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## Learning with a game

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**Abstract** – Mathematics is not only arithmetic. It comprises also developing abilities and skills, for example precision, skillfulness, reasoning, ability for systematic work. Children obtain basic information about mathematics, in a general form which is necessary for further study in elementary school. The main activity which develops mathematical reasoning and creative abilities, such as independence, originality, imagination, intuition and memory, are games. This paper is devoted to characterization of didactic games, their effect on development of empirical education of children of preschool age. It includes a few examples of didactic games which are focused on development of mathematical abilities in children, too.

## 1 Introduction

Who does not like to games? The answer to this question is that everybody likes to play some games. According to Nákonečný (1997), a game is an activity which brings satisfaction in itself which can be observed in children, young animals, and also adults.

In kindergarten, children most often learn through various tasks and games because the game makes them happy and it is the main and most natural activity of children at the preschool age. The development of mathematical reasoning and creative abilities, such as independence, originality, imagination, intuition and memory, is also accomplished in the most pleasant, funny and natural way via games. Moreover, if the games are used in the context with didactic aims, these games can be referred to as didactic games.

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Although it is clear that we come across mathematics nearly everywhere and on many occasions in our everyday lives, mathematics does not belong to the children's most popular school subject. In this paper we would like to present basic characteristics of didactic games and provide a few examples of game-like activities aimed at development of mathematical abilities which can be used effectively within the children's preschool education.

## 2 Didactic games

Didactic games and toys are important means for development of empirical education of children in early years and preschool age. Didactic game has its own special structure. If the game has lost the required structure, it has lost its didactic character and is not a didactic game any more.

In every didactic game, the task is clearly specified. This task is in correspondence with the didactic aim of this game. For the didactic game it is also important to have specified rules. Children must obey these rules, because the rules are of administrative character. As soon as the game loses these rules, the game starts to be spontaneous and unrestrained.

The aim of didactic games is to form the animalism of children. The first goal is to make the acquaintance with form, size, colour, sound and space symbols, i.e. getting acquainted with the typical properties of objects surrounding us, with natural phenomena and their empirical qualities.

The didactic aim of games, in which children have the opportunity to get to know different shapes, colours and spatial relations of the real objects (or of their pictorial representations), as well as various specific features of individual things and at the same time to notice the general, common features of observed objects, is to assign the shape of various objects and the empirical relation of the object to corresponding geometrical units, such as circle, ellipsis, square, etc.; or to group the items according to their colour. These abilities should improve along with the aging of a child as the following illustrative tables show (Tables 1 and 2). Consequently, as soon as the child reaches the age of six, s/he should be able to classify items according to more than one criterion, and should be also familiar with at least 4 main geometric units - circle, square, triangle, and rectangle.

Table 1. Classification, grouping pre-school children.

Age	Knowledge, skills
3-3.5	Classifies according to the type
3.5	Classifies according to the colour, size
5	Classifies according to the shape
5-5.5	Knows what does not belong to the group
5.5	Classifies according to two criteria
6	Classifies according to three criteria

Majority of didactic games for the early preschool age are based on effortless playing with different geometric solids (e.g. cube, sphere) and with different geometric units (e.g.

Table 2. Shapes pre-school children

Age	Knowledge, skills
3	Circle
3.5-4	Square
5	Triangle
5.5-6	Rectangle

circle, square). While operating with them, children get to know them empirically; they learn to differentiate between them, to compare them, etc. At older preschool age, creative and constructional activity becomes more demanding and children get to know wide range of shapes, colours and sizes. At this age, basic measures begin to be insufficient. For these children it is important to broaden the elementary circle of knowledge about these properties of objects. It is also important to teach children to differentiate more precisely.

Another goal of didactic games is to make children familiar with various formulations of measures (e.g. scale of measures of form, size, color, spatial relations, etc.). The universality of terms should be understood by children, too, so that they recognize that the term triangle refers to a group of triangular shaped objects, and not only to a certain triangle they have already seen. Children should also get used to the facts that there are a few elementary colours, but there are also some colour shades derived from them, e.g. damask plum as a shade of basic blue colour.

Didactic games have another, crucial function in empirical education. They constitute an irreplaceable aid to identify the level of empirical growth of child. With the help of these games, the actual current level of child's knowledge and skills can be discovered. Thus didactic games help determine the level the child has reached within the process of empirical, sensual education.

In the Slovak Republic, recently the National Institute for Education has elaborated and edited a new program of education for the children attending kindergarten. In this program, there is required from children the following knowledge concerning mathematical perceptions, divided into three distinct, but related groups:

### **1. Comparison, classification and orientation in space**

Children should learn to understand spatial relations, which describe the positions of objects in space and how this position can be changed. It is thus essential to know the correct meaning of words: in, on, at, below, above, in front of, behind, next to, between, opposite, in the middle, up, down, high, low, near, far, inside, outside, forwards, at the back, around, on the right, on the left, nearer, further, higher, lower, etc.

Using these words, children should be able to describe:

- position of objects subject to the self (in consideration of their own body, limbs, parts of body),
- mutual position of two different objects, e.g. the book is on the table,
- decision making about the position, such as the book is on the table or the book is not on the table; etc.

**2. Comparison and classification of the shapes** Children should acquire and enhance their abilities:

- to denote different shapes with exact words (e.g. round, angular, peaked, etc.),
- to be able to identify the geometrical solids and units in the objects surrounding them (e.g. sphere, cube, triangle, square, rectangle, circle).

**3. Comparison and classification in files according to the size, capacity, quantity and number**

Finally, children should also be gradually led to differentiate the sizes of objects (big/small, etc.). Children should notice that the same object can be referred to in a few different shades of the same size when compared with another object (e.g. small - smaller - the smallest, big - bigger - the biggest, short - shorter - the shortest). Children should also be able to recognize other features of objects, such as hot, soft, hard, etc.

They should be able to point to and denote objects that have another common feature, for example wooden toys; to assign other features of these objects (e.g. colour, size or shape) and to classify these objects into groups of items displaying or not displaying a given property (wooden toys and toys made of materials different from wood; red balls and balls of some other colour, etc.)[8].

The next part of the paper provides some examples of didactic games developing the above mentioned mathematical abilities.

### 3 Examples of didactic games

#### 1. Three kids

**Aim:**

- to assign the feature of objects - colour,
- to group the objects according to the stated feature.

**Age group:** children from 3 to 5 years old.

**Aids:** masks of three kids and masks of flowers of three colours for the other children.

**Rules of game:** Teacher tells a story about three kids:

One day, a mother goat went to the shop and told her kids to stay at home and not to open the door to anybody. Kids said: "Yes, we understand." So the mother goat left. As she only reached only the corner of the street, the wolf knocked on the door of the goat's house. The kids asked him: "Who is this?" and the wolf replied: "It is me, your mother." But the kids were clever and did not open the door. They told him: "You are not our mother, our mother has a softer voice." So the wolf went to the blacksmith to get a softer voice. Then he came back, knocking on the goat's door again. The kids asked again: "Who is this?" and the wolf replied: "It is me, your mother." "Yes, you are our mother!" The kids shouted and opened the door. So the wolf entered the house and wanted to eat all the kids, but they were faster and ran away to the wood, leaving the hungry wolf inside.

Then the teacher explains that they are going to play the continuation of this story. S/he assigns the children who are going to play the three kids, the teacher stands for the mother goat, and the other children are going to be flowers of three colours. The teacher continues:

"The three kids wanted to make their mother happy and they wanted to bring her flowers, but they did not agree upon one colour. Thus the kids brought the flowers of three different colours. The first picked the red flowers, the second the blue ones and the third kid yellow flowers."

Children having masks of the flowers of the same colour make a line in front of the kid, picking flowers of this kind.

The winner is the first complete group that comes to the teacher representing the mother and says: "Mum, I want to make you happy so I brought you the flowers of the (say their) colour. The mother and the other children will reward this group with applause.

**Additional instructions:** The teacher takes care about the children all the time during the game. S/he tries to get all children involved in the game. S/he prepares enough aids and materials before the game starts. The children are motivated by the story told by the teacher at the beginning of the game.

## 2. Shapes and colours

### Aim:

- to learn geometric shapes,
- to identify the feature of an object, its colour.

**Age group:** children from 5 to 6 years old

**Aids:** coloured geometric shapes which are cut out of the cardboard, string, two sets of cards - one displaying the colour; the other including the drawn geometric shapes.

**Rules of game:** Teacher hangs one card displaying the coloured geometric shape round each child's neck. Children sit in a circle on the floor. Teacher draws one card from the set of coloured cards, for example the green one. The children having the cards with shapes of this colour on their neck stand up, then the teacher draws another card, this time from the other set of geometric shapes, for example rectangle. The children who have a green rectangle round their necks remain standing, the other children sit down again.

The children, who stand up at the right time, responding properly to the shown cards, are rewarded.

**Additional instructions:** The teacher takes care about the children all the time during the game. S/he tries to get all children involved during the game. S/he prepares aids and materials before the game starts for all children.

**Modifications:** Children older than 4 years can stand up in response to the teacher saying only the colour or only the geometric shape. Younger children should then stand up when the teacher says only the colour.

## 4 Practical experiences

As we were interested in children's reactions upon learning through games and wanted to check the attractiveness of the prepared games from the viewpoint of preschool age children,

we visited a kindergarten in order to test the games in practice. We chose the kindergarten in one of the town districts of Nitra - in Dolné Krškany. It is very neatly organized, fitting and satisfying the needs of preschoolers. The school is attended by children who are from 3 to 6 years old. They are thus divided into two classes.

We asked the teachers of both classes to mix the children from the classes into one group. As we did not want to disrupt the natural environment the children are used to in their kindergarten, we performed the role of observers. The games were explained to both teachers in detail, so that they were able to supervise the children throughout the game. We prepared enough aids for all children in advance, as we were in knowledge of their number in classes. The main goal of the activities was to get every child involved in the game.

At the very beginning, the children hesitated to start playing. However, soon they became involved in games, as the fairy tale told by the teacher motivated them, i.e. the tale fulfilled its aim. The first game was thus played very easily and efficiently. The children enjoyed playing in masks, and as they fancied it, they played the game with kids and flowers even more than once, changing the roles of kids and flowers.



The second activity was much more demanding for 3 to 5 year old children. It resulted into their impatience, inattention and unwillingness to cooperate and play, although we revised the colours and geometrical shapes before the start of the game. Therefore, we organized children into three groups. We took this possibility into account when preparing the materials, and hence we had enough materials for this activity, too.

The task for the youngest children (who were only 3 years old) was to indicate only the colour. The older children, aged 4, besides colour should try to identify a correct geometrical unit. The last group were 5 and 6 year old children, who played the game following the exact rules of the original activity stated in the part above.





## 5 Conclusion

The main goal we intended to achieve was to bring Mathematics closer to children of preschool age in a natural way, in a form in which the children do not even realize that they are learning. As our experience from the kindergarten proved, children are enthusiastic about this type of activities and are willing to learn. Therefore, we would recommend using games or game-like activities as a useful tool of teaching youngsters the basics of (possibly not only) Mathematics.

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