

An Investigation of Problem Solving Skills in Preschool Education¹

Okul Öncesi Eğitimde Problem Çözme Becerilerinin İncelenmesi

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Abstract. This study is an experimental study aims to examine the effects of board games on pre-school students' problem solving skills. Sample of the research comprises the pre-school students voluntary for the research at Sakarya University Foundation College Kindergarden. Problem Solving Skills Scale was used for the research which was developed by Willoughby-Herb & Neisworth in the year 1983. As a results of Turkish adaptation study, reliability co-efficient of the scale was found .93. Pre-test and post-test which type of pre-experimental design was used in this study. Study results demonstrated that board games are significant in pre-school on their problem solving skills. The results indicated that board games are effective in preschool period in terms of supporting pre-school students' developmental tasks, providing them to express themselves freely, establishing an environment in which students develop their creativity and imagination. In addition, it is found that board games in preschool education effected problem solving skills of pre-school students.

Keywords Problem solving, pre-school education, experimental study, board games, student.

Öz. Bu çalışma, oyunların, okul öncesi öğrencilerinin problem çözme yeteneklerine etkilerini incelemek amacıyla yapılmıştır. Araştırmanın örneklemini, Sakarya Üniversitesi Vakıf Koleji Anaokulundaki araştırma için gönüllü okul öncesi öğrencileri oluşturmaktadır. Araştırma için kullanılan ölçme aracı, 1983 yılında Willoughby-Herb & Neisworth tarafından geliştirilmiştir. Ölçek uyarlama çalışmasında, ölçeğin güvenilirlik katsayısı .93 bulunmuştur. Araştırmada zayıf deneysel desenlerden ön test ve son test deneysel deseni kullanılmıştır. Araştırma sonucunda elde edilen bulgular, okul öncesi dönemde oyunların öğrencilerin problem çözme becerileri açısından önem taşıdığı göstermektedir. Okul öncesi dönemde, öğrencilerin gelişim görevlerini desteklemede, kendilerini özgürce ifade etmelerini sağlamada, öğrencilerin yaratıcılıklarını ve hayal gücünü geliştirdikleri bir ortam oluşturmada oyunların etkili olduğu bulunmuştur. Ayrıca, okul öncesi eğitimde eğitsel oyun oynamanın, öğrencilerin problem çözme becerilerini etkilediği sonucuna ulaşılmıştır.

Anahtar Kelimeler: Problem çözme, okul öncesi eğitim, deneysel çalışma, eğitsel oyun, öğrenci.

Public Interest Statement.

Educational games are very important in terms of finding solutions for the problems that pre-school children face in everyday life. Children can develop themselves by creating game environments that will be useful for children to prepare them for the real life in a healthy way at pre-school institutions and also in the family.

Toplumsal Mesaj.

Eğitsel oyunlar okul öncesi dönemdeki çocukların günlük yaşamda karşılaşılabilecekleri problemlere yönelik çözüm önerileri bulmaları açısından oldukça önemlidir. Bu nedenle okul öncesi eğitim kurumlarında ve aile içinde çocukların kendilerini geliştirebilecekleri oyun ortamlarının oluşturulması çocukların gerçek yaşama sağlıklı bir şekilde hazırlanabilmeleri için faydalı olacaktır.

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1. INTRODUCTION

Educationists directed their attention to explain and teach problem solving skills in the 20th century. At the beginning of 1960s, problem solving was perceived as mechanical (doing automatically), systematic (according to some rules), and a set of some skills (like mathematical equations or solving puzzles) (Garofalo and Lester, 1985). However, in the course of time, with the effects of cognitive learning theories, problem solving was began to be seen as a sophisticated intellectual activity that includes higher order cognitive abilities and activities like “visuality, association, abstraction, comprehension, ability, reasoning, analysis, synthesis, and generalization” (Kirkley, 2003). Today, instead of being considered as a particular ability, it is still considered as a set of sophisticated abilities that includes cognitive, behavioral, and attitudinal components (Garofalo and Lester, 1985; Kirkley, 2003). According to Dewey, problem is everything that confuses, and challenges human mind and that makes the belief vague (Ata, 1998; Baykul, 2002; Gelbal, 1991). On the other hand, Senemoğlu (1998) defines “problem” as the situation that puts the organism in action cognitively because of creating a cognitive imbalance in the organism. Problem, no matter it has different structures and characteristics, has three basic features. These features are the objective that the person sets, an obstacle that the person confronts on the road to success, and an inner tension that makes the person successful (Bingham, 2004). On the contrary, Altun (2002) indicated that the problem must be a trouble for the person that faces with it, and the person needs the problem to be solved. Moreover, that person should not faced with the problem before, and s/he should not have any preparation to solve it. If the problem was faced with and solved once, then it would be understood that the same situation is not a problem anymore. The solution does not come up suddenly, and it requires an effort. Some abilities like applying numerical methods, making measurement and using a tool may be developed with the help of courses taken at a school. Intellectual abilities can be improved when the person uses his or her intelligence or mental capacity. That recalls the question whether or not there is an ability group called as problem solving abilities. Many critical thinkers mention about problem solving abilities and skills. Those abilities can vary from basic intellectual abilities to complicated higher order abilities depending on the characteristics of the problem, structure of the problem, and possible problem solving methods (Güven, 2004). Preschool children who are curious and explorer, always explore their environment, and make lots of trials. Children who examine the problems, and situations that they face with, and those who search those problems’ causes and effects, easily enter into the process of thinking (Akkaya, 2006; Korkmaz, 2002). They are looking for solutions to their problems through thinking. They try the solution that they used before, and in necessary situations they search new problem solving methods (Dinçer, 1995). In other words, when the children have opportunity to face with problem, they develop new skills or master their previous skills.

Problem solving experiences gained in early childhood require participating in the learning process actively, doing research, proposing solutions to the problems, discussing those solutions, applying their plans and cooperating with other people around. Thus, all these activities both provide children gaining new abilities and skills about the problem solving process through cooperating with their friends (Aydoğan, 2004). Improving children’s problem solving abilities during the preschool period is important in terms of their adaptation to the real life. Good problems provide children to explore the troubles with their own style. The balance between the new one and the accustomed one is enabled. While preparing a program, if problem solving takes part in all activities, children’s abilities of analysis, synthesis, and multi- directional thinking will improve (Zembat and Unutkan, 2003). Children develop as they face with problems. Problem is an important opportunity for changing, and this opportunity should be utilized (Tavlı, 2007; Yılmaz, 2003). It is very important that children do not have to be succesful in problem-solving process for the cognitive development. Piaget states that children’s mistakes give them important clues about the nature of thinking.

Awareness of clues about the nature of the thinking obviously contributes their mental abilities, and these abilities can be transferred into academic performance. So, problem solving skills support students to have many positive qualities in education. A child who gains problem-solving skills and enjoys solving problems is also more likely to succeed at school (Düzakin, 2004; Ülküer, 1988). Children should have opportunities to solve problems on their own and gain experience with the results of their own ideas. Thus, children are also equipped with information while solving their everyday problems they face with. Problem solving opportunities encourage children to create new mental relationships through communication with their environment. Children who search for alternative solutions actively use their brains (Eroğlu, 2001). According to Bingham, children with problem solving ability how to take advantage of the opportunities they meet, find different solutions to overcome difficulties they encounter, inquire about everything, ask questions, and make predictions. Children keep their interest and attention on a topic for a long time, pay attention to details and realize the shortcomings (Bingham, 1998; Sahin, 2009). Thus it is very crucial to create an environment for problem solving in childhood, including especially during pre-school ages, in which play has an important role for teaching, developing almost any kind of skills that children will need.

The importance of pre-school play is emphasized by many scholars and theorists. Lauer (2011) reached the conclusion that lack of play leads to violent acts, social skills, and problem solving and communication skills. Besides, it is stated that lack of play is a risk-raising situation in terms of aggressive behavior and obesity (Lauer, 2011). Educational toys effect children's mental development, help them to develop some concepts and to learn to how to play (Yılmaz, 1999). In addition, educational toys make it easier for children to perform mental functions such as observation, thinking, and decision making.

In the literature, as far as we reached, there is no study that investigates the relationship between board games and problem solving abilities in preschool education. For this reason, this initial and exploratory study may create a new method to improve preschool children's problem solving abilities. It may arouse children's early interest to problem solving, and give evidence to students in terms of improving their higher order problem solving abilities in early ages of their life. Moreover, it is the first study that investigates the effect of products called as board game on problem solving abilities. Furthermore, this research may challenge the toy manufacturers to do research and test their educative play materials more in their own research and development centers. In addition, even though many products are introduced into the market with the expressions like brain-boosting, and problem solving improver, how much they have those features are not tested academically. With all these reasons, the main purpose of the current study is to investigate the effects of board games on problem solving abilities of preschool children.

2. METHOD

In the current study, single-group pretest posttest weak experimental design was applied. No control group was conducted because of the ethical issues. There were other students in the same classroom, if we did not let other children play with same board games in the classroom, they would be disappointed. Besides, there was no other classroom in the school. That was the reason for not having a control group. The sampling, instrumentation, and process and data analysis are explained and also the aim of the games is briefly introduced below.

2.1 Sample

An experimental group was composed of preschoolers between the ages of 4 and 5. The participants were composed of preschoolers whose parents were willing and permit their children to take part in the study. The experiment group was created by selecting four children.

2.2 Instrument

Preschool education problem solving scale (PEPSS) developed by Willoughby-Herb & Neisworth in 1983 was used in the present study. It measures problem solving skills of preschool children via observation by teachers. It is adapted into Turkish by Kaya et al. (2013).

The instrument had 25 items within three dimensions; attention, memory re-production, and problem solving. The psychometric properties showed that it is a valid and reliable instrument. Confirmatory factor analysis showed that the three-dimensional model fitted well: $\chi^2=406.05$, $sd=203$, $p=.000$, $RMSEA=.071$, $RFI=.97$, $NFI=.98$, $NNFI=.98$, $CFI=.99$, $IFI=.99$, $RFI=.97$, $SRMR=.044$. The Cronbach's alpha reliability coefficient of the scale was found as .93 (Kaya et al., 2013).

2.3 Procedure

Five board games were chosen for the research. The five board games did not have a hierarchical order, in other words, their mental difficulty were very similar to each other. All games built upon very similar levels of problems introduced with board games. The aims of the games were to reach a target with different strategies with bevaring of some difficulties or dangers. The pictures or the colors on a dice direct the child for some decisions. For example in "kokoriko" game, the goal is to gather more chickens to lay eggs as much as possible, but bevaring of warm. The farmer who has the most of the eggs wins the game. In the game, when the child toss the dice and the dice shows, for example, the brown chicken, the child collects the egg from the middle or from one of her/his friend. If the dice shows gray chicken, the child only takes from her/his friend. In the "shave the sheep" game has also very similar aim, collecting more wools of sheeps as much as possible bevaring of some dangers (e.g.wolf).

The board games were applied in five months, the first 10 days of each month, and for 30 minutes in each day. During these 10 days, one board game of problem solving was played by the children of the experiment group. During the process, children in experiment group also followed their routine curriculum activities, like painting, singing, or ordinary games related to the curriculum.

Data included in the scale for experiment group were recorded by educational experts through observing related behaviors of children as the pre-test, and at the end of the process, as the post-test. Besides, some additional observational data which is not asked in the scale were also recorded during the process.

2.3 Data Analysis

In the present study, premises of parametric tests were not met and Wilcoxon Signed Ranks test was conducted as a non-parametric test in order to compare the pretest and the posttest results of the experiment group. Level of significance was taken as .05.

3. Findings

The aim of the present study was to investigate the effects of board games on preschoolers' problem solving skills. In accordance with this purpose, the findings are as follows:

1st Game

Table 1: Experimental Condition 1st game (Wilcoxon Signed Ranks Test)

Group	N	\bar{X}	Sd	Z	P
Pretest		89.80	6.97		
Posttest	4	99.00	4.00	-1.826	.068

* $p<.05$

As seen in Table 1, the variance analysis that was conducted on the mean scores of the first game showed that in the experimental condition, there was no significant difference between the pretest and posttest scores of PEPSS - Turkish Form ($F(4)= 0.68$; $p<.05$). In other words, there was no significant difference between the means of PEPSS - Turkish Form scores.

2nd Game

Table 2: Experimental Condition 2nd game (Wilcoxon Signed Ranks Test)

Group	N	\bar{X}	Ss	Z	P
Pre-test		54.87	14.66		
Post-test	4	66.00	11.00	-2.371	.018

*p<.05

As seen on Table 2, the variance analysis that was conducted on the mean scores of the first game showed that in the experimental condition, there was significant difference between the pre-test and post-test scores of PEPSS - Turkish Form ($F(4)= 0.18$; $p<.05$). In other words, there was a significant difference between the means of PEPSS -Turkish Form scores, that was the post-test scores higher than pre-test scores.

3rd Game

Table 3: Experimental Condition 3rd game (Wilcoxon Signed Ranks Test)

Group	N	\bar{X}	Ss	Z	P
Pretest		110.87	1.06		
Posttest	4	116.00	1.12	-2.384	.017

*p<.05

As seen on Table 3, the variance analysis that was conducted on the mean scores of the first game showed that in the experimental condition, there was significant difference between the pretest and posttest scores of PEPSS - Turkish Form ($F(4)= 0.17$; $p<.05$). In other words, there was a significant difference between the means of PEPSS - Turkish Form scores, the posttest scores were higher than pretest scores.

4th Game

Table 4: Experimental Condition 4th game (Wilcoxon Signed Ranks Test)

Group	N	\bar{X}	Ss	Z	P
Pre-test		77.00	4.86		
Post-test	4	92.12	14.83	-2.533	.011

*p<.05

As seen on Table 4, the variance analysis that was conducted on the mean scores of the first game showed that in the experimental condition, there was significant difference between the pretest and posttest scores of PEPSS - Turkish Form ($F(4)= 0.11$; $p<.05$). In other words, there was a significant difference between the means of PEPSS - Turkish Form scores, the posttest scores were higher than pretest scores.

5th Game

Table 5: Experimental Condition 5th game (Wilcoxon Signed Ranks Test)

Group	N	\bar{X}	Ss	Z	P
Pre-test		84.12	9.70		
Post-test	4	91.87	7.25	-2.214	.027

*p<.05

As seen on Table 5, the variance analysis that was conducted on the mean scores of the first game showed that in the experimental condition, there was significant difference between the pretest

and posttest scores of PEPSS - Turkish form ($F(4) = 0.27$; $p < .05$). In other words, there was a significant difference between the means of PEPSS - Turkish form scores, the posttest scores were higher than pretest scores.

Some observational findings

Students freely expressed themselves; they started to be more creative in other activities, communicate easier with each other and teachers, they started to be more confident, and be more initiative in other activities in the classroom. They also showed perseverance in terms of solving the problem. For different situations, students developed different perspectives and strategies as compared to previous educational year's preschool children.

4. RESULTS AND DISCUSSION

In this section, the results were discussed in the light of the results of the current study. Besides, limitations and suggestions for future studies were presented. Findings revealed that except for the first game, other four board games had significant and positive difference between pretests and the posttests of the experimental group. The results of the first game did not differ in the pretest and the posttest. The reason for this result may be related to cultural issues. The children did not know such kind of games and it was the first time for them to be challenged by board games. In other words, children may not adapt themselves into the game at first application of the game. Besides, the first game would be a kind of training process for children for the other four subsequent games.

For the rest of four board games that presented to the children in this study, it was found that they positively effect the problem-solving skills of the children. Even though there is no research evidence related to the effect of specifically board games on problem solving as far as we search in the literature, it is reported that construct play affects positively affect the problem solving skills of preschool children (Lillard et.al, 2013). In this perspective, the board games in this research also present some problems to the child like construct games, and that was the reason for why the board games of this research positively effect problem solving skills of children.

Observational findings of the research showed that students' positive behaviors like expressing themselves freely, being more confident and initiative, finding different solutions in different situations and showing more perseverance to solve the problems were more developed as compared to previous educational year's preschool children. These observational findings could be related to the feeling of success which may lead to develop self-efficacy during and after the games. This feeling might not be only as a result of solving problems in the game. Using small toys for a specific aim, making decisions, expressing themselves more easily and freely just the excitement of the game may affect the students' self-efficacy and self-confidence. The feeling of more self-efficacy and self-confidence may provide with being initiative, self-expressing, initiativeness and also perseverance for solving problems and trying to find different strategies in different problematic situations. Even though we couldn't reach any related research for preschooler, some research revealed that self-efficacy beliefs are related to academic motivation and success (Linnenbrink & Pintrich, 2003). Such a feeling as a result of problem solving board game may create more self-efficacy, and more self-efficacy may support more initiativeness for solving new similar or different problems as a transfer in learning.

Ogelman and Sarıkaya (2014) stated in their experimental work that as the level of social game increases, the level of positive social behavior increases. As the level of children's silent play increases, the level of fearful anxiety and non-social behavior increases. These results support observational findings of this study. The children behaved more expressive, more communicative with the teachers and each others. Finally, it can be concluded that board games are effective problem solving abilities because of the following features: while playing the board games, students are expressing themselves easily. In addition, according to the findings, group games developed students' social skills like showing empathy and interpersonal relations. Moreover,

board game technique contributes positively to students' problem solving abilities, and it affects students' mental development assertively. At the end of the study, when all games in all stages were examined, it was observed that children who began to play a game wishfully and voluntarily showed behaviours of understanding the problem, tried to solve the problem with or without a strategy and showed perseverance in terms of solving the problem which means that motivating children to play board game is crucial. The game is one of the most effective means of telling the childrens' wishes, their goals and preparing for their life. The child learns the behaviors, knowledge and skills necessary for life spontaneously in the game. Play is a vital need like nutrition and sleep for the healthy physical and mental development of children.

Children learn about behaviors such as learning, problem solving, decision making, cooperation, sorting, editing, sharing, respecting the rights of others, and helping others during games. Research has proved that children play a positive role in mental, emotional and psychomotor development. Games help children to get used to the real world and also help meet their psychological and physical needs (Ayan & Memis, 2012). In the findings of the experimental study, it was found that the total score of the final test of the experiment group was significantly higher than the pre-test scores. It was seen that the applied activities were effective on the experiment group. At the same time, the experiment group showed a significant increase in fluency, originality, refinement and resistance to early closure subscale scores. The game does not just affect the child's mental and psychomotor development. Children often showed off their inner conflicts, anxiety, and anger in the board game. As Koçyiğit, Tuğluk & Kök (2007) stated the problems they face reflect the grief they feel in these situations by reflecting their views in the game, the children could reflect their negative feelings and it is an opportunity for children to get feedback about proper way of expressing negative feeling during board game.

Even though this is the first study to explore the effects of board games on problem solving abilities of children, as far as we reach in the literature, this research has some limitations. Because of ethical issues and other conditions that was stated in the procedure section, a control group was not composed. Future studies can be done with other quasi experimental or experimental desings. In conclusion, it could be suggested that board games that attract students' attention should be played at homes by cooperating with the family. Within a game, the situation that children can confront in real life should take place. Furthermore, in this process, the methods that children are familiar with should be used, and a path from simple to complicated, from easy to difficult, from part to whole should be followed. In schools, board games that focus on problem solving, and group activities should take place. In education curriculums, while bringing students in problem solving abilities and problem solving sub- skills, the board game technique should be used more. In class environment, problem solving environments and opportunities should be created. Chosen board games should give importance to problems that students can confront in real life. While the board game technique is applied, the teacher should be a good guide. Similarly, during the board game technique, students should be provided with expressing themselves easily. Moreover, during the board games, students should be enabled to show their own creativity. While playing the board games, students should gain following ideas in preschool education: there is no a single solution when someone confronts with a problem, there are always alternative solutions, and there is a finding at the end of every solution. It is thought that children will gain empathy and problem solving skills through board games. Teachers should include story building, drama, and board games that will enable them to empathize, take perspective and solve problems in classroom. In their daily lives, they should create problem situations for their children and only guide them in the solution process. Teachers should not think on behalf of the child should not decide on his behalf. Rather than responding directly to the questions they ask, they should provide children with thought.

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