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Propaedeutic of Working with Tables for Data Handling At Kindergarten

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ABSTRACT

The article presents a model of work in Bulgarian Kindergarten to form knowledge and skills for basic data handling through working with data tables. The work is part of a larger study for building basic statistical literacy at early ages in technologies equipped learning environment. The model has three stages of realization: propaedeutic at Kindergarten, creating knowledge and skills for working with tables and graph sat first-second grade of the Primary school, and building knowledge and skills for conducting independent survey and analysing data at third-fourth grade of Primary school. Experimental work was done with kindergarten children and first-grade students. Examples of learning resources are presented and the outcome of the approbation process is described. Some conclusions and recommendations are formulated.

KEYWORDS: basic statistical literacy, data handling, primary school, kindergarten, tables and graphs

1. INTRODUCTION

After the spread of technologies in all spheres of life, it appears the need of formation of knowledge and skills adequate to the time in which the person develops and forms. The information society today requires so-called "statistical literacy" [1]. Building basic statistical literacy shifts from secondary to primary school, which leads to changes in mathematics education in kindergarten. According Bulgarian national standards for Preschool mathematics education, the content must ensure the formation of elementary ideas for basic mathematical concepts.The main learning modules of the national program of teaching kindergarten mathematics are: Numbers, Measurement, Spatial relations, Time, and Figures. So, if we expect children to form basic statistical literacy at Primary school we must do some propaedeutic of data handling at Kindergarten level. Kids should have knowledge and skills to arrange data in tables in meaningful way. Working with data tables at Kindergarten should be realized through specially designed learning resources on paper or in a digital form.

2. APPLICATION OF MODEL FOR FORMING DATA HANDLING KNOWLEDGE AND SKILLS

The main purpose of the propaedeutic of working with data handling is the formation of an understanding that the table is a structure where elements are arranged in rows and columns.

Forming skills for working with data tables goes through three main stages:

- Forming skills to identify a position within a table.

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- Forming skills for sorting objects and place them in a simple table.
- Forming skills for qualification objects and placing them in a two-way table.

At the first stage, kidsshould be able to count row and/or columns of the table to decide where to place some object. On next stage, they must order items in different columns on given indicator. And on the third stage the children should determine and organize a paired data.

3. APPROBATION OF THE MODEL AT KINDERGARTEN LEVEL

3.1. THE EXPERIMENTAL FRAMEWORK

The aim of the study is to clarify and to raise the level of understanding of preschool and Primary school children of the way of working with data tables.

The educational process in Bulgarian kindergarten is organized in learning situations on different learning subjects – Mathematics, Mother language, Science and Nature, Arts, Music, Physical activities. Each situation is about 30 minutes long with short breaks between. Usually children have 3 or 4 situations in the morning and 1 or 2 situations in the afternoon.

At the first grade of the Primary school classes are 30 minutes long with a break between. Usually students have 4 to 5 learning classes in the morning.

During Math classes at Kindergarten and at school, the work with technologies and educational software was no more than 15-20 minutes. The rest of the time kids worked on variety of tasks, but in game-based activities.

3.2. PARAMETERS OF THE STUDY

The target group was preschool group at Kindergarten and the first grade at Primary school. In Bulgarian Kindergarten, there are two preparatory for the school groups – 3-rd (5-6 years old), and 4-th (6-7 years old). The experimental work was done in 2 kindergartens and 1 primary school with 4 preschool groups (100 kids, 6-7 years old) and 1 first grade class(20 students).

The experimental work included 2 situations/ lessons per group (one situation in Mathematics and one – in English, or two situations in Mathematics).

At kindergarten, the experimental work was done with the following technologies equipment: interactive whiteboard for the teacher, 30 tablets per group for individual work of kids, and educational software with tasks in digital form. At Primary school only an interactive whiteboard and educational software were available.

At kindergarten kids work individually on their tablets. The teacher has a communication software module and can present the work of selected kids on the whiteboard for collective discussions and comments. At school students worked collectively on problems proposed by the teacher.

The learning content is divided in three parts: Part 1. Identifying a position within the table; Part 2. Sorting objects in simple table (working with one indicator); Part 3. Ordering objects in two-way table (working with two indicators)

3.3. INDICATORS AND DATA COLLECTION

The following indicators were used to determine the initial level of understanding the way of working with tables from preschool and first-grade school students:

Working with tabular information

Indicators:

- The student can identify the position of an object into a table.
- The student can order objects in a simple table.
- The student can order objects in a two-way table.

Data collection was done through monitoring of kids' and students' work on given tasks.

3.4 EXAMPLES AND COMMENTS

The main purpose of the propaedeutic of working with tables is the creation of understanding that the table is a place where, such as in a web, the

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elements are arranged in rows and columns. Each position in the table is determined by two parameters – a row and a column. Many things from the surrounding world can be modelled by a table – buildings, candy boxes, notebooks with pages in small or big squares and so on. Counting the rows starts from top to bottom, and the columns – form left to right: the yellow cell in the table from figure 1 is on the first row, and the blue cell – on first column (the table has 3 rows and 3 columns and the colored row and column determine the position in the table). At this stage, the kid should be able to identify a position within a table by intersection of row and a column. On the task presented on figure 1 the children must place the colored circles on the right positions. This is a logical problem and its purpose is to create skills for determining a position in the table by crossing a row and a column. The mixed with green and blue circle should be placed on the row determined by the green color and on the column marked as blue. The way of crossing of the row and the column may be marked using some of the interactive whiteboard's tools (an arrow, or a pencil, i.e.). The place where the row and the column crosses each other is the element's position.

Figure 1. Allocation of a position within the table

After the children assimilate the row and the column they can gradually "address" the cells in the table. On figures 2 and 3 some tasks form the educational software ITI-AE, used during the work are presented [2].

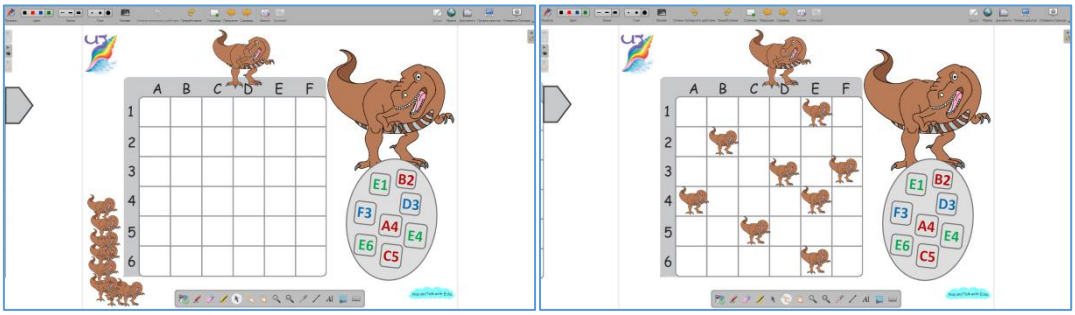

Figure 2. Kids must allocate the small Dinos to the correct cells.

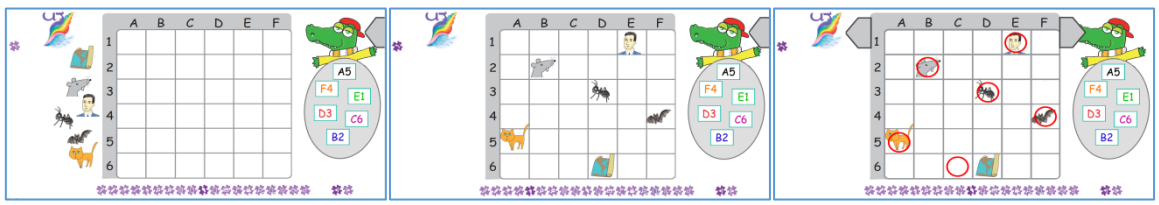

Figure 3. Small pictures should be positioned within the table on the cells written on right.

The columns are named with the letters of the Latin alphabet, and the rows – with numbers from 1 to 6. In the first task (Figure 3) the children must place the dinosaurs on the positions written on the right. B2 means the cell of column B and row 2. On the next example (figure 3), the children must

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arrange the objects on the indicated cells on their choice. The interactive technology allows the usage of useful elements. In this case a control net was made. There are circles on the net. They show the correct places where the elements must be placed. When this net was placed over the table the wrong placed elements were easily seen. For example: on figure 3 it appears that the image of map was incorrect placed on D6 instead of C6.

The task on figure 3 is from English teaching situation at Kindergarten. After the elements are allocated, the teacher selects one of the cells, and points one of the kids. The kid must name the object he/she has placed on this position in English. In this way, the mathematical knowledge is integrated in the English language learning process.

Comments:

Following teacher's explanation of the algorithm for identifying of a place into a table, all kids and students managed with the task given. There was no problem to them to determine the place of the objects within the table.

There are tabular data in all subjects, so knowledge and skills for working with tables could be applied in a variety of learning tasks not just from Mathematics learning content.

On the next stage from developing knowledge for working with tables kids should sort objects and place them correctly within a simple table. At the task from figure 4, each column corresponds to one of Bulgarian bills or coins, and each object has a label showing its price. The objects are not placed correctly [3]. The children must sort them in the columns so each label to correspond to the correct amount of money.

Figure 4. Sorting task – working with a simple table

Comments:

This task was quite difficult for the children – about 40% of kids and 60% of first grade students did some mistakes working on the problem. To double check the results another task for sorting was given to the students – to allocate different vehicles, according to whether they are land, water or air in a table with three columns. All of kids and students managed with this task. The explanation for failing with the first one is that students cannot read well, and when they see labels showing the prices most of them don't pay attention whether it was meant banknotes or coins.

Another interesting fact is that the percentage of first-grade students who did not manage with the first task was greater than the percentage of the kindergarten kids that had a problem with the task. Possible explanation is the different way of the use of the technologies. At the kindergarten, every kid worked on his tablet. So, kids were more concentrated and had more time to think about the problem and to take the decision how to sort the objects on the table. At the Primary School students had no tablets. They worked on the interactive whiteboard. So, the students did not have enough time to take well thought out action.

The last stage from the process of building knowledge and skills for working with data tables

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at kindergarten is the work with two-way tables. On Figure 5 is presented one task from the mathematics module of educational software ITI-DG [4]. There are different objects with labels showing their price. Each object is coded with a figure. The objects are categorized as clothes, toys, food and school accessories. According to the price, the children must arrange the geometric figures into the table. For example: the sweater costs 10 lv. (10BGN) The sweater belongs to clothes' category, and it's coded with a yellow square. So, one of the yellow squares must stay next to the sweater and the other one must be placed in the table's cell where the clothes' row and the 10 leva bill's column cross each other, i.e. on the first row in the first column.

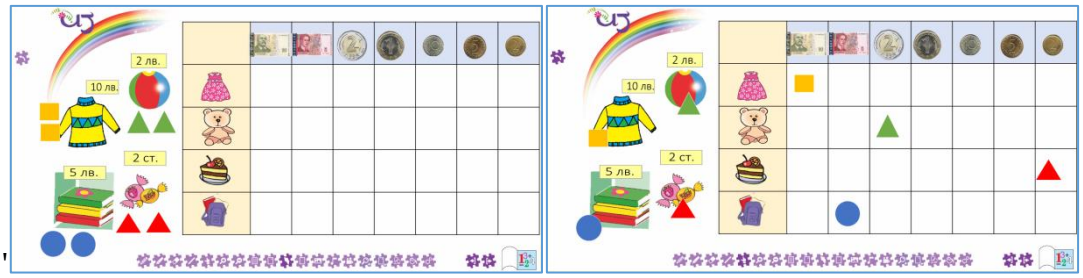

Figure 4. Working with a two-way table

Comments:

This task was not clear for the kids. Without teacher's guides, no one of the students had an idea how the objects should be placed within the table. After clarifying the categories and the prices, most of the students and the kids managed to arrange the figures in the correct places on the table.

3. CONCLUSIONS

Working with tables in the kindergarten and in the first grade is interesting and the children perceive it not as difficult tasks but as a funny game. The tasks from the presented examples can be used for other topics in different educational content in the kindergarten and on different school subjects in the first grade.

The tabular form of representation of data helps students to classify objects from different areas of knowledge. Skills of working with tables could be used by the teacher to realize interesting interdisciplinary tasks. Similar to presented here examples could be formulated as tasks for team work on paper or on a poster.

5.

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