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A Mixed Method Research Study on the Effectiveness of Board Game Based Cognitive Training Programme *

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Abstract

This study aimed to examine the influence of the 'Board Game Based Cognitive Training Programme' (BGBCTP) on the cognitive development of the second and third graders among primary school children. BGBCTP is based on educational board games for second and third graders and aims to help them develop cognitive skills. Mixed method was used and it was carried out within the framework of embedded design. A quasi-experimental pretest-posttest design was the quantitative data gathering method and a case study was the qualitative one. The participant group consisted of 120 children (60 in the experimental group, 60 in the control group). The interviews were conducted with twenty grade teachers who carried out the training programme in the experimental group. The General Information Form, The Thurstone Primary Mental Abilities Test 7-11 (PMA 7-11) and "Semi-structured Interview Form" were used to collect data. PMA 7-11 was used to statistically test the influence of BGBCTP on the development of second and third graders' cognitive skills. BGBCTP was used by the researcher with the children in the experimental group in a 'regular and controlled' manner, for 12 weeks, 2 days in a week, 1 hour each day (a total of 24 hours), in addition to their daily activities in their regular environment. For quantitative data analysis, the dependent-samples t-test was carried out for in-group comparisons, whereas the independent-samples t-test was used for intergroup comparisons. For qualitative data analysis, a descriptive analysis approach was used. The quantitative research findings indicated that the BGBCTP has had a significantly positive effect on the cognitive developments of the children in the experimental group. Besides the qualitative research findings revealed that the BGBCTP has a positive effect on children's linguistic, shape-space, reasoning, discrimination and numerical abilities. In conclusion, BGBCTP is an effective programme on the cognitive development of children.

Keywords: Cognitive development, cognitive games, educational board games, cognitive training programme, primary school

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INTRODUCTION

Cognition can be defined as the internal mental process involving mental faculties such as memory, learning, recall, problem solving and thinking (Aral & Baran, 2011; Neisser, 1967; Yeşilyaprak, 2002). Cognitive development refers to the development in active mental faculties such as perception, memory, reasoning, decision making and problem solving, which encompass the individual's interaction with her/his environment beginning from birth, facilitates the understanding of the world and helps acquiring information, using, storing, organising and evaluating it (Aral & Baran, 2011; Atkinson, Atkinson, Smith, Bem, & Nolen-Holeksema, 2008; Ministry of National Education [MoNE], 2007). During early childhood, children have their own frames of mind and worldview; their cognitive properties are quite different from those of adults. The objective of cognitive development is to argue in an abstract way, think rational manner about hypothetical situations and organise the rules in a more complex structure. Since cognitive development refers to the growing child's cogitation on the objects that she/he sees, hears, touches and tastes, it is crucial for them to collect information on their own, remember it, reorganise it by interpretation, evaluate and try and modify it for suitable application (Bayhan & Artan, 2009; Goswami, 2004; MoNE, 2007).

Cognitive development consists of mental information processing, such as potential power, ability, perception, attention, imitation, conceptualisation, memory and recall, reflexion and reasoning and problem solving and creativity. Benefiting from these processes, the individual remembers the past, solves the problems, collects new information about herself/himself and others and plans the future using the collected information (Cüceloğlu, 1997; Ömeroğlu, 2005). Potential power means the characteristics, intellectual powers and the abilities referring to the latent, potential, inexistent yet possible power the child possesses since birth not manifesting naturally due to environmental aspects or other obstacles but believed to be revealed through education. An individual's potential power in terms of learning, working and harmony related to her/his cognitive, affective and motor behaviours is defined as ability. Abilities are inherent but can be developed through experience. Perception is the process during which the stimuli received by sense organs are transformed into meaningful stimulators that activate the organism through its interaction with life and experience. Psychologists espouse the idea that based on perception, there are inherent skills and abilities that are acquired thorough interaction with the environment; furthermore the perception is influenced by an individual's mental structure, past experiences, prior knowledge, motivation level and many other internal factors (Aral & Baran, 2011; Aydın, 2002; Bayhan & Artan, 2009; Bee & Boyd, 2009; Cüceloğlu, 1997; Düzce & Cinel, 2006; MoNE, 2007; Ömeroğlu, 2005; Senemoğlu, 2007).

Attention is the process of conscious focus on stimuli. Whether or not learning occurs depends on the duration of attention and focus level. Children gain an increasing ability for selecting the stimuli and focusing their attention over time. Imitation is the ability to follow and copy a certain behaviour sample or pattern. First, imitation is pleasurable stimuli of the sight and other senses and then a way of maintaining previously interesting stimulations. Conception is an inner process representing the common properties of objects and occurrences, while conceptualisation is the operation of classifying objects. It includes the processes of perceiving or identifying differences and similarities, arranging them in order, generalising them and classifying them. Whereas memory involves the skill that helps the individual to properly retain the acquired and learned information in his or her mind without impairing their integrity to be used when required, recall refers to the process that the retained information are safely activated by a proper stimulus (Aral & Baran, 2011; Bayhan & Artan, 2009; Bütün Ayhan, 2005; Bütün Ayhan & Aral, 2007; Erden & Akman, 2002; Groome et al., 2005; MoNE, 2007; Morgan, 2000; Ömeroğlu, 2005; Öztürk & Kısaç, 2007; Selçuk, 2010; Senemoğlu, 2007; Smith, Cowie, & Blades, 2003). Thinking is a way of overreaching information already possessed, thus transforming past information by gaining more information over that gained through observation, experimentation and reasoning. Reasoning unites and organises the acquired information, as well as carrying out predicts, deduces and decides about it according to the perceived similarities and relations to solve an encountered problem. Problems are situations of conflict the individual encounters on her/his path to achieve a certain goal. Solving a problem is defined as the act of finding the best way to overcome an obstacle that prevents the individual from achieving the goal.

Problem solving is the basis of learning (Aral & Baran, 2011; Aslan, 2001; Aydoğan & Ömeroğlu, 2003; Bingham, 1998; Cağdaş, 2002; Eysenck & Kahney, 1993; Kail, 2010; Keane, 2010; Meadows, 1994; Oaksford, 2005; Ömeroğlu, 2005; Özden, 2005; Sandberg & Mccullough, 2009; Senemoğlu, 2005; Sevinç, 2003; Solso, Maclin, & Maclin, 2009; Taylor, 2005; Zembat & Unutkan, 2005). San (1985) defines creativity as the skill to make connections between the relations that were not developed before, thus to cultivate new experiences, ideas and products within a certain pattern of thinking.

Scientists seem to agree that the cognitive development that's mental information processing mentioned above is supported by play beginning in infancy. By stimulating a child's curiosity and sense of discovery, playing a game contributes to the cognitive development by positively influencing learning. During complex games that help her/him gain rich experiences for cognitive development, the child performs mental activities in terms of abstract skills such as reflexion, perception, comprehension, order arrangement, analysis and synthesis, evaluation, reasoning, problem solving, establishment of cause and effect relationships, focus and development of convergent thinking. An effective game develops the children's cooperative learning, communication, problem solving, and critical thinking abilities.Therefore, playing a game is the leading factor that influences cognitive development (Aral, Gürsoy, & Köksal, 2000; Athey, 1988; Cheyne & Rubin, 1983; DeVries, 2015; Doğanay, 2002; Driscoll & Nagel, 2008; Hazar, 2000; Kamii, 2015; Lillard et al., 2013; MoNE, 2007; Özdoğan, 2000; Pehlivan, 2005; Pepler, 1982; Persky, Stegall-Zanation, & DupuisVanderberg, 1980; Ulrich & Glendon, 2005; Wolfgang, Stannard, & Jones, 2001; Wyvern & Spence, 1999).

A board game is a game that involves counters or pieces moved or placed on a pre-marked surface or "board", according to a set of rules (Vij, 2011). Traditional teaching methods are difficult to meet the expectations of today's students. But board games energize and encourage children to learn, promote creativity, concentration, and confidence and fit the preferences of children who expect learning tasks to be fast, active, and exploratory (Kirriemuir & McFarlane, 2004; Sardone & Devlin-Scherer, 2016). Board games can be based on pure strategy or chance. They sometimes involve both strategy and luck. These games usually have a goal that a player aims to achieve (Vij, 2011). Board games which have different educational goals can be used in an educational environment (Casbergue & Kieff, 1998). Chidren can learn more effectively through active learning that they directly participate in their own learning (Odenweller, Hsu, & DiCarlo, 1998). When the educational board games are used, children can learn more actively (Selby, Walker, & Diwakar, 2007). Since these games motivate children, inspire them to learn, make learning fun and encourage teamwork, they are considered an effective, creative and interactive alternative to support the traditional teaching approaches (Lujan & DiCarlo, 2006; Patel, 2008). Educators can use these games for reinforcing a previously learned topic or teaching a new concept (Odenweller, Hsu, & DiCarlo, 1998). Besides educational board games facilitate children's friendship development, parent-child interaction, social skills and social development (Chen, Liao, Cheng, Yeh, & Chan, 2012; Kırıkkaya, İseri, & Vurkaya, 2010; Rubin, Bukowski, & Laursen, 2011; Türkoğlu, Çeliköz, & Uslu, 2013; Yen, Chou, Chen, Wu, & Kao, 2015).

Game-based learning means using games that could be entertaining games or educational games in educational contexts to reach educational objectives (Connolly, Boyle, MacArthur, Hainey, & Boyle, 2012). These games could. Game-based learning (GBL) is a pedagogic approach that involves using games, both traditional and digital, to support and enhance learning, teaching or assessment. It is an effective way in which to support curriculum, motivate students and engage them in active and experiential learning (Charlier, Ott, Remmele, & Whitton, 2012; Laski & Siegler, 2014; Naik, 2015; Park & Yun, 2018; Ya-Ting, 2012). Game-based learning develops the students' academic aptitude and cognitive competencies, thus it increases their academic success (Byun & Loh, 2015; Ke, Xie, & Xie, 2016; Kim, Roh, & Cho, 2016; Laski & Siegler, 2014; Shin, Sutherland, Norris, & Soloway, 2012). According to Papastergiou (2009a) students can learn more actively and with greater interest through game-based learning. Game-based learning sustains interest and attention; improves confidence, learning motivation and performance; increases engagement and achievement; provides opportunities to prepare the future learning, teaches new knowledge and skills, practices and

reinforces existing knowledge and skills and develops 21st-century skills (Eseryel, Law, Ifenthaler, Gel, & Miller, 2014; Felicia, 2014; Filsecker & Hickey, 2014; Hung, Huang, & Hwang, 2014; Kebritchi, Hirumi, & Bai, 2010; Maclellan, 2013; Plass, Perlin, & Nordlinger, 2010; Smeda, Dakich, & Sharda, 2014; Villalon, 2016; Zhang, 2015).

Since game-based training programme which consists of different educational board games has a lot of benefits, many researchers have made to determine the effects of these games on these children. In Turkey, there are a limited number of studies on the effects of board game-based cognitive training programme on the cognitive development of primary school children. Considering the increasing rate of board games among primary school children and the game-based approach mentioned in Turkey's Education Vision 2023 document published by Turkey's Ministry of National Education (MoNE, 2018), the present study was conducted to investigate the effects of board games on cognitive development of these children.

The main research question of this study is as follows: How does Board Game Based Cognitive Training Programme (BGBCTP) influence the cognitive development (linguistic, spatial, reasoning, discrimination, numerical and general skills) of children in primary school?

The sub-questions that have been identified for the main research question are presented below:

1. Is there a significant difference between the cognitive pre-test mean scores of the children in experimental and control groups?

2. Is there a significant difference between the cognitive post-test mean scores of the children in experimental and control groups?

3. Is there a significant difference between the cognitive development pre-test and post-test mean scores of the children in the control group?

4. Is there a significant difference between the cognitive development pre-test and post-test mean scores of the children in the experimental group?

5. What are the opinions of second and third grade teachers about the influence of BGBCTP on the cognitive development of children?

METHOD

The Study Design

In this study, mixed method was used and it was carried out within the framework of embedded design. Mixed method is a research approach whereby the researcher collects, analyzes data, integrates the findings and draws inferences using both qualitative and quantitative approaches and methods in a single study or a series of studies to understand a research problem (Creswell & Plano Clark, 2011; Tashakkori & Creswell, 2007). Creswell (2012) described the purpose of the embedded design as "to collect quantitative and qualitative data simultaneously or sequentially, but to have one form of data play a supportive role to the other form of data". In one variant, qualitative data are embedded within a quantitative design; in another variant, the quantitative data are secondary to the qualitative and the interpretation is qualitatively led (Lieberman, 2005).

Both quantitative and qualitative methods were used in this study. A quasi-experimental design was the quantitative data gathering method and a case study was the qualitative one. The pre-test/post-test control group design is used to reveal the difference between the levels of cognitive development for students who participate in BGBCTP and those who do not. The dependent variable in the design is the 'cognitive development' (linguistic, spatial, reasoning, discrimination, numerical

and general skills) of children in primary school. The independent variable is BGBCTP, effects of which on the cognitive development of children were examined. The qualitative data were collected via semi-structured interviews with the second and third grade teachers by the researcher. BGBCTP is a training programme based on cognitive games, which aims to enhance the cognitive development of children and involves experimental group children chosen from among the second and third graders of Cahit Zarifoğlu Primary School, affiliated to the Ministry of National Education, serving students in two different shifts (morning and afternoon). In this study, the training programme designed by the researcher was used with the children in the experimental group in a 'regular and controlled' way for a period of 12 weeks, 2 days in a week, for 1 hour each day, in addition to their own daily activities in their environment, resulting in a total of 24 hours of training. The programme was implemented by the grade teachers in class in both individual and group formats. The grade teachers providing the training were trained by the researcher prior to the implementation. The control group was selected from among students of Yazır Şehit Osman Küçükdillan Primary School, also affiliated to the Ministry of National Education where the students have similar socio-economic conditions. This school serves its students in two shifts of the day, morning and afternoon. The control group was not subject to any activity related to BGBCTP; the students in this group continued attending courses in their daily programmes offered by their own grade teachers.

Study Group

The target population of this study comprises students and their teachers in the second and third grades of the primary schools affiliated to Konya Municipality Selcuklu District Directorate of National Education in Turkey in 2015–2016 school year. In the quantitative dimension of the study, the study groups were formed within Cahit Zarifoğlu and Yazır Şehit Osman Küçükdillan Primary Schools that were chosen through cluster sampling method from among the primary schools affiliated to Konya Municipality Selcuklu District Directorate of National Education providing education in two shifts, morning and afternoon, where it is appropriate to design cognitive training classes with independent physical conditions. The experimental groups and control groups are selected from two different schools to prevent any interaction between children and double standards for children who share the same environment. While choosing the above-mentioned schools, several reasons such as the socio-economic level of their zone, their physical facilities and atmosphere, the cooperation of their management staff were considered determinant. At first, PMA 7-11 was applied simultaneously to 100 children in the second grade from each school (200 children in total) and to 100 children in the third grade from each school (another 200 children in total) aiming at determining the students who prequalify. The parents of these children were asked to fill out the General Information Form. The study group was formed with 120 children in total: 30 children in the second grade and 30 children in the third grade of Cahit Zarifoğlu Primary School who have never taken board game based cognitive trainings before and who have had a normal development period, and 30 children in the second grade and 30 children in the third grade of Yazır Şehit Osman Küçükdillan Primary School who have never taken board game based cognitive trainings before and who have had a normal development period. As the dependent variable of the study is the cognitive development of the children, the groups were formed before the training, in line with children's personal information and the Thurstone Primary Mental Abilities Test (PMA 7-11) results. In the qualitative dimension of the study, the interviews were conducted with the grade teachers who carried out the training programme in the experimental group. Twenty teachers from the experimental group who were all the second and third grade teachers were interviewed. 10 (50%) of teachers are second grade teachers and 10 (50%) of teachers are third grade teachers; 12 (60%) of grade teachers are female, and 8 (40%) are male; 4 (20%) of the grade teachers are in the age interval between 26 and 30 years, 9 (45%) are between 31 and 35 years, 7 (35%) are between 36 and 40 years; 17 (85%) of grade teachers hold bachelor's degree, and 3 (15%) of grade teachers hold master's degree. 5 (25%) of the teachers have 5-10 years, 9 (45%) have 11-15 years, and 6 (30%) have 16-20 years of professional experience.

Data Collection Tools

In this study, "General Information Form" that includes questions about children and parents was used as the data collection tool, together with the "PMA 7-11" that helps to statistically test the effectiveness of the BGBCTP on the cognitive development of the children. Besides "Semi-structured Interview Form" was used for the qualitative data.

General Information Form. A general information form was designed by the researcher with the aim of collecting information about the children and their parents who are included in the study. The form involves questions about children's gender, number of their siblings, the duration of their pre-school education and ages, educational statuses, work statuses, professions of their parents, economic situation of the family as well as questions revealing whether the children have already participated in a game-based cognitive development training and whether they have already played games such as box games or computer games that support cognitive development.

The Thurstone Primary Mental Abilities Test 7-11 (PMA 7-11). The Primary Mental Abilities Test 7-11 is a group intelligence test and was designed by T. G. Thurstone and L. L. Thurstone based on the factor analysis theory, to measure linguistic, spatial, reasoning, discrimination, numerical and general skills of children comprising 181 questions. PMA 7-11, an adjusted version started in 1998 and completed in 2001, was built on the data collected from 4154 children in 20 sample cities. The first part of the test comprises the language test, includes a vocabulary test with 30 questions to measure the ability to comprehend what is meant by the words and a picture test with 19 questions. Spatial skill refers to the ability to visualise the objects in two and three dimensions. The notion of place test has 24 questions through which a partial square shape is asked to be completed. The skill of reasoning involves solving logic problems, predicting the result and planning. The test of reasoning includes 22 questions about grouping words, in which a different word is asked to be found in a word index, and 23 questions about grouping shapes, in which a different shape is asked to be found in a shape index. The skill of discrimination is the skill to discover visual details quickly and accurately; it comprises 32 questions through which two similar shapes are to be identified among a series of shapes. Numerical skills refer to the ability of working with numbers and dealing with simple quantitative questions quickly and accurately. The test of calculation requiring speed and accuracy includes 31 questions in which the results of additions are asked to be calculated. The reliability estimates of PMA 7-11 range from 0.73 to 0.98 when calculated using Cronbach's alfa reliability coefficient. As Cronbach's alfa shows the minimum coefficient related to the reliability of the test, it can be presumed that the reliability of PMA 7-11 is higher than the given coefficient. In addition, the estimates of the predictive validity coefficient of the PMA 7-11 scores of 701 students range from 0.03 to 0.48 (MoNE, 2001).

Semi-Structured Interview Form. The semi-structured interview form consists of open-ended questions. By performing a literature review, the interview questions were prepared. To ensure content validity, the opinions of three experts in this field were sought, and a semi-structured interview form consisting of five questions was created. To ensure the internal validity of the question items, a preliminary interview was held with three teachers, their answers were recorded in writing. Besides an expert was asked to check whether the questions were clear and intelligible and whether the questions served the main objective by examining the questions and interview records. After ensuring the validity of the semi-structured interview form, face-to-face interviews with second and third grade teachers were started and the answers given were recorded in writing by the researcher.

Designing the Training Programme

To design BGBCTP, the first step was literature review. The studies conducted in Turkey and abroad with an understanding based on game-based education as well as those which achieved to make a difference in the area of cognitive development were examined. Within the scope of the study, the Thurstone Primary Mental Abilities Test 7-11 (PMA 7-11) was analysed in detail; the aims and acquisitions regarding the children's linguistic, spatial, reasoning, discrimination and numerical skills

were defined with their sub-dimensions. BGBCTP comprises a total of thirteen cognitive games selected by the researcher in line with sub-dimensions of linguistic, spatial, reasoning, discrimination and numerical skills with six games personalised for each of the two different grades, a total of twelve games, as well as one activity game designed to reinforce the skill of creativity for all grades. For the second grade students Rory's Story Cubes, Katamino, Q-bitz, Math Dice 6-8, Chocolate Fix and Pentago games; for the third grade students Last Letter, Architecto, Set, YUP 9+, Quoridor, Reversi games and Bio Blo for the skill of creativity were used.

Procedures

A cognitive training classroom was designed by a civil engineer, employed in Selçuklu Municipality, in Cahit Zarifoğlu Primary School that was selected as pilot scheme based on the idea that the physical conditions are as important as the training programme, the teachers and the equipment in terms of their influence on the quality of education. Both the civil engineer and the researcher paid attention to the materials used for the design of the classroom so that it can be convenient, healthy, comfortable and interesting for children. White as used as the general colour of the classroom in order to prevent the children from being distracted and create a luminous atmosphere. In addition, four other colours (yellow, orange, blue, green) were added to the details of the design. Next, the materials necessary for the games that will be played during the cognitive development training were provided. Individual games were provided for each student so that they had their own materials, whereas group games were given to groups of two or four students depending on the type of the game. Consequently, none of the students missed any game, and all participated actively in the games.

Before starting the training programme, all participating grade teachers attended a workshop by the researcher for 2 weeks; then, the grade teachers provided the training to the children in their classes. The grade teachers conducted the training for the following reasons. First, the student adaptation to the programme with the help of their own teachers was aimed. Second, the grade teachers would hold a more sound understanding of the differences occurring in the children was aimed. Finally, the fact that the programme would continue to be implemented in the classes by these teachers in the subsequent years was envisaged. The researcher participated in all the trainings run by the grade teachers as an observer and supported the teachers to overcome any drawbacks or complete omissions. To be fair and just, the training was given to all students of Cahit Zarifoğlu Primary School without exception so that they would not develop a negative self-image or psychological problems. However, no training related to BGBCTP was held in Yazır Şehit Osman Küçükdillan Primary School, where the usual curriculum was continued, to detect the differences that the training programme would create. The school management prepared a timetable planning the use of cognitive training classroom, in order to ensure that the classroom is used equally by all classes, thus prevented the disorder in the use of the classroom and the disruption of the training programme. All students at the second and third grades took courses in the cognitive training classroom for 2 hours a week, 1 hour over two days, which lasted 12 weeks, comprising a total of 24 hours in the second semester. In addition, the reason why the training is distributed over different days stems from the need for raising the children's awareness about the continuity of the training and thus to prevent them from being disconnected from the training programme.

The cognitive training programme started on 14/03/2016. For the pilot scheme practices, one activity game and six cognitive games intended for different sub-dimensions depending on each class were used. Every game in the programme for the second and third grades was presented by the grade teacher during the first lesson of the first week; then, the students worked on the games both individually and in groups in the following lesson. After that, they continued practising the games both individually and in groups in the first lesson of the following week; in the last lesson of second week, in-class competitions (tournaments) were organised. The following week the grade teacher introduced a new game. In this way, one game was presented and completed in two weeks, and a total of six games were presented over 12 weeks. Before starting the trainings for the experimental group, the Thurston Primary Mental Abilities Test 7-11 was administered as the pre-test by the school counsellor

to 400 children who were selected using random sampling to determine the prequalifying children, both in the experimental group school and in the control group school. In addition, the parents were asked to fill out the General Information Form prepared by the researcher. In selecting the children in the experimental and control groups, the scores of PMA 7-11 as well as the similarity of demographics pertaining to the children and their parents were accentuated. The groups were formed considering the existence of similar properties in each one; a total of 120 children from both schools constituted the working group. Analysing the results of the pre-test, it was found that if there was a significant difference between the mean scores of the groups and the inference that the groups are homogeneous, the training programme of the experimental group could commence. It was also ensured that the children enjoyed while learning new things during the programme. Hence, that the selected games match with the level of the children was considered and ensured. It was ensured that the new information, acquisitions and strategies that were gained through training each week of game play were transferred and merged with new information, to be consolidated in the following weeks. After each lesson, mutual ideas about the process were shared with the children and the difficulties they faced, and the new strategies they developed during the lesson as well as their feelings and ideas were evaluated. During the group game activities, the main aims were to reinforce their skills of supporting each other, and getting help and cooperating, whereas in the individual game activities were to help them gain the skills of learning by being active and by experiencing, the skills to be autonomous and the skills to analyse and synthesise. The training programme ended on 03/06/2016. Once BGBCTP was over, the PMA 7-11 was administered once more to the study-group children as a post-test and the opinions of teachers on BGBCTP were collected by Semi-structured Interview Form.

Data Analysis

In this study, the quantitative data analysis was performed using SPSS 16.0 programme. The independent-group t-test was used for comparing the pre-test scores of the children in experimental and control groups and for comparing the post-test scores of the children in experimental and control groups. For comparing the pre-test/post-test scores of both groups, the dependent group t-test was used.

In the qualitative data analysis, a descriptive analysis approach was used. Themes and sub-themes were first created in the study. Coherence and therefore internal consistency were ensured by checking the relationship between the themes and sub-themes and the relationship between each theme. A code number was given to teachers (Teacher 1, Teacher 2, Teacher 3...) who were asked for their opinion in the analyses, and their names were not used directly. The findings were presented with frequency and percentage values. The codes with “consensus” and “dissensus” were determined and the necessary arrangements were made separately by the encoders (the researcher and two expert academicians in the domain) in the descriptive analysis process. The reliability formula (Reliability = Consensus / [Consensus + Dissensus] × 100) suggested by Miles and Huberman (1994) was used in the codification. According to this formula, the percentage of reliability between encoders was determined as 93% in the first question, 94% in the second question, 91% in the third question, 93% in the fourth question and 90% in the fifth question. This ratio indicated that the analyses were reliable. In order to ensure external reliability, the research model, study group, preparation of the data collection tool, data collection, data analysis process, and comparisons made with different studies conducted on the subject were explained in detail.

RESULTS

Quantitative Findings on the Influence of the Board Game Based Cognitive Training Programme on the Cognitive Development of the Second and Third Grade Students

In this section, the findings relating to the sub-dimensions of linguistic, spatial, reasoning, discrimination and numerical and general skills of PMA 7-11 were discussed to test the hypotheses formulated to find out whether BGBCTP has any effect on the cognitive development of second and third graders.

Findings Related to Differences Between Experimental and Control Groups As Regards the Cognitive Development Pre-Test Mean Scores of Second Graders. Before the implementation of BGBCTP, the cognitive development pre-test mean scores of the experimental and control groups were compared using the independent-groups t-test in order to examine whether the control groups and experimental groups belonged to the same target population, i.e. whether their cognitive development pre-test mean scores were statistically similar. The results are given in Table 1.

Table 1. N, $\bar{x}$, SD, t and p Values of the Cognitive Development Pre-test Mean Scores of Second Graders in the Experimental and Control Groups

Cognitive Development Ability Area	Groups	N	$\bar{x}$	SD	t	p
Linguistic Ability	Experimental	30	26.13	4.015	0.870	0.388
	Control	30	25.20	4.286		
Shape And Space Ability	Experimental	30	11.40	3.460	1.462	0.149
	Control	30	12.77	3.775		
Reasoning Ability	Experimental	30	26.73	4.402	0.225	0.823
	Control	30	26.97	3.577		
Discrimination Ability	Experimental	30	15.33	4.715	1.899	0.063
	Control	30	17.67	4.802		
Numerical Ability	Experimental	30	13.47	4.175	0.820	0.416
	Control	30	12.40	5.775		
General Ability	Experimental	30	93.07	7.847	0.734	0.466
	Control	30	95.00	12.111		

In Table 1, the t values of the sub-dimension of linguistic skills (t=0.870; p>0.05), spatial skills (t=1.462; p>0.05), reasoning skills (t=0.225; p>0.05), discrimination skill (t=1.899; p>0.05), numerical skill (t=0.820; p>0.05) and general skills (t=0.734; p>0.05), calculated using the independent t-test to detect any significant difference between the pre-test mean scores of the second graders in the experimental and control groups, were found to be statistically not significant.

Findings Related to Differences Between the Cognitive Development Post-Test Mean Scores of Second Graders in Experimental and Control Groups. After the implementation of BGBCTP in the experimental group, an independent-group t-test was performed to detect whether the cognitive development post-test mean scores of the children in the experimental and control groups differ significantly. The findings are given in Table 2.

Table 2. N, $\bar{x}$, SD, t and p Values of the Cognitive Development Post-Test Mean Scores of Second Graders in the Experimental and Control Groups

Cognitive Development Ability Area	Groups	N	$\bar{x}$	SD	t	p
Linguistic Skill	Experimental	30	30.43	3.617	4.347	0.000
	Control	30	26.27	3.805		
Spatial Skill	Experimental	30	14.33	3.231	2.210	0.031
	Control	30	12.40	3.539		
Reasoning Skill	Experimental	30	30.30	3.687	3.865	0.000
	Control	30	26.70	3.525		
Discrimination Skill	Experimental	30	20.53	4.776	2.238	0.029
	Control	30	17.73	4.913		
Numerical Skills	Experimental	30	17.40	4.889	2.748	0.008
	Control	30	13.73	5.433		
General Skills	Experimental	30	113.00	7.413	6.893	0.000
	Control	30	96.83	10.491		

In Table 2, the t values of the sub-dimensions of linguistic skills (t=4.347; p<0.05), spatial skills (t=2.210; p<0.05), reasoning skill (t=3.865; p<0.05), discrimination skill (t=2.238; p<0.05), numerical skills (t=2.748; p<0.05) and general skills (t=6.893; p<0.05), calculated using the independent t-test, statistically showed that the post-test scores of the experimental group were significantly higher than those of the control group.

Findings Related to Differences Between the Cognitive Development Pre-Test/Post-Test Mean Scores of Second Graders in the Control Group. Pre-test/post-test mean scores of second graders in the control group were compared using the dependent group t-test. The findings of the comparison are shown in Table 3.

Table 3. N, $\overline{x}$, SD, p and t Values of the Cognitive Development Pre-Test/Post-Test Mean Scores of Second Graders in the Control Group

Cognitive Development Ability Area	Groups	N	$\overline{x}$	SD	t	p
Linguistic Skill	Pre-test	30	25.20	4.286	1.470	0.152
	Post-test	30	26.27	3.805		
Spatial Skill	Pre-test	30	12.77	3.775	0.795	0.433
	Post-test	30	12.40	3.539		
Reasoning Skill	Pre-test	30	26.97	3.577	0.490	0.628
	Post-test	30	26.70	3.525		
Discrimination Skill	Pre-test	30	17.67	4.802	0.097	0.924
	Post-test	30	17.73	4.913		
Numerical Skills	Pre-test	30	12.40	5.775	2.210	0.035
	Post-test	30	13.73	5.433		
General Skills	Pre-test	30	95.00	12.111	1.897	0.068
	Post-test	30	96.83	10.491		

The dependent t-test results, as seen in Table 3, revealed no significant difference between the pre-test/post-test mean scores for linguistic skills (t=1.470; p>0.05), spatial skills (t=0.795; p>0.05), reasoning skill (t=0.490; p>0.05), discrimination skill (t=0.097; p>0.05) and general skills (t=1.897; p>0.05). However, a significant difference was found between the pre-test/post-test mean scores for numerical skills (t=2.210; p<0.05) of the children in the control group.

Findings Related to Differences Between the Cognitive Development Pre-Test/Post-Test Mean Scores of Second Graders in the Experimental Group. The cognitive development mean scores of second graders before and after participating in BGBCTP were tested to identify whether the difference was significant. The pre-test mean scores of the children in the experimental group were compared to their post-test mean scores using the dependent group t-test. The results are shown in Table 4.

Table 4. N, $\overline{x}$, SD, p and t Values of the Cognitive Development Pre-Test/Post-Test Mean Scores of Second Graders in the Experimental Group

Cognitive Development Ability Area	Groups	N	$\overline{x}$	SD	t	p
Linguistic Skill	Pre-test	30	26.13	4.015	5.937	0.000
	Post-test	30	30.43	3.617		
Spatial Skill	Pre-test	30	11.40	3.460	7.213	0.000
	Post-test	30	14.33	3.213		
Reasoning Skill	Pre-test	30	26.73	4.402	4.607	0.000
	Post-test	30	30.30	3.687		
Discrimination Skill	Pre-test	30	15.33	4.715	6.827	0.000
	Post-test	30	20.53	4.776		

Numerical Skills	Pre-test	30	13.47	4.175	5.759	0.000
	Post-test	30	17.40	4.889		
General Skills	Pre-test	30	93.07	7.847	18.879	0.000
	Post-test	30	113.00	7.413		

According to the dependent group t-test results, the post-test mean scores of the children in the experimental group were significantly higher than their pre-test mean scores for linguistic skills (t=5.937; p<0.05), spatial skills (t=7.213; p<0.05), reasoning skill (t=4.607; p<0.05), discrimination skill (t=6.827; p<0.05), numerical skills (t=5.759; p<0.05) and general skills (t=18.879; p<0.05).

Findings Related to Differences Between the Cognitive Development Pre-Test Mean Scores of Third Graders in the Experimental and Control Groups. Before the implementation of BGBCTP, the cognitive development pre-test mean scores of the experimental and control groups were compared using the independent group t-test to examine whether the control groups and experimental groups belonged to the same target population, i.e. whether their cognitive development pre-test mean scores are statistically similar. The results are given in Table 5.

Table 5. N, $\bar{x}$, SD, p and t Values of the Cognitive Development Pre-Test Mean Scores of Third Graders in the Experimental and Control Groups

Cognitive Development Ability Area	Groups	N	$\bar{x}$	SD	t	p
Linguistic Skill	Experimental	30	31.10	3.968	0.404	0.688
	Control	30	31.60	5.494		
Spatial Skill	Experimental	30	14.37	2.785	0.142	0.888
	Control	30	14.47	2.675		
Reasoning Skill	Experimental	30	30.93	3.850	1.753	0.085
	Control	30	29.00	4.654		
Discrimination Skill	Experimental	30	21.53	4.392	1.786	0.079
	Control	30	23.37	3.508		
Numerical Skills	Experimental	30	20.07	3.542	0.799	0.427
	Control	30	21.07	5.866		
General Skills	Experimental	30	118.00	9.948	0.456	0.650
	Control	30	119.50	15.037		

In Table 5, the t values of the sub-dimensions of linguistic skills (t=0.404; p>0.05), spatial skills (t=0.142; p>0.05), reasoning skill (t=1.753; p>0.05), discrimination skill (t=1.786; p>0.05), numerical skills (t=0.799; p>0.05) and general skills (t=0.456; p>0.05), calculated using the independent-group t-test were found not to be statistically significant.

Findings Related to Differences Between the Cognitive Development Post-Test Mean Scores of Third Graders in the Experimental and Control Groups. After the implementation of BGBCTP, the post-test mean scores of the children in the experimental and control groups were compared using the independent group t-test. The findings are given in Table 6.

Table 6. N, $\bar{x}$, SD, p and t Values of the Cognitive Development Post-Test Mean Scores of Third Graders in the Experimental and Control Groups

Cognitive Development Ability Area	Groups	N	$\bar{x}$	SD	t	p
Linguistic Skill	Experimental	30	33.97	3.764	2.728	0.008
	Control	30	31.13	4.265		
Spatial Skill	Experimental	30	16.43	2.388	2.577	0.013
	Control	30	14.63	2.988		
Reasoning Skill	Experimental	30	32.70	4.036	2.700	0.009
	Control	30	29.40	5.341		

Discrimination Skill	Experimental	30	26.47	3.893	2.328	0.023
	Control	30	23.60	5.506		
Numerical Skills	Experimental	30	25.73	3.321	2.359	0.022
	Control	30	22.70	6.210		
General Skills	Experimental	30	135.30	8.183	4.559	0.000
	Control	30	121.47	14.464		

As seen in Table 6, the t values of the sub-dimensions of linguistic skills (t=2.728; p<0.05), spatial skills (t=2.577; p<0.05), reasoning skill (t=2.700; p<0.05), discrimination skill (t=2.328; p<0.05), numerical skills (t=2.359; p<0.05) and general skills (t=4.559; p<0.05), statistically indicated that post-test scores of the experimental group were significantly higher than those of the control group.

Findings Related to Differences Between the Cognitive Development Pre-Test/Post-Test Mean Scores of Third Graders in the Control Group. The cognitive development pre-test/post-test mean scores of the third graders in the control group BGBCTP were compared using the dependent group t-test. The findings of the comparison are shown in Table 7.

Table 7. N, $\overline{x}$, SD, p and t Values of the Cognitive Development Pre-Test Post-Test Mean Scores of Third Graders in the Control Group

Cognitive Development Ability Area	Groups	N	$\overline{x}$	SD	t	p
Linguistic Skill	Pre-test	30	31.60	5.494	0.634	0.531
	Post-test	30	31.13	4.265		
Spatial Skill	Pre-test	30	14.47	2.675	0.342	0.735
	Post-test	30	14.63	2.988		
Reasoning Skill	Pre-test	30	29.00	4.654	0.547	0.589
	Post-test	30	29.40	5.341		
Discrimination Skill	Pre-test	30	23.37	3.508	0.402	0.691
	Post-test	30	23.60	5.506		
Numerical Skills	Pre-test	30	21.07	5.866	2.382	0.024
	Post-test	30	22.70	6.210		
General Skills	Pre-test	30	119.50	15.037	1.798	0.083
	Post-test	30	121.47	14.464		

The dependent t-test results, as seen in Table 7, demonstrated no significant difference between the pre-test/post-test mean scores for linguistic skills (t=0.634; p>0.05), spatial skills (t=0.342; p>0.05), reasoning skill (t=0.547; p>0.05), discrimination skill (t=0.402; p>0.05) and general skills (t=1.798; p>0.05). A significant difference was detected between the pre-test/post-test scores for numerical skills (t=2.382; p<0.05) of the children in the control group.

Findings Related to Differences Between the Cognitive Development Pre-Test/Post-Test Mean Scores of Third Graders in the Experimental Group. The cognitive development mean scores of third graders before and after participating in BGBCTP were tested to find out whether there was any significant difference. The pre-test mean scores of the children in the experimental group were compared to their post-test mean scores using the dependent group t-test with the intention of testing the effect of the programme on cognitive skills. The results are given in Table 8.

Table 8. N, $\bar{x}$, SD, p and t Values of the Cognitive Development Pre-Test Post-Test Mean Scores of Third Graders in the Experimental Group

Cognitive Development Ability Area	Groups	N	$\bar{x}$	SD	t	p
Linguistic Skill	Pre-test	30	31.10	3.968	4.838	0.000
	Post-test	30	33.97	3.764		
Spatial Skill	Pre-test	30	14.37	2.785	4.312	0.000
	Post-test	30	16.43	2.388		
Reasoning Skill	Pre-test	30	30.93	3.850	2.608	0.014
	Post-test	30	32.70	4.036		
Discrimination Skill	Pre-test	30	21.53	4.392	8.891	0.000
	Post-test	30	26.47	3.893		
Numerical Skills	Pre-test	30	20.07	3.542	13.440	0.000
	Post-test	30	25.73	3.321		
General Skills	Pre-test	30	118.00	9.948	19.979	0.000
	Post-test	30	135.30	8.183		

According to the dependent group t-test results, as seen in Table 8, the post-test mean scores of the children in the experimental group were significantly higher than their pre-test mean scores for linguistic skills ($t=4.838$; $p<0.05$), spatial skills ($t=4.312$; $p<0.05$), reasoning skill ($t=2.608$; $p<0.05$), discrimination skill ($t=8.891$; $p<0.05$), numerical skills ($t=13.440$; $p<0.05$) and general skills ($t=19.979$; $p<0.05$).

Qualitative Findings on Second and Third-Grade Teachers' Opinions about the Effects of the Board Game Based Cognitive Training Programme on Children's Cognitive Development

Whether BGBCTP has an effect on children's linguistic, shape-space, reasoning, discrimination and numerical abilities, and its reasons were asked to second and third-grade teachers to determine the effects of BGBCTP on children's cognitive development. The answers received were analyzed and presented below.

The question "Does BGBCTP have an effect on children's linguistic ability? Why?" was posed to second and third-grade teachers. All of the teachers gave the answer "Yes, BGBCTP has an effect on children's linguistic ability." With respect to the effect of BGBCTP on children's linguistic ability, 10 (50%), 7 (35%) and 3 (15%) of the teachers stated that it has quite positive effects on "expression ability", "vocabulary", and "comprehension ability", respectively.

Examples of the answers indicating that BGBCTP has a positive effect on children's expression ability:

"I have observed that my students express themselves, their feelings and thoughts very properly while playing games for language development." (Teacher 3)

"Children expressed their thoughts more smoothly during the games differently from the lessons." (Teacher 11)

Examples of the answers indicating that BGBCTP has a positive effect on children's vocabulary:

"My students contributed to their vocabulary with the new words they heard from each other while playing games." (Teacher 7)

"Children used different words during game applications and easily learned the new words they heard from each other." (Teacher 19)

Examples of the answers indicating that BGBCTP has a positive effect on children's comprehension ability:

"I have personally witnessed the progress made by my students who had reading and listening comprehension problems after this training program." (Teacher 13)

"I have observed that my students who had difficulty in reading comprehension have made progress especially through the games for language development." (Teacher 20)

The question "Does BGBCTP have an effect on children's shape-space ability? Why?" was posed to second and third-grade teachers. All of the teachers gave the answer "Yes, BGBCTP has an effect on children's shape-space ability." With respect to the effect of BGBCTP on children's shape-space ability, 9 (45%), 6 (30%) and 5 (25%) of the teachers expressed that it has positive effects on "two or three-dimensional thinking", "recognizing similarities and differences", and "perceiving the changes", respectively.

Examples of the answers indicating that BGBCTP has a positive effect on children's two or three-dimensional thinking ability:

"I think Architecto game makes a huge contribution to children's three-dimensional thinking ability." (Teacher 1)

"I have observed that most of my students have been more successful in two and three-dimensional perception after this training." (Teacher 17)

Examples of the answers indicating that BGBCTP has a positive effect on children's ability to recognize similarities and differences:

"I have realized that my children with developed visual perceptions perceive similarities and differences more easily with this game training." (Teacher 5)

"I have observed nice improvements in my students who have difficulties in distinguishing similarity-difference relations between the objects during and after the training practices." (Teacher 12)

Examples of the answers indicating that BGBCTP has a positive effect on children's ability to perceive changes:

"This training program has been really very useful for my students who have difficulties in recognizing changes in the existing states of objects." (Teacher 8)

"In particular, Katamino game enabled my students to quickly perceive the space and location at first by focusing and then the changes that occurred." (Teacher 9)

The question "Does BGBCTP have an effect on children's reasoning ability? Why?" was posed to second and third-grade teachers. All of the teachers gave the answer "Yes, BGBCTP has an effect on children's reasoning ability." With respect to the effect of BGBCTP on children's reasoning abilities, 8 (40%), 5 (25%), 4 (20%) and 3 (15%) of the teachers expressed opinions on "making an inference", "decision making", "creative thinking", and "analyzing", respectively.

Examples of the answers indicating that BGBCTP has a positive effect on children's ability to make inferences:

"I have observed that children came to conclusions by making various inferences especially in strategy games." (Teacher 4)

"In both individual and group games, all of my students shared their ideas with each other by making different inferences, so they came to conclusion more easily." (Teacher 15)

Examples of the answers indicating that BGBCTP has a positive effect on children's decision making ability:

"The students who realized that the first condition to come to a conclusion in games is to make a decision and who put it into effect completed the process faster." (Teacher 14)

"It makes me happy that my students who have difficulties in making a choice and therefore making decisions have begun to take faster and more accurate decisions to be successful in games." (Teacher 16)

Examples of the answers indicating that BGBCTP has a positive effect on children's creative thinking ability:

"It really makes me excited that children come to the same conclusion by considering different and functional ways in game applications." (Teacher 2)

"The fact that my students display performance and come to conclusions in games by using their imagination and revealing their creative power is a great development for me." (Teacher 18)

Examples of the answers indicating that BGBCTP has a positive effect on children's ability to analyze:

"Through strategic games, my students have learned to assess the existing situation at first and then to make decisions." (Teacher 6)

"When children faced complicated situations in games, they continued to progress by making the situation clearer for themselves." (Teacher 10)

The question "Does BGBCTP have an effect on children's discrimination ability? Why?" was posed to second and third-grade teachers. All of the teachers gave the answer "Yes, BGBCTP has an effect on children's discrimination ability." With respect to the effect of BGBCTP on children's discrimination ability, 9 (45%), 7 (35%) and 4 (20%) of the teachers stated that it has positive effects on "recognizing visual details", "finding similarities and differences", and "focusing", respectively.

Examples of the answers indicating that BGBCTP has a positive effect on children's ability to recognize visual details:

"I have observed that my students with weak visual attention have made progress and recognized details more carefully through game applications." (Teacher 7)

"I think my students who have difficulties in paying attention to visual details have been able to recognize details better through these games." (Teacher 13)

Examples of the answers indicating that BGBCTP has a positive effect on children's ability to find similarities and differences:

"In particular, my students with attention deficit have made progress after this training program, and I can say that they have become skilled especially in recognizing differences." (Teacher 10)

"I do a big puzzle with my students in the classroom, my students who had difficulty in finding suitable pieces before the training now easily find the necessary pieces by paying attention to similarities and differences." (Teacher 15)

Examples of the answers indicating that BGBCTP has a positive effect on children's ability to focus:

> *"It has made me really happy to see that the attention span of my students who have serious problems in focusing was affected positively after the game applications." (Teacher 18)*

> *"Since children take great pleasure in playing games, they give their full attention to the games to be successful, which supports the development of focusing abilities." (Teacher 19)*

The question "Does BGBCTP have an effect on children's numerical ability? Why?" was posed to second and third-grade teachers. All of the teachers gave the answer "Yes, BGBCTP has an effect on children's numerical ability." With respect to the effect of BGBCTP on children's numerical ability, 13 (65%), 6 (30%) and 1 (5%) of the teachers expressed that it has positive effects on "problem-solving", "performing operations", and "establishing relation", respectively.

Examples of the answers indicating that BGBCTP has a positive effect on children's problem-solving ability:

> *"We had always started to play the game by setting up a problem before the Math Dice game, all my students solved these problems much more willingly and successfully than the problems I wrote on the blackboard." (Teacher 3)*

> *"Through these games, children develop their problem-solving abilities on life by means of reasoning and establishing strategies." (Teacher 8)*

Examples of the answers indicating that BGBCTP has a positive effect on children's ability to perform operations:

> *"Learning through games gave all my students speed at different levels, and this speed also supported their four operation abilities." (Teacher 9)*

> *"I have observed remarkable improvements in the mathematical operations of my students who expressed that they did not like mathematics course because they had difficulty in performing operations, after the game applications." (Teacher 12)*

Example of the answers indicating that BGBCTP has a positive effect on children's ability to establish relations:

> *"I have noticed that my students have been able to establish relations between conceptual and operational information through these games." (Teacher 2)*

DISCUSSION

According to the findings of the study, the results of the statistical analyses conducted to determine whether there is a significant difference between the pre-test scores of the experimental and control groups at second and third grades show that the groups are similar, i.e. they belong to the same target populations. This finding can be interpreted as evidence that the children in the experimental and control groups are similar in their cognitive development level before the training programme in terms of their family structure, socio-cultural, economic structures and demographic aspects.

The differences between the post-test mean scores of the second and third graders in the experimental and control groups were compared in the areas of linguistic skills, spatial skills, reasoning skills, discrimination skills, numerical skills and general skills to test the impact of the training programme on the cognitive skills of the children, in comparison with the existing curriculum. The difference between the cognitive development post-test mean scores of the children in the

experimental and control groups were found to be significant with a *p* value of 0.05. In the light of this result, it is possible to attribute this differentiation to child development or the existing curriculum but to BGBCTP. This finding indicates that the games in BGBCTP positively influence cognitive development. In other words, BGBCTP, which was implemented to contribute to the cognitive development of the children, increases their cognitive skills significantly. In her research, Altunay (2004) applied game-based mathematics training to an experimental group of third graders and traditional mathematic training to a control group; the results showed a significant difference in the success and achievement levels in favour of the experimental group. Tural (2005) analysed the effects of the game- and activity-based learning on the students' achievement and attitude towards math lessons at the third-grade level for 5 weeks in comparison with the traditional educational system and concluded that a significant difference existed between the achievement and attitude towards math lesson in the experimental group where 'Game- and Activity-based Learning' was applied and the control group where 'Traditional Learning' was applied in favour of the experimental group. Keskin (2009) analysed the influence of in-class and confined-space games on the development of multiple intelligence fields of children and observed the children playing the games that target multiple intelligence fields. According to the results, these games contributed positively to multiple intelligence development of children. In another study focusing on the impact of playing chess on cognitive functions, Campitelli and Gobet (2004) revealed that task-based activities such as chess positively influenced intellectual and psychomotor skills such as problem solving, decision making and reaction time and that such strategy games reinforced intense and quick decision making in the long-term memory. Game-based learning improves the students' performance, increases the students' motivation, enriches the learning environment and makes the learning atmosphere entertaining (Ahmad, Shafie, & Latif, 2010; Burguillo, 2010; Gürbüz, Erdem, & Uluat; 2014; Hamalainen, 2008). According to research results (Caldwell, 1998; Griffiths, 1994; Krajewski & Schneider, 2009; McGonical, 2011; Papastergiou, 2009b; Ramani & Siegler, 2008; Rosas et al., 2003; Skoumpourdi & Kalavasis, 2009; Skoumpourdi, Tatsis, & Kafoussi, 2009; Virvou, Katsionis, & Manos, 2005; Whyte & Bull, 2008; Wideman et al., 2007; Wilson et al., 2009) board games improve children's interdisciplinary thinking, motivation, learning effectiveness; support their number sense and numerical achievement; develop problem solving and critical thinking skills; give them the opportunity to tackle complex ideas. The findings of all above-mentioned studies are coherent with the findings of the present study.

As the children at the second and third grades in the control group did not receive any other training than their usual and daily education curriculum, no increase was recorded in their cognitive linguistic skills, spatial skills, reasoning skills and discrimination skills, whereas their pre-test/post-test scores relating to numerical skills increased significantly. Consequently, it can be argued that the significant increase in numerical skills of the children who did not take any other additional training than education in school was attained through formal education in which the goals were achieved through a planned and programmed education process. It is believed that this learning, which was the result of the formal education with the children not attending any special training programme, can be linked to the fact that the curriculum, the sourcebooks used and the attitudes of the teachers and parents placed more importance on numerical skills than linguistic skills, spatial skills, reasoning skills or discrimination skills. It can be attributed also to the fact that the most promoted lesson in primary school is math, that school activities, books and other sources mainly focused on the concept of 'numbers'. Therefore, the development of the children's numerical skills in the control group was a natural consequence. Furthermore, the findings of this study are also coherent with the findings of another study conducted to determine the effect of a game-based programme on the cognitive development of pre-schoolers (Türkoğlu, 2016).

A significant increase at a *p* level 0.05 was observed regarding the difference between the pre-test and post-test scores for cognitive abilities including the linguistic skills, spatial skills, reasoning skill, discrimination skills and numerical skills of the second and third graders in the experimental group before and after participating BGBCTP. The applied training programme triggered a significant increase in their cognitive development level. Based on these findings, it can be asserted that BGBCTP was successful and the games in this training programme had a notable effect in the

development of the cognitive abilities of the children. The progress was not possible with the standard curriculum used in primary schools and this training programme allowed the children to manifest their intellectual potential naturally, without any compulsion and through fun and play. Board games are very important in developing features such as thinking skills, logical reasoning, strategic thinking, visual perception, selective visual attention, reasoning and spatial abilities, short-term and working memory (Anguera et al., 2013; Bottino & Ott, 2007; Feng, Spence, & Pratt, 2007; Green & Bavelier, 2003; Shute, Ventura, & Ke, 2015). Besides these games increase motivation, sustained attention and concentration; develop a positive attitude towards learning (Anguera et al., 2013; Garris, Ahlers, & Driskell, 2002; Lou, Abrami, & D'Apollonia, 2001; Rosas et al., 2003). The results of this study are also coherent with those of Mackey, Hill, Stone and Bunge (2011), who put forward that their game-based programme which lasted 8 weeks demonstrated that cognitive procedures such as reasoning and speed of operation could be changed and developed through game-based learning.

The idea that the game plays a crucial role in developing cognitive skills is not new. Piaget and Vygotsky, who are the most influential theorists of cognitive development, emphasize that playing games contributes to many areas of development, such as children's vocabulary, problem-solving abilities, self-confidence and motivation, comprehension of the concepts in different subjects, and consciousness of the needs of other people, by highlighting the importance of games in cognitive development (Zhang, 2015; Zigler & Bishop-Josef, 2009). Studies reveal that educational board games improve cognitive abilities (Fissler, Küster, Schlee, & Kolassa, 2013; Powers, Brooks, Aldrich, Palladino, & Alfieri, 2013). Whether BGBCTP has an effect on children's linguistic, shape-space, reasoning, discrimination and numerical abilities, and its reasons were asked to second and third-grade teachers to determine the effects of BGBCTP on children's cognitive development. All of the second and third-grade teachers stated that BGBCTP has an effect on children's linguistic, shape-space, reasoning, discrimination and numerical abilities. With respect to the effects of BGBCTP on children's linguistic abilities, teachers created the "expression ability", "vocabulary", and "comprehension ability" themes. Board games improve the communication skills between children and parents as well as between children and teachers (Ceglowski, 2007; Hansen, 2005; Skoumpourdi, 2012). With respect to its effects on children's shape-space abilities, they identified the "two or three-dimensional thinking", "recognizing similarities and differences", and "perceiving changes" themes. With respect to the effect of BGBCTP on children's reasoning abilities, teachers created four themes including "making an inference", "decision making", "creative thinking", and "analyzing". With respect to its effects on children's discrimination ability, teachers identified the "recognizing visual details", "finding similarities and differences", and "focusing" themes. Finally, with respect to the effect of BGBCTP on children's numerical abilities, teachers created three themes including "problem-solving", "performing operations", and "establishing relation". Some studies show that board games develop young children's numerical skills (e.g., counting, arithmetic, number line estimation on the game, counting, number identification, numerical magnitude comparison skills) and mathematical thinking (Kamii & Rummelsburg, 2008; Ramani, Siegler, & Hitti, 2012; Ramani & Siegler, 2008; Siegler & Ramani, 2008; Starkey, Klein, & Wakeley, 2004; Young-Loveridge, 2004). In the study of Türkoğlu (2018) classroom teachers state that the cognitive training program has an impact on communication, emotional and speech skills, especially on the cognitive and social skills of children. Besides the findings of the study are also consistent with the research findings indicating that cognitive and educational games support children in all areas of development, especially in cognitive development, have an effect on attendance to lesson and motivation, support the curriculum, and positively affect the academic achievement in mathematics and science teaching (Gerber, Abrams, Onwuegbuzie, & Benge, 2014; Kaya & Elgün, 2015; Koçyiğit, Tuğluk, & Kök, 2007; Liu & Chen, 2013; Özyürek & Çavuş, 2016; Romine, 2004).

CONCLUSION AND SUGGESTIONS

In this study, following conclusions were drawn in relation with the hypotheses that were tested through the research question. This study was conducted in order to observe the effect of BGBCTP on the cognitive development (linguistic, spatial, reasoning, discrimination, numerical and

general skills) of the children at the second and third grades. The study sample comprised a total of 120 children (60 in the experimental group and 60 in the control group).

As the data collection tool, the General Information Form that contained questions about the children and parents, PMA 7-11 that was administered to statistically test the development of cognitive skills of the second and third graders within the framework of BGBCTP and for the qualitative data "Semi-structured Interview Form" were used. PMA 7-11 was applied to the experimental and control groups as pre-test and post-test. As for the statistical analysis of the findings, the independent group t-test was used for the comparison of the pre-test scores of the experimental and control groups. While the independent group t-test was also used for the comparison of their post-test scores, the dependent group t-test was used for the comparison of the pre-test/post-test scores of both groups. In the qualitative data analysis, a descriptive analysis approach was used.

Conclusions

With reference to the findings, the following conclusions were drawn:

- There were no significant differences between the pre-test mean scores of PMA 7-11 sub-scale of the children in experimental and control groups who were at the second grade before the implementation of BGBCTP.

- There was a significant difference between the post-test mean scores of PMA 7-11 sub-scale of the children at the second grade in the experimental group where BGBCTP was applied and those of the children at the second grade in the control group where the existing curriculum was applied in favour of the experimental group.

- No significant difference was found between the pre-test/post-test mean scores of PMA 7-11 sub-scales of linguistic, spatial, reasoning, discrimination and general skills of the children at the second grade in the control group where the existing curriculum was applied, but a significant progress was observed concerning their pre-test/post-test mean scores of the numerical skill sub-scale.

- There was a significant difference between the pre-test/post-test mean scores of PMA 7-11 sub-scales of the children at the second grade in the experimental group where BGBCTP was applied, and it was found that this difference was significantly higher in favour of the post-test scores.

- No significant difference was found between the pre-test mean scores of PMA 7-11 sub-scales of the children who were at the third grade in the control and experimental groups before the implementation of BGBCTP.

- There was a significant difference between the post-test mean scores of PMA 7-11 sub-scale of the third-grade children in the experimental group where BGBCTP was applied and those of the third-grade children in the control group where the existing curriculum was applied in favour of the experimental group.

- No significant difference was observed between the pre-test/post-test mean scores of PMA 7-11 sub-scales of linguistic, spatial, reasoning, discrimination and general skills of the third graders in the control group where the existing curriculum was applied, but a significant progress was identified concerning their pre-test/post-test mean scores of the numerical skill sub-scale.

- There was a significant difference between the pre-test/post-test mean scores of PMA 7-11 sub-scales of the third graders in the experimental group where BGBCTP was applied, and it was found that this difference was significantly higher in favour of the post-test scores.

- All of the teachers who applied BGBCTP in the experimental group stated that BGBCTP had an effect on children's linguistic, shape-space, reasoning, discrimination and numerical abilities.

- It can be concluded that all of these teachers have positive attitudes towards this training program.

- In-class observations made by the researcher during the applications also support these findings.

- The fact that the students had a great time and learned with pleasure during training applications was expressed by their teachers and was also observed by the researcher.

- These qualitative results are also consistent with and support the quantitative findings of this study.

- In this study, it was established that the mentioned programme had been highly effective on their cognitive development.

Suggestions

Based on the findings of this study the following suggestions were developed.

Suggestions Based on Study Findings

- BGBCTP, which is based on games that can be considered as windows opening to the life for children, may be rolled out to all state schools.

- BGBCTP, which facilitates significant achievements for the development of linguistic, spatial, reasoning, discrimination and numerical skills, may be integrated into the entire formal curriculum of primary school periods.

- Teachers working in the primary schools affiliated to the Ministry of Education may be provided with in-service training and seminars on BGBCTP in order to use the game-based learning method in their lessons.

- Courses on the presentation and preparation of the trainings involving educational board games can be included as elective courses in the graduate or postgraduate degree programmes of primary education for prospective teachers.

- Since the educational board games used in training programme are very expensive, it is recommended that these board games should be produced in Turkey.

Suggestions for Future Research

- BGBCTP may be applied in different cities and in diverse socio-economic and cultural groups, and the results can be compared.

- The students with insufficient cognitive development subject to mainstreaming in education can be identified, they can be provided with intensive courses within the framework of BGBCTP and the effect of the training programme on cognitive development of children may be investigated.

- BGBCTP may be used as an early intervention programme or as a special education program for the children who are diagnosed with Autism Spectrum Disorder, Down Syndrome or Asperger Syndrome and the effect of the training programme on cognitive development of children may be investigated.

- BGBCTP may be implemented in the schools in which gifted children are educated and the effect of the training programme on cognitive development of children may be investigated.

In conclusion, it is believed that the findings of this study will facilitate the roll-out of this training programme to other schools and even its inclusion to the Primary School Curriculum as a lesson, thereby contributing to the cognitive development of all children.

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