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MAIN ACTIVITIES OF THE TEACHER AND THE STUDENTS IN THE PROCESS OF PROJECT WORK

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Abstract. In the present paper we examine some results of mathematical work on projects in 21st Secondary School Hristo Botev, Sofia. During the first stage of the project work: "Introducion" the students develop some basic skills shown in the paper. At all stages: "Introducion", "Trial and error", "Basic" and "Advanced" the teacher and the students carry out some basic activities that are differentiated and presented in tables.

Key words: project work, activity, stages of the project work
Mathematics Subject Classification 2000: 97D40, 97C90

1. Introduction

Education and training are central to the Lisbon Strategy for Growth and Jobs. European framework for lifelong learning identifies and defines eight key skills, including skills in mathematics and information technology skills [14]. Emphasis in mathematics, along with the receipt of knowledge is placed on developing skills and positive attitude to the subject, but also on greater relevance in solving real problems. A report by the European Commission in 2009 [14] indicating the importance of work and placement evaluation of projects and the need the experience in this field to be further studied and developed. Emphasis is placed on in-depth study of the potential of new technologies for enhancing innovation and creativity to create new partnerships and customization educational needs.

In this connection, more than ten years, in 21st Secondary School Hristo Botev it is formed and confirmed model to project work by the students upper classes. Psychological attitude of the newly students is that they will occupy only a foreign

language. The work of the math teacher is difficult, so it is necessary to use all methods of organizing and carrying out educational activities [10, 181-195]. The teacher gives an overview of the project work. Activities other than student life, causing expression of attention and interest in new, diverse, unknown. The curiosity of the children increases after presentation of projects which are developed larger students. Following their example, students are convinced that the project work in mathematics can help them to develop into one or another area to fill gaps in their knowledge and to extend them

2. Methodology of training

Work on the project is an educational strategy which is successfully used in various countries for years. It promotes social development of students and create a favorable learning environment with a spirit of cooperation and group identity. At the heart of the project activity is the idea of constructive training of J. Dewey, redefined and reassessed by W. Kilpatrick. Constructivism is an educational philosophy based on the premise that people actively construct their own understanding or knowledge through the interaction of what they already know, and events and activities that come into contact. The contribution of Jean Piaget [11], Lev Vygotsky [13], J. Brunner [1], G. Piryov, D. Pravdolyubov, D. Katsarov and others is essential. According to R. Slavin essence of this theory is the idea that "learners must individually discover and transform complex information if we want to make it their own" [12]. Constructivism, as a teaching methodology is based on considering the interactions between two main factors in the cognitive activity of the individual – the process of internal development of cognitive schemes and appropriate external stimulation and updating [2]. Constructivist approaches provides a high degree of understanding, it is adequate in practice. Purpose of training is not only transmit information but also to transform the students from passive recipients of foreign knowledge into active constructors of their own and others' knowledge, i.e. the goal is to reach their own understanding and not to remember the "correct answers". Teaching should be engage in active construction of knowledge. For the success of this approach they are used problem-situation method, project work and other teaching strategies.

3. Formation of skills and activities

Pedagogical effectiveness of the method of the projects is based on the activity approach in the education and on the principle of learning problem [15]. Its realization leads to the development of intrinsic motivation for learning, development of constructive critical thinking of students, establishment of basic competencies. Through the project work the students learn to self-organization, and "the self- organization include and self-education" [4].

In [9] we observe the stages of the project work process in the upper school course: Introduction (8th grade), Trial and Error (9th grade), Basic (10th grade), Advanced (11th and 12th grade). The Introduction is quite different from the rest, as it prepares the students for the future activity. At this stage are formed the basic skills necessary for the beginning of project work. This is an activity, which includes some elements of scientific research work and supports medium close to the creative one of the mathematicians. That is why the first skills which the students posses are close to the skills of the young scientists [7]. The long years spent working over mathematical projects by the students is leading us to the necessity of formulating in the young people the following

Main Skills

– **Knowledge Collecting.** During the Introduction Stage the students from language classes collect knowledge mainly in the sphere of the studied language. This knowledge has its own place in the project work. Though, most needed is basic knowledge of mathematics. This the young people gain in the mathematical classes and in the extracurricular activities where the level of learning is increased. "In the beginning human activity is always outer and practical, and afterwards it gets inner, an activity of the mind" [8, 35]. This starting formulation is a methodological guide for detecting the nature of the process of accumulation of knowledge. During the work on the subject we are looking for forms, means and ways to acquire more basic knowledge and to form mathematical skills. Through discussions, debates, lectures, individual and group work, students are accustomed to and guided to the formation of the skill of perceiving more information for a certain period of time. In this way we obtain a synergic effect in the process of knowledge collecting. In his work "About the Mathematical Problems" [3] Ivan Ganchev makes detailed analysis of the choice, systematization and place of problems in the process of teaching mathematics. The results of this analysis may be used in the knowledge collecting and the preparation for project work. In the paper "Tools for Finding and Support of Distinguished Mathematical Students" [6] Sava Grozdev and Petar Kenderov show systems of basic problems for the contestants in mathematics. Some of the basic problems, adapted to the level of the students, may help for the knowledge collecting, which will prepare them for the mathematical projects work.

– **Skills for Information's Finding.** With the pace of scientific development and the increase of any information (printed and electronic), students must have both the ability to detect the necessary information, and to assess it. They learn to make bibliographic references on a subject, to search information on the Internet. The latter is not always reliable, so they need to separate the one that is valuable. When they have a large amount of sources, students learn to choose the highest quality, something difficult even for the more experienced.

– **Skills for Usage of Certain Amount of Specialized Literature.** These are expressed by reading, and the ability to understand what is read.

– **Skills for Self Learning of the Found and Selected Material** – mental stress, efforts to explore the materia, trying to understand the problems solved and to solve such.

– **Skills for Optimal Loading** – include skills sessions with enough interesting and complex matter, and at the same time work according to the strenghts.

– **Skills for Self-organization** – these are skills for time management, optimal regulation of the tasks, their ranging in time, skills for alternating work and rest. These are formed through daily training and ongoing effort to do so.

– **Skills for IT Usage** – formed mainly in the IT classes. For many young people working with new technologies is a hobby that they practice at every opportunity.

– **Skills for Oral Expression of the Material** – exact exposition, smooth voice, choice of means of expression. This is one of the most difficult obstacles for the students. Initial skills will be upgraded over the next years of training.

– **Formulation of Personal Qualities** such as honesty, courage, kindness, diligence, perseverance, joy, humor, responsibility, etc.

– **Skills for Aesthetic Ordering of the Material** – the sense of aesthetic is formed for a long time both in the art classes, and in the daily activities of the students.

Main Activities

The formed basic skills enable the students to start the actual project work. In the process of training and development of mathematical projects, the teacher and the students perform some basic operations. In his work [4] S. Grozdev examines major learning activities in the preparation of the students for competitions in mathematics. Some of the ideas can be adapted and used in determining the basic learning activities.

More detailed and shown separately for the students and the teacher, the main activities in the project work during the Introduction stage may be presented in the following way:

Table 1. Main Activities at Introduction Stage

Teacher	Students
Provides an overlie of project work	Listen to what the teacher says
Offers students to consider new projects, shows photos from sessions	Review finished projects and photos from the activities
During classes uses presentations (teaching through this tool), prepared by the older pupils	Actively perceive the information presented through the presentations of the older students, learn academic knowledge

Organizes School Conference or other forms of presentation of projects done by older students and invites students from introductory stage to these forums.	Attend presentations of projects done by older students (for example School Conference)
Organizes meetings with older students.	Attend meetings with older students: present and ex-students, listen actively, ask questions, and participate in discussions.
Organizes the start of project work	Do first own tries
Clarifies the rules for teamwork	Get to know the rules of teamwork
Clarifies the rules for presenting and participating in School Conference	Perceive and comprehend the information requirements during the actual School Conference

In his work "Olympiads and Synergetics" [5] Sava Grozdev states that when preparing outstanding students the teacher may use the following theoretically possible approaches: explanative and illustrative, heuristic (searching) and explorative. In developing projects in mathematics, the first approach is mainly used during the introductory stage. The activities of the teacher related to better academic preparation and ability to present a clear, accessible, attractive, relevant information. The activity of students is mainly focused on information acquisition. These include activities: listening, remembering and understanding. In the heuristic approach the learning activities both of the teacher and the students are analyzing, abstracting, formulating hypotheses, experimentation, observation, etc. These are closely related to the processes of exploration. The goal of the heuristic approach is the solution of a problem and how the students reach to it. The exploration, on the other handm begins with the solution, and the goal is determination the of heuristic techniques that led to it. Both approaches are used in the Trial and Error, Basic and Advanced stages. At these stages the teacher and the students perform the following activities:

- **Determination of teams**
- **Determination of deadlines**
- **Determination of criteria for evaluation**
- **Choice of topic**
- **Team work over the chosen topic**
- **Projects presentation**
- **Evaluation and advices for future work**

We may differentiate and systematize the activities in a general table:

Table 2. Main Activities of the Teacher and the Students in Project Work during the Trial and Error, Basic and Advanced Stages:

Main Activities	Trial and Error Stage	Basic Stage	Advanced Stage
Determination of teams	Teacher's activity	Students' activity	Students' activity
Determination of deadlines	Activity of the teacher , who has prepared yearly plan		
Determination of criteria for evaluation	The criteria are determined by the teacher	The criteria are determined by the teacher. The students may give their own suggestions	
Choice of topic	The teacher gives a list of topics, and the students may choose from that list	The teacher gives a list of topics. The students may choose from that list, but they may also choose a topic on their own.	The students choose a topic on their own. The teacher may help them, in case they need it.
Team work over the chosen topic	The students realize the algorithm of work over a mathematical project. The teacher supports the teams by providing advice, checking the preliminary versions, explaining obscure materia, leading to problems solution, finding additional literature, rebuking, encouraging, promoting, etc.		
Projects' presentation	The students present their projects, participate in the organization of the class and school conferences. The teacher organizes the class and school conferences, gives technical and logistic support, finds a jury, prepares evaluation cards, etc.		The students present their projects, participate in the organization of the class and school conferences. The teacher organizes the class and school conferences, gives technical and logistic support, finds a jury, prepares evaluation cards, etc.
Evaluation and advices for future work	The students observe the way of evaluation and compare the criteria and the ratings. The teacher evaluates each project and each student separately. Gives directions for corrections, additional literature and	The students fill in evaluation cards for the class and school conferences, give advices and other written instructions. Get ratings and give answers to the jury and their classmates, participate in the	The students fill in evaluation cards for the school conference and get rated y the jury. They listen to the advices and instructions of the jury, answer questions, back thesis with arguments.

	development of the project work.	preparation of the evaluation cards and in the organization of their filling. The teacher organizes a jury that will evaluate each project presented on the school conference. The teacher directs the students towards the future work and the development of the projects.	The teacher organizes a jury that will evaluate each project presented on the school conference. The teacher advice the best students towards participation in national contests and conferences.

4. Conclusion

The main activities are performed at each stage. However, there is a difference in the way of work and the degree of autonomy of the students. Gradually, from chief active force in the organization and implementation of project activities, the teacher yields presence to the students. Step by step, with the formed and developed basic skills, the young get more confident and conquer new horizons. At the end of their training they can all alone deal with the development and presentation of projects.

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ОСНОВНИ ДЕЙНОСТИ НА УЧИТЕЛЯ И УЧЕНИЦИТЕ ПРИ РАБОТА ПО ПРОЕКТИ

Иванка Марашева – Делинова, Евгения Ангелова

Резюме. В настоящата работа се разглеждат някои резултати от работата по математически проекти в 21 СОУ „Христо Ботев", София. През първия етап на работа по проекти – Въвеждащ, се формират основни умения у учениците, които са представени в разработката. На всички етапи – Въвеждащ, Проби и грешки, Базов и Елитарен, учителят и учениците извършват основни дейности, които са диференцирани и представени в таблици.