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#### THE USING OF LOGICAL-MATHEMATICAL GAME IN THE PRE-SCHOOL EDUCATIONAL ACTIVITIES IN ROMANIA

Ioana Magdaş (a), Ramona Răduț-Taciu (b)\*, Violeta Iușca (c)

\*Corresponding author

(a) Babeș-Bolyai University, 7 Sindicatelor Str., Cluj-Napoca, Romania, magdas\_ioana@yahoo.com

(b) Babeș-Bolyai University, 7 Sindicatelor Str., Cluj-Napoca, Romania, ramona\_radut\_t@yahoo.com

(c) Prichindelul ișteț Kindergarten, 16 Aviatorilor Str., Turda, Romania, vio1leta@yahoo.com

#### *Abstract*

The diversity of ludic activities in the kindergarten's educational offer increases the interest of children in the learning process. In the context of pre-school curricular changes, logical-mathematical games are a valuable and effective educational component, to which every teacher must pay attention, adopting, first of all, a creative attitude in both the way in which the work is done and in the relationship with the children, thus ensuring a relaxing atmosphere that will allow them to stimulate creatively. That is why we considered it appropriate to conduct a study to identify the teachers' opinions on the use of logical-mathematical game in the pre-school educational activities. For this purpose, we applied a questionnaire addressed to preschool teachers. The questionnaire was made using the Google forms application in Google Drive and was completed by 15 teachers. The questionnaire items aimed: the regularity with which logical-mathematical game is used in the preschool education, the ways of its integration in the kindergarten activities, the formative valences and the ways to optimize and even innovate this type of game in the context of the new educational paradigm. The study has confirmed the importance of logical-mathematical game in kindergarten. We have found a regular use of this type of game and the fact that teachers are aware of its formative aspects. Most teachers integrate the logical-mathematical game with activities from other experiential domains, although the methods used by them are rather traditional.

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**Keywords:** Logic-mathematical games, pre-school education, questionnaire, Romania.



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## 1. Introduction

In building the curriculum for early education, developed by the Romanian Ministry of National Education, several principles have been taken into account, one of which refers to the ludic approach of learning. The specificity of the Romanian preschool curriculum encompasses the logical-mathematical game in the integrated educational-educational activities, starting from the pedagogical definition of it, namely: "A type of game or a mathematical didactic game, which introduces logical operations into the children's communicative repertoire from the early pre-school level and who aim to form skills for the elaboration of value judgments" (Bocoș, 2016, p. 268). Their main purpose is to equip children with a logical kit that allows them to orient themselves in the surrounding reality and to express judgments and reasoning in an appropriate scientific language (Bocoș, 2016; Petrovici, 2014). The specificity of the logical-mathematical game is based on the sets theory and logic, whose elements play a key role in the subsequent assimilation of mathematical notions, having as main objectives: the formation of the ability to think logically, to work with logical structures and operations in an intuitive way among children, without explicitly communicate the notions and terms specific to the domain (Dima, Pâclea, & Tarcă, 1998).

According to Magdaș (2014),

*Logic-mathematical games emphasize logical reasoning, mathematical contents having a secondary role. The reasoning used in logic-math games involves working with logical operators. Because their practice is making easiest by operating with sets, most of the logical-mathematical games are based on the operations with sets (union, intersection, complements etc.). Other types of logical-mathematical games are with moving or setting the order of some elements and counting problems.* (p. 80)

Generally, the materials used for logical-mathematical games are geometric kits as Diènes, Logi I and Logi II with pieces of different shapes, colours, sizes and / or thicknesses (Bocoș, 2016; Magdaș, 2014). These materials can be in physical format but also in digital format on CD or available online. A didactical analysis of math online games for primary education was made by Magdaș and Răduț-Taciu (2016).

In the Romanian literature there are presented different classifications and examples of logical-mathematical games (Bocoș, 2016; Iftime, 1976; Magdaș, 2014; Petean & Petean, 2010; Petrovici, 2014; Răduț-Taciu, 2007). Regarding its formative aspects, logical-mathematical games stimulate the formation of perceptions and operative structures of thinking (Bocoș, 2016). Also, the logical-mathematical games contribute to the abstraction and generalization processes, to a more realistic approach to the first mathematical notions, so that it helps pupils understand the notion of numbers and number operations that will be studied in the primary cycle (Tătaru, Glava, & Chiș, 2014). These games provide the basis for various practical activities that help to understand the connections between elements of systems in reality (Dulamă, 2008), cause-effect relationships (Dulamă & Ilovan, 2015, 2017), perceiving and accurate representation of space and time (Bagoly-Simó, Dulamă, Ilovan, Kosinszki, & Răcăsan, 2016).

In order to prepare the pre-schoolers for school, educators should pay a special attention to the development of thinking, which at the pre-school age has a gradual transition, from sensorimotor thinking to intuitive-imaginative and verbal thinking (Dulamă, 2011). So, logical games are focused on the formative

side of the activity, aiming to prepare pupils for the learning process. Taking into account the fact that the logical-mathematical game is based on the first knowledge and elements in the sphere of mathematics, it is advisable for the educators to valorise their mastery, the pedagogical tact and the professional experience, putting their personal footprint on the game by introducing some active methods or attractive teaching materials that will stimulate the spirit of initiative, inventiveness and independence in the thinking of pupils. Besides, methodological suggestions that shade the peculiarities of the playful activities can be found in up-to-date specialized papers of Tătaru, Glava, and Chiș (2014), Lăzărescu and Ezechil (2015).

## 2. Problem Statement

In the educational plan, there is a growing interest in identifying and implementing psycho-pedagogical strategies that can provide the prerequisites for school and can develop the necessary skills necessary to the next educational stage. In the context of the changes brought by the new educational paradigm in pre-school education (MECT, 2008), we consider it appropriate to innovate the logical-mathematical game in order to develop competencies among pre-schoolers. But first of all, we wanted to find the opinion of the pre-school teachers about the accessibility of the logical-mathematical game, which difficulties encountered in the design and integration of the logic-mathematical game, how to optimize this type of game in order to increase its attractiveness and, implicitly, the interest of preschools for instructional and educational activities involving this game. By applying a questionnaire, we wanted to identify teachers' views on these questions. Their opinions will help us identify ways to innovate the logical-mathematical game so that to meet the requirements of the new pre-school curriculum.

## 3. Research Questions

The research questions are:

- How often logical-mathematical games are used in pre-school education?
- What are the possibilities of integrating logical-mathematical games in kindergarten activities?
- What are the formative valences of the logic-mathematical game for pre-schoolers?
- How can be optimize logical-mathematical games in preschool education?

## 4. Purpose of the Study

The purpose of this study was to collect information on the perception and opinions of pre-school teachers about how the logical-mathematical game is being used in the educational process carried out in the institutionalized kindergarten environment.

## 5. Research Methods

46 teachers completed voluntarily the questionnaire. 56% of respondents have a teaching experience of more than 20 years, and the others less. 60% of the preschool teachers have the first didactic degree (which is the highest stage of the teaching career in Romania), and the others have the second didactic

degree, the definitive didactic degree or are debutants. 56% of the preschool teachers teach in the urban area. The respondents' level of expertise and the years of teaching experience ensure the response credibility. In research, was involved the teacher for preschool education Moldovan Krisztina Rita, who developed the questionnaire based on the study of several bibliographic sources and accepted using its results in this study.

### **5.1. Procedure**

Data collection was conducted using the questionnaire survey method. The questionnaire applied by the preschool teacher had three parts. The questionnaire was made using the Google forms application in Google Drive. The questionnaire contained 16 items on the use of logical-mathematical play within the educational-educational activities of the kindergarten. Out of these, 6 were single-choice items, 3 items were asked to choose answers on a Likert scale with 5 values, 2 items were multiple choice, and 5 items were open-ended. The questionnaire covered three parts. The first part had 4 items related to age, the years of teaching experience, didactic degree and level of studies. The second part covered 6 items (questions 5-10) regarding the perceptions of educators on the accessibility of the logical-mathematical game among pre-schoolers, as well as the design of the integrated instructive-educational activities that include logic-mathematical game. The third part of the questionnaire contained 6 questions (questions 11-16), which focused on the formative valences of the logical-mathematical game and ways to optimize it. The collected data was statistically processed, represented in tables and diagrams specific to Education Sciences (Bocoș, 2007; Magdaș, 2018) with the Excel spreadsheet editor.

### **5.2. Participants**

15 teachers for pre-school education completed voluntarily the questionnaire. Teachers participating in the study are young, 67% of them having an age between 21 to 39 years old, only 13% of them are in the last decade of didactic activity. Regarding the education level of the pre-school teachers, only 20% graduated a pedagogical high school, while 80% of them have a licence degree in pre-primary education. Only a small percentage of the pre-school teachers participating in the study (6.7%) have a Master's Degree in Sciences of Education. 26.7% of the teachers participating in the study are debutants, with a minimum experience in the field, 46.6% of the respondents have experience between 2 and 16 years, and the remaining 26.7% have an extensive experience. 27% of the respondents are debutants, one third of them have the definitive didactic degree and the 40% remaining have the first or second didactic degree (which are the highest stages of the teaching career in Romania).

## **6. Findings**

### **6.1. The regularity with which logical-mathematical games are used**

A high percentage of 67% of teachers use the logical-mathematical game weekly in educational-instructional activities, 27% of them use it 2-3 times per month, while a very low percentage of 6% use it approximately two times per semester.

## 6.2. The ways of integrating the logical-mathematical game into the kindergarten activities

In Table 1 we list the experiential domains and the types of activities in which teachers integrate logical-mathematical games.

**Table 01.** Integration of the logical-mathematical game with activities from other Experiential Domains

Experiential domain	Respondents (%)	Examples of activities
<i>Man and Society Domain</i>	60%	<i>Practical activities:</i> House, Train, Beads for girls, Sit me on my place, Make wild animals masks, Rocket, Hive, Geometric Robot.
<i>Science Domain</i>	20%	<i>Environmental Knowledge Activities:</i> Our House, Romanian Tricolor, In the Flower Garden.
<i>Language and Communication Domain</i>	13.3%	<i>Language education activities:</i> Giant Radish and Alice in Wonderland
<i>Aesthetic and Creative Domain</i>	6.7%	<i>Artistic and skill activities:</i> Colorful train

We see pre-school teachers' preference for the integration of logic-mathematical games in the *Man and Society Domain* with practical activities, which is natural because it is much easier to achieve such integration. The actual approach consists of designing the logical-mathematical game in order to achieve the proposed operational objectives, aimed to the valorisation of mathematical knowledge in the sphere of geometry, followed by the application of the acquired knowledge through the practical realization of some practical works. For example, in the integrated activity: "At Zoo", the pupils participate in a logical-mathematical game that involves: identifying the cages of the wild animals according to their geometric shape and the placement of each wild animal in his own cottage; making masks with some shapes geometric: the elephant made of circles, the tiger made by triangles, the zebra made by rectangles. The reason for the high percentage of 60% of teachers, who prefer the integration of logical-mathematical game with practical activities, is because gives pupils a concrete understanding of mathematical notions.

Only a small part of the pre-school teachers integrates logical-mathematical game with activities specific to language learning or artistic and skill, because this requires a greater effort. Rather, they integrate logical-mathematical games in environmental knowing activities, where they can use visual aids to illustrate geometric features, and preschools have the opportunity to handle didactic material, to tap and learn directly by discovering geometric shapes. For example, within the "Our House" integrated activity, preschool children are in a position to associate the elements of the house with different geometric shapes: the roof with a triangle, the house viewed from the outside with a square, the walls of a room with a rectangle, sink with a circle, and so on.

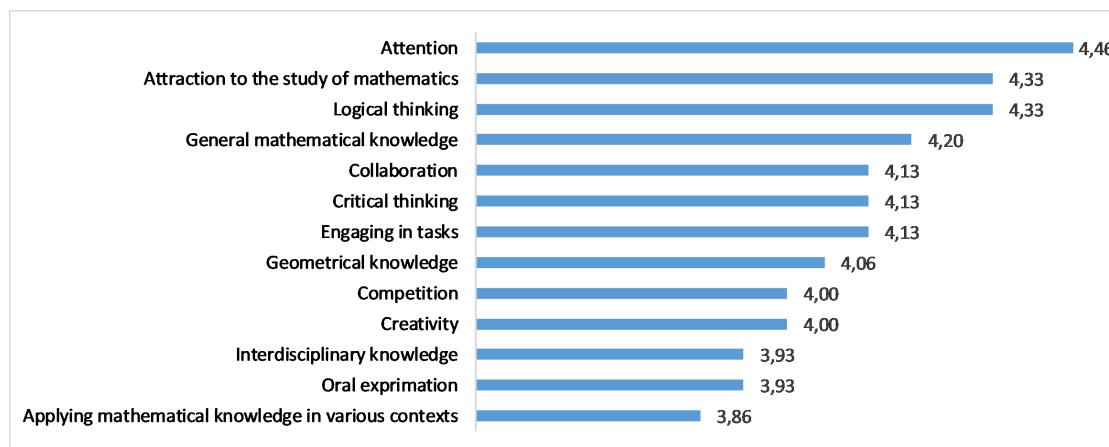
The educators participating in the study appreciated differently the level of difficulty of transmitting and assimilation of geometry knowledge by pre-school children. 20% consider difficult to train preschoolers in the field of geometry, about half (47%) consider it has an average difficulty and only a quarter believe it is easy to get knowledge in the sphere of geometry by the pre-school children and fewer, only 6.7% being very easy.

60% of the teachers consider the integration of the logical-mathematical game in other educational-educational activities than the mathematical ones to be a little difficult, 20% do not appreciate it at all difficult, while a percentage of 20% considers it quite difficult.

47% of teachers design instructional-educational activities involving logical-mathematical game in less than 1 hour, 40% allocate between 1-2 hours in the design of such activities, only 13% of respondents consider that it takes more time, between 2-4 hours.

### 6.3. Formative valences of the logic-mathematical game

Teachers participating in the study had to appreciate on a Likert scale of 5 values to what extent logical-mathematical games develop certain pre-school competences from a provided list. Average scores of respondents are shown in Figure 01.



**Figure 01.** The average score to which logical-mathematical games develop competences to pre-school pupils

We find that "Attention" is the most appreciated competence developed by logical-mathematical games, which is consistent with the mathematics specificity. Surprisingly, the "Application of mathematics in various contexts" is considered by respondents to be the least developed competence through logical-mathematical games. Corelating these observation with the fact that the "Interdisciplinary knowledge" competence was given less than 4 points, we can conclude that pre-school teachers are able to approach interdisciplinary these games only in a little measure. The fact that "Oral expression" also has a mean under 4 shows that this type of games uses a limited language. However, some of the teachers have given examples of integrating these games with language learning. According to the opinions expressed in the study, two more positive effects related to the participation of pre-schoolers in the logical-mathematical games were highlighted: stimulation of their interest and their imagination, the first effect having a much larger share in the opinions expressed, 82%.

### 6.4. Ways to optimize the logic-mathematical game

The suggestions made by the pre-school teachers in order to optimize the logical-mathematical game focused mainly on the diversity and attractiveness of the didactic material (57%), as well as the introduction of novel elements in the game (29%). Only 7% recommend using educational software and others 7%

recommend rewards to increase the attractiveness of the logical-mathematical game. It has been noticed that more than half (53.3%) of teachers use traditional methods to facilitate the assimilation of mathematical knowledge in geometry by pre-schoolers, only one-third (33.3%) use interactive methods and less than a quarter turn to pragmatic methods, which imply the applicability of mathematical notions to everyday reality.

Teachers have noticed that pre-school children apply mathematical notions in the field of geometry in activities undertaken in the kindergarten; in other words, with the help of geometric pieces, they build different objects as: castles, houses, rooms, rockets or reproduce aspects of nature such as animals or landscapes.

In terms of evaluation, 73.3% of teachers prefer to use math sheets specially designed to evaluate mathematical knowledge in the sphere of geometry, 20% use the math sheets included in the didactic aids and a small percentage of approximately 7% of teachers design freely chosen activities, which include work tasks involving mathematical knowledge in this field.

## 7. Conclusion

The diversity of ludic activities in the kindergarten's educational offer increases the interest of pupils in the learning process. In this context, logical-mathematical games are a valuable and effective educational component, to which every teacher has to pay attention, by adopting, first of all, a creative attitude both in the way of doing the activity and in the relationship with the children, so a relaxing atmosphere that allows pupils to stimulate creatively. The study has confirmed the importance of logical-mathematical play in kindergarten. We have found a regular use of this type of game and the fact that teachers are aware of its formative aspects. Most teachers integrate the logical-mathematical game with activities from other experiential areas, although the methods used by them are rather traditional.

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