

The Impact of Games in Understanding Mathematical Concepts to Preschool Children

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Abstract

The purpose of this action research is to examine the impact of Mathematics games on the understanding of concepts of numbers and numbering with preschool children. The research involved a total of 58 children from four groupings of "Naim Frashëri" school and their parents. Firstly, it was conducted pretest, with the aim of identifying the children who have difficulties and problems with adopting Mathematics concepts, followed by an action plan in class. The research was implemented during the first semester of 2014. During this period, three action plans on learning the number and numbering concepts were realized: in the first action plan – through Games with manipulativ tools; in the second action plan through Games in nature; whilst the third action plan involved Mathematics and Logic Games. The study involved data collection through observation lists, focus group, questionnaires with parents, working sheets, preparing the test before, during and after the action plan. Afterwards, we observed the data and analyzed it through statistical methods, thematic methods, coding the information extracted from questionnaires with parents and the observation list. The results of this research show that the uses of the mathematic games with preschool children's have an impact in the development on understanding's the number and numbering concepts. The use of Mathematics games, also have a direct impact on effectiveness and quality during Mathematics classes.

Keywords: Games, preschool children, mathematical concepts, creativity.

1. Introduction

Game is one of the main factors associated with children during their childhood. From birth they begin to know the world around them, to realize it through concrete actions, through various games, interaction, where they challenge and are challenged and also where they face and solve a problem.

Well-known pedagogues, psychologists and sociologists such as: Montessori, Piaget, Susan, Isaac and Dearden have contributed a lot in the development of knowledge for preschool children. They have researched and have made various studies concluding that preschool children learn best through play, indirectly - without realizing that they are learning. Even, they compare children's play with the adult work. Using games develops creativity in children, integrates learning across different curriculum areas, which enable the teaching of mathematical concepts. By providing material manipulator, they gain knowledge and become agile in the game. By enabling children to play simple games with numbers, addition and subtraction, by always using something new and creative, and in this way they unconsciously, are in direct contact with mathematics, which, rather than considering "a difficult subject" they learn while having fun.

The reason for choosing this subject is because in modern society mathematics is characterized as a difficult subject to be learnt essentially. We must find methods and strategies to make children love mathematics. To learn this subject by playing, exploring and making things on their own.

The importance of this research lies in effectiveness that games have in early childhood development.

The purpose of this research is the identification of suitable methods of teaching and learning that include the integration of different games to help children understand easier and entertain with the mathematical concepts.

2. The Formulation of the Problem

The development of mathematical concepts has a great importance, because children gain the main knowledge base from an early age and continue to enrich it with new knowledge, which start to become more difficult day by day. *Main concepts that preschool children face in mathematics are: the development of understanding numbers and counting; the understanding of space, basic geometrical figures and measuring the sizes, classification, clustering and comparison* (Standards for Early Childhood Development, 2011, p. 55).

Mathematics should be taught through mathematical games, in order to become a simple subject. Debord 1999 argues that the inclusion of children in the daily use of numbers helps them gain knowledge of mathematics since the beginning of life.

While playing with numbers and counting, besides entertainment, children also achieve physical, social and intellectual development, as well as welfare and health. In the book *Psychology of Education*, Bardhyl Musai states that "*The concept of learning through play includes recognition of the role of imagination and emotions in intellectual development*" (Musai, 1999, p. 73)

Through mathematical games children understand and learn different ways of learning. By having fun they reach independence. Above all, they become more social, more agile and face the challenges easier. "*Game enables children independence, success and fun*" (Save the Children, 2007, p. 36)

Well known scholars and researchers have proved that through mathematical games can be learned and developed sustainable concepts to children, in particular the development of mathematical concepts.

Through the whole time games have been part of people's lives. Anthropologists have studied the unique games played by ancient people, their time, place and environment (Barta & Schaeilling, 1998). Comber & Zeiderman & Kevin (1994, p. 35) in their research write that "*it is important to detect early childhood interests. On the basis of their interests, the adaptation of the activity will be easier. Each child will find itself somewhere*". The methodology Step by Step (SBS), we find that "*The process of learning in young children is inextricably intertwined with games, the usage of concrete buildings and verbal expression of opinions*" (HPH 1999, p. 173).

The main question of the research:

What impact do the games have on the development of number and numbering concepts to preschool children?

Auxiliary questions:

- *How do the games and manipulative materials effect on the development of number and numbering concepts?*
- *What impact and creativity in learning concepts do the outdoor games have?*
- *Do logical games help the increasing of confidence in children in order to clarify number and numbering concepts?*

This study will contribute in finding the most suitable games for the development of important mathematical concepts for preschool children; assessing the impact of games in learning *number and numbering* concepts; the importance of their implementation through creativity, as well as improving the performance of educators in schools.

3. Literature Review

The integration field in our curriculums has a great place in child's everyday life through mathematical activities "*Mathematical activities provide fun and are successfully realized when combined and integrated with the child's environment and context living*" (Curriculum of preschool education in Kosovo 3-6 years, 2006, p. 86).

"The game is considered as one of the main instruments for promoting child's development. Game for a child is life itself, growth and gladness of his/her, and as such, play should be encouraged, directed, stimulated and supported because just as such game has its meaning and importance" (Standards for Early Childhood Development, 2011).

Education Specialist Debord (1990), writes that early age children should be provided with manipulator material, in order to gain knowledge and become agile in the game.

To the *Math Teacher' Handbook manual*, Portman, J. & Richardon find thoughts Eklavya (2007), stating that the games help children to: understand mathematical concepts, develop mathematical skills, to know the mathematical facts and learn the language and vocabulary of mathematics.

If the game is based on the ideas of children, they spend a wonderful time, compete, and each of them wishes to win. Sungmi K. (2003) to *Estimation Games and Proportional Reasoning* argues that mathematical games influence to encourage a sense of curiosity and exploration to children.

Games in yards gardens give children the experience to compare numbers, to count, for addition and subtraction, and also offering informal experience with the ideas of statistics and probability wrote to division of Marilyn Burns Education Associates (2007).

On learning of mathematical concepts and their meaning, is increasing significantly the importance of preparing children to be successful in the future and to prepare for life. Duncan et al. (2007) found that early knowledge of mathematics would be the best forecasters for subsequent achievements in mathematics. The new state standards for math joint (CCSSM, 2012) enable number of classification, measurement, and construction of spatial relations as

necessary constructions to be addressed in preschool.

Alan J. Bishop (1997, p. 3) during his research has concluded for the "fear" to teach mathematics to children at home.

4. Research Methodology

For this study, is used research methodology in action, mixed methods that are deemed as a combination of quantitative and qualitative methods in the way that best suits specific project.

4.1 Sample

The methodology of research is conducted with children of four groups, ages 5-6 years old, in "Naim Frasher" school in Prishtina, during the first half semester of school year 2014/2015. The participants were fifty-eight children, thirty of them were females and twenty-eight of them were males and students', two educators and parents of my class too.

4.2 Purpose and research questions

The purpose of this research in action is the identification of suitable methods of education and learning that include the integration of different games to help children to understand easier and while having fun the mathematical concepts - number and numbering.

4.3 Research instruments

For the realization of the research are used these research instruments:

- Interviewing protocol with educators as a focus group
- Interviewing protocol with parents as a focus group
- observation lists
- working sheets

4.4 Action plans

The first action plan - learning number and numbering concepts through games with manipulative materials.

The second action plan - learning number and numbering concepts through outdoor games.

The third plan of action - learning the number and numbering concepts through logical games.

5. The Methodology of Research

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5.1 The aim and questions of research

The aim of this action research is the evidence of suitable methods of teaching and education that include integration of different games to help children understand Mathematical concepts especially the concepts of number and counting in a simply and having fun.

5.2 Action plan

The first action plan – the learning of notion number and counting using games with manipulative tools. The purpose of this plan was the development of notion number and counting, accordance one with one and creation of different figures via manipulative tools. The purpose was to solve problems, to communicate, to justify the relationships and to evaluate.

The second action plan- learning of notion number and counting through plays in nature. The aim of this plan was

the children to learn notion of number and counting by having a good time, playing creative games outside, a good education, and sociability of children and the learning of how to respect rules.

The third action plan- learning these two notions via logic games, keeping in mind the number and counting, solving Mathematical problems through different examples of games. The purpose of this plan was the progress of logic thinking for children, imagination, challenging of challenges and to evaluate on their own.

5.3 *The detailed plan of data collection and their analysis*

A survey of a pre-test was firstly done with fifty-eight children, via tests collecting dots to form numbers, to differ the known numbers from unknown ones and to match with objects that define the number.

The result was enjoyable, where 45 or 77.59% of children were correct, whereas 13 or 22.41% of them were incorrect (in this result are also included two children with special needs).

5.4 *The analysis of questionnaire with parents*

The questionnaire for parents includes four questions of closed-type and one open-type question. Data collections are coded. The answers of 29 parents will be shown in the tables below. The questions are:

1. Do your children like counting spoons, forks and plates while setting the table?
On the above question 22 or 75.86% of parents answered that their children like to count spoons, forks and plates while setting the table; whereas 7 or 24.13% of children do not like to count these things.
2. Do you ever play any game with numbers and counting that define measurement less or more?
The answer from the second question was in similar percentage as first one, where it is shown that 22 or 75.86% of parents answered that they play these kind of games; whereas 7 or 24.13% do not play these games. From this answer we came to the conclusion that children have the same interest about counting and there is no difference about things they count.
3. Does your child count the ingredients of a cooking recipe, for example: how many spoons of flour, how many glasses of milk?
On this question we got answer by which we understood that more than 50% of parents let their children to be involved in cooking, exactly 17 or 58.62% of children counted during the cooking, and 12 or 41.38% did not count, because they do not cook together with their parents.
4. Does the child counts the stairs going up and down?
Parents 24 out 29 or 82.76% answered positively on this question, whereas negatively answered 5 or 17.24% parents that makes us to understand that children like to count stairs and their steps up and down.

While to the last question, which was an open-type question, if you have any of your children' favorite game that has to do with counting, there was a diversity of answers. A mother (1) writes that her child counts animals and classifies from other toys- extra-mundane, dolls, even dramatization toys. A father writes he plays hide-and-seek with his daughter and his daughter counts from 1 to 10 and again from backward and looks for me till she finds me. Another mother(2) says that her boy plays with columns, droops and counts how many of them has droop, how many are let, if there are more left or less.

6. **Data Analysis According to the Focus Group**

Focus group was realized with parents of group 3 and 4 of preschool classes at "Naim Frasheri" school. Participants were ten parents who had different profession and they were answered in seven questions (we will choose some of these questions and answers). The aim of the focus group creation was to get parents' opinions about the influence of Mathematical games in understanding the notions number and counting to their children.

The chosen parents in this focus group were interviewed for one hour. Selection of parents was done purposely, with those who also had difficulties when they were young. In the first question: "How important do they see the progress of Mathematics' notions via play?"- all the parents said they see the progress of Mathematical notions via game as a really important thing because this game is easy to be learnt and understood. Parent no. 1 says: "*Learning Math through plays it's a really good way to develop Math concepts, particularly for preschool age*".

If games have a really important place in families where is mentioned the notion number and counting, it can be

understood through parents' replies of second question, where majority of them stated that life itself is Math and that everything can be counted. Majority of parents responded they play Mathematical games with their children every day. Parent no. 3 says: *"In my family games take place everywhere, we count scones of bread when we cook in kitchen; we count shoes in the hall, we count clothes that we take off from washer machine in the bathroom and when we put them to be dried, we classify clothes, my daughter counts them and tells who do they belong to; we count toys in bedroom; counting traffic lights in boulevard; cars according to the brands they belong to and so on"*. If children have fun and their intelligence grows via games in outside environment, based on the replies of question number four:, we find out "What kinds of environment does your child prefer to play with pleasure in which you think he or she develops in a very good way the notion number and counting?. All parents responded that their children prefer to play in outside area, nature, parks or yards. The influence of Math games played in nature is considered to be really enjoyable. Parent number 10 says: *"My child prefers to play in our yard. The games are created based on seasons. Example: now that is winter time, my child makes snowballs and counts them. She plays together with her brother and counts how many times she has hit at him with snowballs"*.

To the last question: Do you want to add anything else about games?- all the answers were almost the same. All the parents said they are really happy their children are learning during games. *"This is a new way of Math's notions development and it is given a chance to us to practice this method of learning with our children everywhere, in home or even in nature"*. This tells us that parents really appreciate the developing of Math notions via plays.

6.1 The first action plan

6.1.1 Learning of notions of number and counting via manipulative material games

In the first action plan it is used *"the magic box"* with numbers, geometrical figures, paper cut in heart shape, written with numbers and we did evaluation as feedback.

Checking and evaluation of children's work make us known children's achieving and educator's success. Feedback helps us to find shortcoming to each pair. Next, we will present some children's work and their results:



Figure 1: Magic numbers



Figure 2: Counting and matching

Via figures 1 and 2 are presented a lot of Mathematical concepts. The duty of children was to do the matching; dots-color- figure (with numbers that are learnt till then). Instructions were each child to take a number from "magic box" and then to do the matching according to instructions. While doing this activity children had to choose figures they want, toys (soft and strong), figures, blocks, pencils, balls, or anything else they thought it matched. Children worked in an individual way. The result was surprising, 52 or 89. 66% of them were correct, whereas 6 or 10.34% were incorrect.

6.2 The second action plan

6.2.1 Concept of number and counting through games in nature

In the second action plan there were played different games in school's backyard. Each time and more, we were convinced about the influence and creativity of games in nature and their impact to learn the Math notions, notably the

concept of number and counting. The most successful were those that were played in pairs and small groups. Through below pictures we can see some of the games that were played to know number and counting.



Figure 3: Game – Jumping according to number

Figure no.7 presents a game played in pairs. A child throws a cube, and the other child jumps as far as the dots in cube show. While he/she jumps, counts loudly and when he/she stops, opens the sheet and says the number that it was hidden. This was the most children's prefer game and that is why a high result has been achieved. The results taken from this game were: 56 or 96.55% of children were correct and 2 or 3.45 of them were incorrect. The next picture tells a game of bottles crash



Figure 4: Game- Bottles' crash

In picture no. 4 there are shown numbers from 0 to 10. Each bottle has blowpipes within according to the number written on the bottle. Blowpipes are put inside while counting by children. They threw in bottles a balloon filled with water and crash them. Children were divided into two groups from each class. The purpose of this game was children to count how many bottles there were crashed, and how many of them were left. This sort of game was also their favorite one and it had a good result too. All children were correct; they knew how many bottles and which numbers they crashed, and how many of them are left.

6.3 The third action plan

6.3.1 Learning of concepts of number and counting via logic Mathematical games

In the third action plan we were focused at multiplication and subtraction of numbers; in matching; keeping in mind of number and counting, solving mathematical problems through varied examples of games. The reason of the third action plan creation based in these concepts, had to do with monitoring of lessons review and identification of children with difficulties to match numbers and to do multiplication and subtraction of numbers. Children worked in groups and individually, based on the activities that were used.

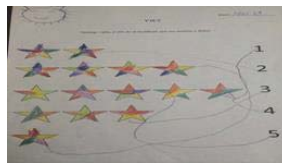


Fig. 6: Correct matching of stars with numbers



Fig. 7: Incorrect matching of stars with numbers

In this activity, picture 6 and 7, the children had to match stars with the correct number. Firstly, they colored the stars as they wanted and then continued with matching. It was an individual work and we got these results: 52 or 89. 66% of this test was correct, whereas 6 or 10. 34% was incorrect.

From all these three action plans we found out the answers of the main and helping questions of this research.

6.4 The common plan for each of three steps of action plan

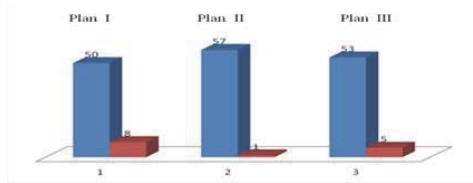


Figure 8: Results of common tests through three action plans

By this picture, the results of the three action plans in our classrooms can be seen better. In the first action plan via taken average from games with manipulative materials, it is seen that 8 children were wrong while we monitored closely while 50 of them were right. The most successful plan was the second one- games in nature. During these games just 1 of 58 children did not have the right result. Whilst, based on the third plan, we took these average results: 53 children were correct, 5 of them incorrect.

It is clearly seen that the most successful games to learn concepts of number and counting were *games in nature*. These results are basically the same with the focus group of parents.

7. Conclusion

This research's purpose was to tell the importance of Mathematical games for development of concepts of number and counting to preschool children.

All the action plans have influenced the achieving of this research purpose. After conclusion of each action plan, children's results were exactly those which showed the importance of Mathematical games during Math classes, starting from children's confidence, bringing joy during the class of Math concepts.

It was a satisfactory cooperation with parents and children and by taken results we were able to know a lot of things together. This study suggests to all parents to be part of this continued process of teaching. It also suggests educators to play even one of these games in a Math class, because of integration of these concepts in everyday life of children, to be learnt easily and clearly, and in these manners children will feel they are involved in game and in indirect way they will be in contact with concepts that are learnt.

We hope our results and conclusions will be a good starting point to review usage of Mathematical games in knowing of the concepts of this subject, because they directly influence cooperation in classrooms and increase possibilities to children. At the same time, they have fun and learn without knowing they are doing this, they develop their curiosity, imagination, esthetic education, spontaneity which make them critical thinkers and influence the effectiveness of Math classes too. We can get favorite results about our children only by analyzing achieved conclusions by national and international researchers and also adjusting with our working conditions to prepare them to be capable and competitive of tomorrow.

8. Recommendations

In the end of this research we have some recommendations which would be really helpful for educators during their Math classes:

- To apply more games during teaching of Mathematical concepts in which all children's are involved
- It is recommended educators to do researches in coherent manner about Mathematical games for development of Mathematical concepts or at least to use these games that we did during this study;
- To cooperate with professionals, colleagues, familiars and so forth. Furthermore, they can recommend or give any ideas about the activities that could be relevant, or to exchange with each other their positive

experiences;

- Inside the classroom democratic values to be promoted, encouraging the children to give their opinions to gain self-confidence;
- Games should be adjusted with the explanation of concept and should be referred to their age;
- A positive environment related with Math subject should be created in classrooms ;
- Children should be motivated to use imagination during Math classes and through games to solve Mathematical problems;
- Children should be challenged with individual, pair or group work by their educators;
- Children should be learnt to see and describe their Mathematical world;
- They should be encouraged to make as many question as they can about the concepts of number and counting;
- Children must be challenged about their critical and creative thinking, cooperation in Math classes too;
- Children should be able to cooperate with their classmates.

This research suggests the educators to use diversity of Mathematical games while teaching Mathematical concepts. Application of Math games such as: *Games with manipulative material*, *Games in nature and Logic games*- are good ways to encourage children understand easier these concepts, to explain these new concepts in order to keep in mind for a longer time, to increase self-confidence and to know information for a longer period.

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