# DATA HANDLING AND PROJECT- BASED LEARNING AT PRIMARY SCHOOL

**Rumyana Y. Papancheva**
University „Prof. Dr. Asen Zlatarov" – 8000 Burgas, Bulgaria
Faculty of Social Sciences
+359888272944
papancheva@dgklaz.net

**Original Scientific Paper**
**doi:10.5937/joupроman5-15372**

**Abstract.** The article presents the author's experience from implementation of project-based learning at Primary school aiming in development of knowledge for data handling. Students conduct variety of surveys and present their results by creative designed diagrams. The work is part of a larger research for developing statistical literacy at Primary school. The project work "Funny diagrams" is described and some conclusions and recommendations are formulated.

***Keywords:*** *basic statistical literacy, project-based learning at Primary school, data handling, tables and graphs, technologies integrated teaching and learning, Primary school mathematics*

## I. INTRODUCTION

The school nowadays sets serious challenges to teachers, students and parents. We live in a society defined by technology and requiring the formation of people with analytical thinking. At the same time, the educational system is working on norms set many decades back in time - a problem not only relevant to the Bulgarian education system, but in a global scale.

The modern school proposes various innovative forms and approaches for the realization of an adequate learning process. These include "the flipped classroom", multimedia lessons, interactive lessons, creative tasks and their presentation, and first, the use of project-based learning. Project-based learning with integration of technology offers learning through doing. It puts the student in an active position. It requires the realization of a final product.

Project-based learning is most commonly associated with John Dewey's name. In his book "My Pedagogical Creed" from 1897, are exposed his views on education, and they are relevant today more than 100 years later (Dewey, 1897).

Project-based learning aims the setting of a task for realizing of a final product solved and achieved as a result of the pupils' independent research. The role of the teacher is to guide and support the learning process and not to provide a ready solution. His role changed and instead of standing in front of the class, the teacher positions himself among the students in the class. In general, the organization of work is teamwork or in pairs. Students are placed in the active position of researchers on the assigned project task. The performance of the assignment is determined by pre-assigned assessment criteria. The final product of the project work is presented publicly.

Projects and investigations are ideal for student engagement, for learning to solve problems in context. The emphasis should be on students posing their own questions about the data, and learning new information about the real world from the data. Students can choose any topic of interest to them for their work in the statistics classroom, which can increase student motivation. Working with real data helps students investigate issues that do not often appear in textbook problems (Batanero, 2011)

## II. APPLICATION OF MODEL FOR TECHNOLOGIES INTEGRATED PROJECT-BASED LEARNING AT PRIMARY SCHOOL

The specificity of applying the project approach in elementary school is that the teacher should support the learning process. Its role is to guide the task, by dividing it into meaningful subtasks with the possibilities of the students.

In figure 1 is presented a model for project-oriented education with integration of technology at elementary school (Papancheva, et al., 2005). A basic element of the model is the school project. The project work follows certain objectives. The definition of the project also defines the product of its realization.

The work is divided into situations that, step by step, lead to reaching the end goal. Key factors for the successful implementation of the model are the interdisciplinary links, the integration of modern information and communication technologies, the application of a team form of work, the use of various forms of evaluation and self-assessment of different stages of the project work.

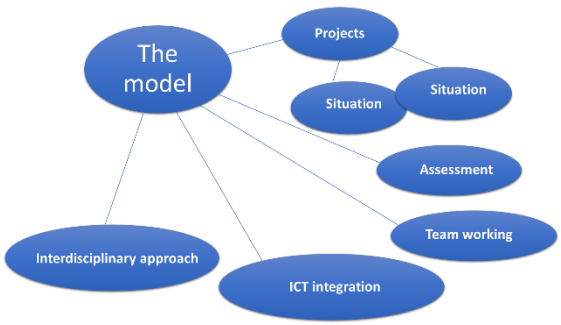


*Figure 1. Model for technologies integrated project-based learning at Primary school*

The stages for realization of project work at primary school are: organizational, operational and productive. The organizational stage includes all activities prior to starting the actual learning activity with students. The operational phase is the time of real work with the pupils during the realization of the curriculum. The productive stage includes the presentation of the final product, analysis and correction of the volume of work performed and the formulation of conclusions (Papancheva, et al., 2006).

## III. THE EXPERIMENTAL WORK

The goal of the study is to clarify and to raise the level of understanding of the third-grade students of conducting survey and to present its results in a creative way.

The subject of the research is the use or Project-based work into the process of forming and developing knowledge of conducting survey at Primary school.

The approbation process took place in technologies equipped learning environment. The teacher worked on an interactive whiteboard on specially designed learning tasks in digital form. Students worked individually and in teams on variety of project tasks.

For presentations of results of the surveys conducted students had to use creative way of visualization of data graphs using variety of materials.

The target group was 3rd grade students (two classes, 40 students). The experimental teaching lasted 6 academic hours distributed in the following manner: Diagnostic test, 5 Math classes, One teacher's class of the weak, Control test.

The following indicators were used for determination of the level of understanding of working with data from third-grade students:

Skills for conducting independent research (survey). Indicators:

- The student can do a survey and collect the data.
- The student can process the data and summarize them in tabular form.
- The student can present the data collected in graphical view (via diagram)

The evaluation scale is from 0 to 4. The points correspond to student's work from "weak" to "excellent" level.

There are additional criteria, concerning team working, and the development of creative and communicative skills of the students.

For the experimental work was developed a learning project on topic "Funny Diagrams". The main purpose of the project is to create knowledge and skills for conducting a self-study, with an additional emphasis on the formation of team skills and the development of the students' creative thinking.

The realization of the project work is carried out in three stages - organizational, operational, productive. The following criteria and indicators are formulated to evaluate the survey results:

- Ability to read information given in tabular or graphical form: the student can draw conclusions on a given table or diagram; using information given in graphical or tabular form, the student can add missing information to a table or diagram by additional calculations.
- Ability to present information in tabular or graphic form: the student can present information given to him by a chart using a diagram; the student can present information given to him in the form of text or image using a table or diagram.
- Skill to carry out a survey: the student can conduct a survey and record the answers received; based on the conducted survey the student can summarize the results in tabular form; the student can build a chart using the data that is systemized in the table.
- Teamwork skills - the student wishes to work in a team organization of the learning process and has a real self-assessment for his contribution to the work of the team.
- Development of creative thinking - the student successfully implements a variety of creative techniques for building diagrams and adds his/her element in fulfilling the assigned task.

The class is divided into 5 teams, each team having different research tasks grouped in four rounds: "Appearance"; "School"; "Geography" and "Entertainment". Upon completion of the study, each team should reflect the obtained results using a diagram made in artistic, creative way. One of the requirement in the first round of the project is that each member of the team develops their diagram using different creative approaches. In the remaining three rounds, the entire team makes one diagram using different materials. Each of the rounds is completed within 1 academic hour. Each team's research assignments are placed in advance.

1 round - Appearance:

- First team conducts a survey of the eye color of the students in the classroom and draws a chart using the data obtained;
- Second team – research of the weight in kilograms of the students in the class;
- Third team – research of the height in centimeters of the students in the class;
- Fourth team – research of the hair color of the students in the class;
- Fifth Team – research of the shoe size of the students in the class.

Each child makes their own diagram by choosing the way and materials for that purpose: by applying paper; by applying construction paper; with mosaic; by drawing in a different, unconventional way (Figures 2 -5).

*Figure 2. Results of students' work in building diagrams using application*

*Figure 3. Results of students' work in building diagrams using construction paper*

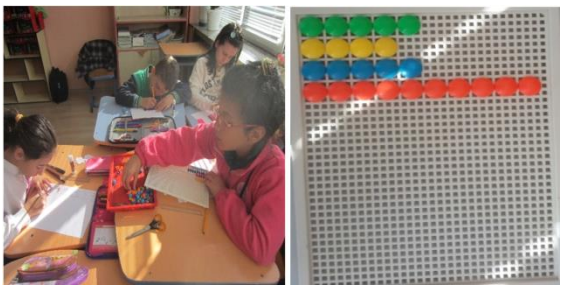

*Figure 4. Moments from the teamwork in building charts using a mosaic*

*Figure 5. Students' results in building diagrams by drawing in a non-standard way*

2nd round - School:

- First team conducts a study on the favorite subject of each student in the class and builds a diagram with the help of the obtained data;
- Second team - study on the subject;
- Third team – study on the participations of students in various competitions, Olympiads, etc.;
- Fourth Team – study on the favorite sport of the students;
- Fifth Team - study on the awards received in the class.

Each team produces diagrams using different materials - constructor; modelling compound; rolls of kitchen paper. (Figures 6-8).

*Figure 6. Moments from teamwork in building diagrams using a constructor*

*Figure 7. Moments from teamwork when building diagrams using modelling compound*

*Figure 8. Building diagrams using kitchen paper rolls*

3rd Round - Geography:

- First team - conducts research on "Favourite city in Bulgaria";
- Second team - a country where I have relatives / friends;
- Third team - the neighbourhood I live in;
- Fourth team – my hometown;
- Fifth Team - where do my grandparents live?

Using a geographic map, teams find the location from the survey and mark it (Figures 9-10).

*Figure 9. Moments from the teamwork when building diagrams using a geographic map*

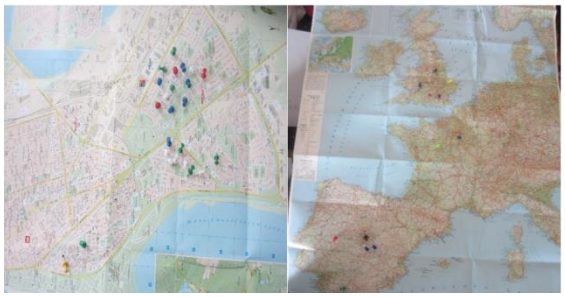

*Figure 10. Results from the teamwork using geographic map*

4 Round - Entertainment:

- First Team - conducts a survey of how many students can play piano;
- Second team – research on how many students from the class can swim;
- Third team - how many students can ski;
- Fourth Team - How many students play basketball;
- Fifth Team - how many students can sing;

The purpose of this round is to develop skills for building a circular diagram again by drawing in different, interesting and unusual ways (Figure 11).

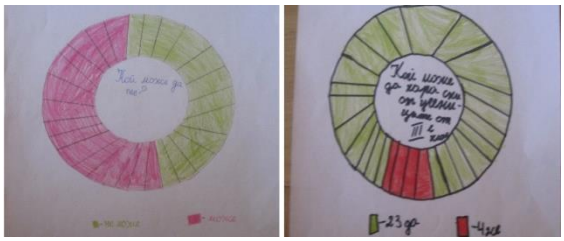

*Figure 11. Results from the teamwork in building circular diagrams*

## IV. STATISTICS

The results show that after the completion of the learning project “Funny diagrams”, students have formed basic statistical literacy.

The strongest positive result is observed in terms of the ability to conduct a self-study. At the incoming level, there are single failed attempts to solve the task. Figure 12 compares the results of incoming and outgoing diagnostics. The results of the final test indicate the success of the work with the students - 57% of the students conduct a self-study by documenting the results, summarizing them in a tabular form and successfully visualizing them via a diagram. 43% of the students also manage to conduct their own study with small inaccuracies - incomplete documentation of the research. This categorical positive result shows that the formation of basic statistical competencies is not a difficult process for this age group. Children are happy to perform their assigned tasks, take them as an interesting game, and imperceptibly create important knowledge and skills to work with data structures.

## PARAMETERS OF THE STUDY

The target group was 3rd grade students (no indication for additional interest in mathematics among them) – two classes with 40 students. The experimental work lasted 6 academic hours distributed in the following manner: diagnostic test, one teacher's class of the weak, 3 Math classes, and control test.

Students worked collectively on problems proposed by the teacher. The teacher's class is one hour per weak where the teacher and the students discuss variety of problems, concerning different aspects of students' life at school and out of the school. Such a class is used as introduction activity to acquaint students with the topic of the work, and to motivate them for active work with data, tables and graphs. During math classes students solve problems concerning data handling. The learning content is divided in three parts: Part 1. Filling in tables by doing calculations. Understanding and interpreting data, presented in tabular form; Part 2. Writing text information in a tabular form; Part 3. Understanding and interpreting data, presented by a chart.

## INDICATORS AND DATA COLLECTION

The following indicators were used to determine the initial level of understanding the way of working with data from third-grade students:

Working with tabular information

Indicators:

- The student can fill in a table keeping the data dependence on rows and columns.
- The student can structure information, presenting it in tabular form.
- By using information given in graphical or tabular form, the student may calculate missing information in the table or into the diagram.

Working with diagrams

Indicators:

- The student can interpret information, presented by a diagram.
- The student can use information from some diagrams to formulate a conclusion.
- The student can present the information from a tabular graphical view (via diagram).

The evaluation scale is given in Table 1. Adding a coefficient 2 gives an assessment of the performance of the students in the six-point system (according Bulgarian system of estimation, the excellent mark is 6) – from "weak" to "excellent" assessment.

## STATISTICS

The results show that after the completion of the learning project "Funny diagrams", students have formed basic statistical literacy.

The strongest positive result is observed in terms of the ability to conduct a self-study. At the incoming level, there are single failed attempts to solve the task. Figure 12 compares the results of incoming and outgoing diagnostics. The results of the final test indicate the success of the work with the students - 57% of the students conduct a self-study by documenting the results, summarizing them in a tabular form and successfully visualizing them via a diagram. 43% of the students also manage to conduct their own study with small inaccuracies - incomplete documentation of the research. This categorical positive result shows that the formation of basic statistical competencies is not a difficult process for this age group. Children are happy to perform their assigned tasks, take them as an interesting game, and imperceptibly create important knowledge and skills to work with data structures.

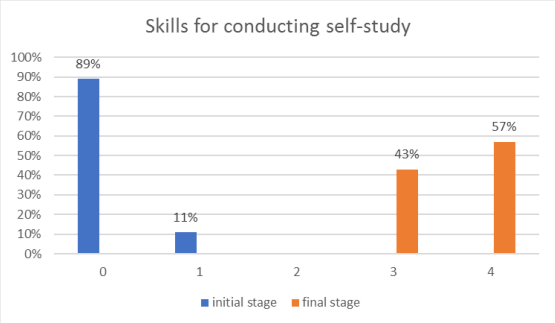


*Figure 12. Comparison of the results of incoming and outgoing diagnostics on the students' ability to conduct a self-study*

## V. CONCLUSIONS

The development of skills to conduct a study includes the following stages:

- Forming a skill to define the study - identifying the problem to be researched; determining the group to be investigated; determining the duration of the survey; preparation of a questionnaire/question for the people surveyed.
- Developing skills to collect raw data from the survey - a way of recording the data.
- Developing skills to analyze the collected data from the study - processing of raw data into numerical information and writing it in a tabular form and / or in the form of a diagram; formulating conclusions from the conducted survey.

The process of forming knowledge and skills for working with tables and charts is effectively illustrated when using interactive hardware and software technologies. Students are placed in an active position by conducting surveys. When combined with a gameplay approach, quality learning outcomes are achieved..

## REFERENCE

[1] Dewey, J., My Pedagogic Creed, School Journal, vol. 54, no. 3, p. 77-80, 1897

[2] Papancheva, R., K. Dimitrova, N., Kaloyanova, Technologies integrated project-based learning at Primary school, Microsoft, Sofia, 2005

[3] Papancheva, R., N. Kaloyanova, K. Dimitrova, Aspecti na obuchenieto pri integrirane na tehnologii v treti I chetvartiklas. Godishnik na Universitet "Prof. Dr Asen Zlatarov", Burgas, pp.12-13, 2006

[4] Published in C. Batanero, G. Burrill, & C. Reading (Eds.), Teaching Statistics in School-Mathematics Challenges for Teaching and Teacher Education: A Joint ICMI/IASE Study (pp. 407- 418), DOI 10.1007/978-94-007-1131-0, Springer Science+Business Media B.V. 2011. 3.

## ACKNOWLEDGMENTS

*The article is part of a study of the author under project DN 05/8 14.12.2016, funded by the Bulgarian National Science Fund on „Digital Competencies and Media Education at Pre-school and Primary School Age ".*