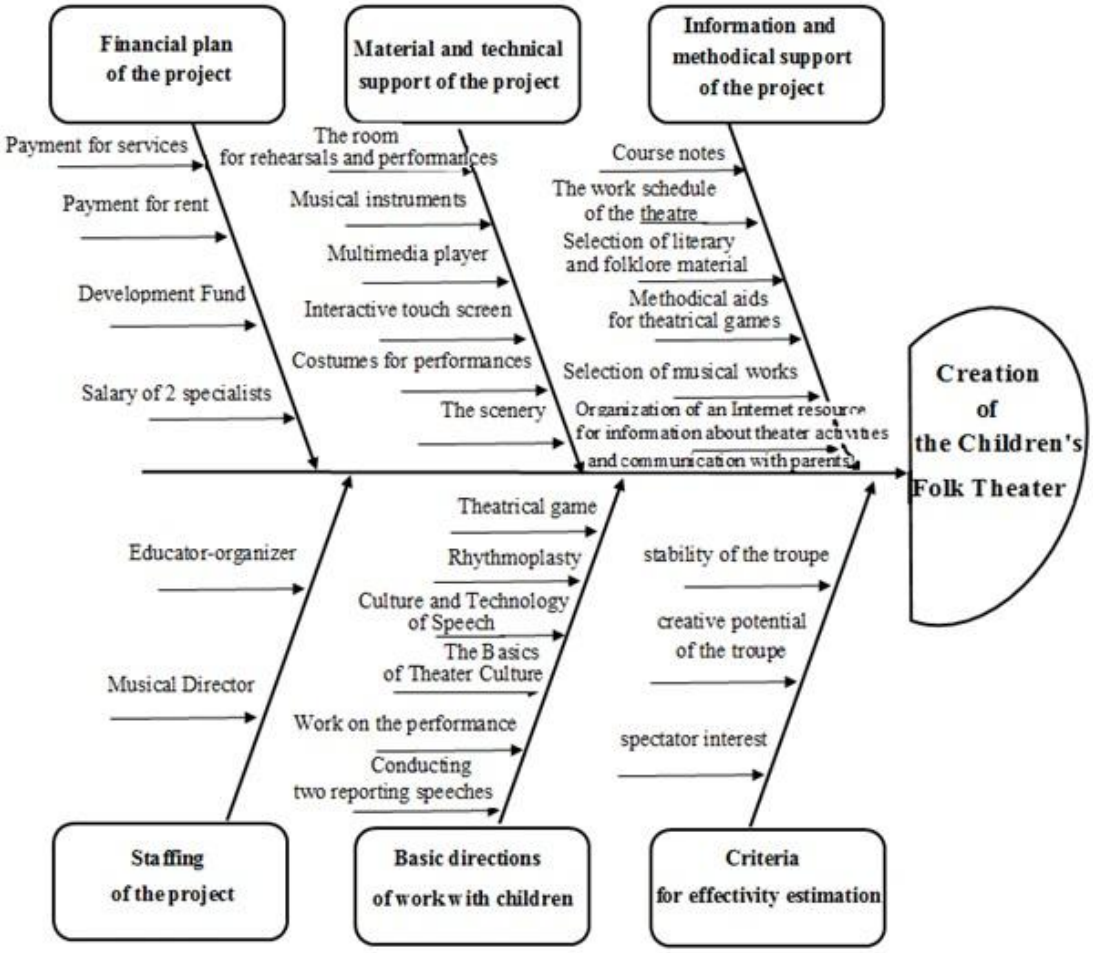

Fig. 3 Ishikawa diagram of the problem "creation of the children's folk theater on the basis of preschool institutions"

The diagram allows to show in simple and accessible form the basic aspects of the resolution of this problem, to see and realize the factors influencing the final result in the aggregate. Also, the work on the diagram undoubtedly increases the qualification of the researcher.

As can be seen from the examples considered, the graph representation of specific professional situations enables students to present the problem as a whole, to see its structure, to determine the optimal logical connections between its elements, to identify the options for correct and erroneous solutions. All this develops the skills and abilities of analyzing the problems that arise in the professional activities of future social educators, developing their research and analytical thinking. With the help of graph modeling, you can carefully sort out the solutions to the problem. Using in their graduate work elements of graph modeling, students thereby gain new knowledge, develop cognitive-creative abilities, improve skills and abilities of self-independent work, self-organization, develop imagination and creativity [4], and this significantly improves the quality of teaching.

In their diploma researches, future social educators used graph modeling while considering and analyzing pedagogical problems for:

1. formalization and construction of a general structural model of the object at different levels of its complexity,

2. analysis of the model obtained, the allocation in it structural units (subsystems),

3. studying the levels of the structure of hierarchical systems: the number of levels, the number of inter-level and intra-level links,

4. analysis of the effectiveness of the functioning of this system,

5. searching for the optimal structure,

6. analysis of the location and significance of each elementary phenomenon in the overall process of functioning of the system under consideration.

V. CONCLUDING REMARKS

Based on the above, it can be concluded that the trainee, in our case the future social pedagogue, having acquired the skills and abilities of graph modeling, in the graduate research work:

- structures the problem that needs to be resolved;
- highlights its main components;
- considers possible solutions;
- analyses and draws conclusions based on the constructed model.

It should also be noted that graph modeling is a valuable link in decision support systems, allows considering a large number of options, play different scenarios.

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