Education and Science

Original Article

Vol 46 (2021) No 207 21-42

Effects of Mind Mapping Studies on the Creativity Skills of 60 to 72-month-old Children

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Abstract

Along with the needs of the 21st century, flexible thinking and creativity skills in the education of young children began to gain importance. One of the techniques for supporting the skills of children to think flexibly and generate new ideas and the ability to integrate their knowledge, is motivation through mind mapping. This research which used a pre-test - post-test control group experimental model aimed to examine the effect of the mind mapping program, developed for 60-72-month-old children, on their creativity skills. The research was conducted in two classrooms in preschool education, located in the Kadıköy district of İstanbul. The study group consisted of 47 randomly assigned children of which 26 were experimental group and 21 to the control group. of w The Creative Thinking Skills of the Hybrid Creativity was used as pre-test and post-test measurement of the creativity skills of the children in the research project. Following the pre-tests, members of experimental group were first subjected to five mind mapping studies for the purpose of learning. These studies were carried out once a week and completed within five weeks. Later, for a total of 10 weeks, the children prepared individual mind maps about various subjects. During the week, the children prepared their mind maps at playtime. Post-tests were conducted at the end of the practices, and data was collected. Upon collection of the data, the t-test was implemented on the independent group in order to discover whether there is an important difference in the findings for the experimental and control group through the use of the pre-test of the Creative Thinking Skills of the Hybrid Creativity. After analysis, the difference between the arithmetic means of the groups was found to be significant ($t=2.29$; $p<.05$). In order to assess the possible effect of the difference on the post-test a single factor covariance analysis (ANCOVA) was carried out. Means were compared with paired sample t-test and independent samples t-test. The former test was used to determine whether or not there is a significant difference between the mean of the pre-test and post-test scores of the Creative Thinking Skills of the Hybrid Creativity applied for the experimental and control groups. Independent samples were subjected to the t-test to determine whether or not

Keywords

Creative Thinking Skills
Mind Mapping
Preschool Children

Article Info

Received: 03.18.2020
Accepted: 02.11.2021
Online Published: 03.23.2021

DOI: 10.15390/EB.2021.9582

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there was a significant difference between the mean of the post-test scores. Lastly, one-factor analysis of covariance (ANCOVA) was performed to find out that the difference between the post-test means arising from the independent variable application or the difference between the pre-tests revealed in comparison. It was understood as a result of the analyses that creativity skills of both experimental and control groups increased. However, the covariance analysis conducted to test the significance of the increase in arithmetic means of the experimental and control groups by keeping the pre-test results constant showed that the children who created mind mapping progressed further than the children who did not create mind mapping. It was concluded in the research that mind mapping is an effective strategy for development of preschool children's creative skills.

Introduction

The ability to adapt to the life conditions which develop and change day by day plays an important role for children in shaping their experiences in the following years. Along with the needs of the 21st Century, in addition to flexible thinking and creativity skills, learning concepts and developing intelligence have also become an important part of young children's education. Robinson (2001) stated that creativity skills are primary elements for human development in the face of a rapidly changing social and technological future. For this reason, the encouragement of creative thinking through the use of educational models and teaching strategies has become a priority for educators. (Batey, Furnham, & Safiullina, 2010; Cheung & Mok, 2018; Hartley & Plucker, 2014; Leggett, 2017).

Creativity; is the ability to develop new ideas (Benedek, Franz, Heene, & Neubauer, 2012), to bring together unrelated concepts in different ways, (Ward, 2007) to convert something that already exists into new forms (Simonton, 2008) and the ability to look at objects, events and situations in a flexible perspective (Silvia, 2008). Plucker and Beghetto (2004) defined creativity as not only the ability to generate a new and useful outcome or product, but also an interaction of this skill and generation process. Torrance (1969) defines creativity as the capacity to detect problems, offer solution to problems, form new ideas, integrate the generated ideas and establish new connections between ideas.

Creativity is a skill which can be developed through the incorporation of these learning techniques in education (Wyse & Dowson, 2009). Research indicates that from a young age, there is an openness in terms of the development of creative abilities. Faizi, Azari, and Maleki (2012) revealed in their study that flexible use of the natural stimulants and participation in group activities promotes creative skills by increasing children's curiosity and excitement. Rizi, Yarmohamadiyan, and Gholami (2011) analysed the effect of group studies on creativity levels of six-year-old preschool children. They found a rise in creativity levels of the children who joined the program. In a study by Nadjla and Yasaman (2016), it was revealed that the activities which employ a storytelling method, positively influenced the creativity levels of children aged five and six.

The skill of producing a new idea and organizing such ideas is one of the important aspects of creative thought (Treffinger, Young, Selby, & Shepardson, 2002). It is known that directing children to question, discuss and research in education environments and helping them produce and organise new ideas through brainstorming, supports creativity (Llewellyn, 2013; Michalopoulou, 2008).

One of the strategies which triggers thought and assists in the integration of new ideas and knowledge that come about due to it, is mind mapping (Buzan & Buzan, 1996). The nature of mind mapping means that can be used in almost every activity which has any relation to the mind, thought,

remembering, planning and creativity (Buzan, 1989). Mind map is an inspiring visualisation in which lines, colours, numbers, pictures, symbols or keywords are used to associate a learned concept with the former ones, and integrate and detail them (Buzan & Buzan, 1996). Brain research which make up the basis of the mind mapping technique, indicates organised and outward activity of the brain starting from its central focus point. Similarly, the subject to be considered in mind maps is visualized centrally. Main themes spread as branches from the central picture. The branches include a key picture or a key word that emerge from the centre. The subjects of less importance are represented by upper branches. Thus, all branches form a structure of interconnected nodes (Buzan & Buzan, 1996).

Mind mapping can be integrated into a large variety of learning models to enable students to discover the relationships between concepts, and to promote their creative thinking (Davis, Sumara, & Luce-Kaper, 2000). In contrast to the methods in traditional approaches such as note-taking and draft preparation, keywords, colours, codes and symbols are used in mind mapping. In this way, the thinking and learning process becomes more efficient (Buzan, 1989; Margulies, 1991). Mind maps remove the gaps and deficiencies in significant subjects as well as ease cognitive activities and remembering by allowing for the visualization of concepts (Hardy & Stadelhofer, 2006; Nesbit & Adesope, 2006). Mind mapping makes recording of a great deal of information about a concept possible and enables the relationships between ideas to be shown. In this way, using a visual perspective an integrative perspective is achieved. Such visualization helps concepts, knowledge or problem cases to be elaborated and more detailed facts to be revealed (Hardy & Stadelhofer, 2006). In addition, mind mapping, which contains the systematic organisation of knowledge contributes to the development of a person's attention, logic, reasoning, analysis, planning, coordination and integration abilities (Wen-Cheng, Chung-Chieh, & Ying-Chien, 2010).

Mind mapping ensures maximum use of the brain's potential while it develops the skills in associating the concepts. In general, the left hemisphere of the human brain regulates language, processing mathematical ideas, writing, grouping ideas, and organising logical, verbal and analytical functions whereas the right hemisphere manages non-verbal functions such as processing diagrams or shapes and spatial and intuitive thinking as well as perceiving stimuli such as music, rhythm and colour (Farmer-Dougan & Alferink, 2013; Madi, 2014; Ozden, 2003). In addition to supporting the left hemisphere through developing logical thinking and grouping skills, mind mapping activates the right hemisphere by emphasising spatial and visual language. Thus, the left brain's ability to carry out logical analysis and reasoning and the right brain's creative thinking and memory are actively used (Wen-Cheng et al., 2010). Mind mapping provides the brain with an unbounded and free imaginary area and assists in maximising the potential of the brain (Buzan & Buzan, 1996).

Windura (2008) highlighted several constraints of mind mapping studies. The first constraint is that making a sufficient mind map takes quite a long time. Determination of the keywords regarding the focus subject in mind mapping and summarisation of the central topic may require long-term thinking or research. In addition, the actual drawing of the mind map can be a long process. Secondly, it may be difficult for young children to determine the main branches that make up the mind map, and keywords. On the other hand, older children may avoid only writing the key words with the worry of forgetting their knowledge.

Apart from these constraints, mind mapping studies provide numerous advantages. Thinking about the visual symbols used in mind mapping studies, and relationships of such visuals, develops creativity, comprehension and problem-solving abilities (Wen-Cheng et al., 2010). Moreover, it offers young children who are deprived of sufficient experience in conveying their opinions to written language, the opportunity to express themselves by means of visual materials. Likewise, preschool

children are known to have the capacity to show their feelings, ideas and knowledge developmentally via appropriate means (Smith, Cowie, & Blades, 2001).

Howwitt (2009) specified that the three-dimensional mind mapping studies which may be conducted in early childhood differ from two-dimensional mind maps, because they focus on real objects. He asserted that three-dimensional mind mapping studies can be discussed with two different methods: The approach based on the drawings of children (Buzan, 2003) and the approach based on the views of children (Call & Featherstone, 2010. In both approaches, mind mapping studies start with engaging the attention of the children, using an object or a focus question. Then, the focus object is placed on the floor or centre of the table where mind mapping study will be performed. If using the approach based on children drawing, they are asked to draw the visuals as the answer of the focus question and to find the objects which generate answers. A paper tape is put between the focus object and the drawings of children to state the relationships between object and drawing. The children's sentences and statements for explaining this relationship are written on the tape. Later, the objects collected from the classroom are placed near the drawings. The aim here is to enable the child to establish the relationships between the drawings and the objects in the classroom. For example, in a mind map about cleaning, it would be expected that a toothbrush would be placed next to a picture of a tooth and a soap near a picture of a hand. In cases where that the study utilises the approach based on the views of children; the teacher writes answers from the children regarding the focus question on a paper tape (e.g. washing the dishes). Then, the children collect the objects which are associated with the relationship according to them and place them at the end of the relevant tape. In this phase, where children have made unexpected matches, or ones that contains no relationship to each other they are discussed in the classroom. In both approaches, the opportunity to enhance or arrange the map with new ideas or objects should be given to children at the last stage (Howwitt, 2009).

When children get the support and assistance required in their first attempts, they will have the necessary experience in order to create their own mind maps. Mind mapping enables children to develop brilliant and creative ideas, since it improves their organisation and thinking skills (Buzan, 2002). With this although there is various literature on studies carried out showing the positive effects of the various educational programmes on the creativity skills of young children (Bagherpour & Shamshiri, 2018; Cheung, 2018; Faizi et al., 2012; Kirkham & Kidd, 2015; Moedt & Holmes, 2018; Nadjla & Yasaman, 2016; Rizi et al., 2011; Vong, Cheng, Wu, Kam, & Liu, 2017), no application-based studies evaluating the effect of mind mapping activities on the creative skills of young children were encountered. In this regard, the main purpose of this study is to examine the effect of mind mapping studies developed for 60-72 month-old children on their creativity skills. The study questions determined in line with this purpose and the hypotheses to be tested are as follows:

1. Is there a significant difference between the creativity pre-test scores of the students in experimental and control groups according to the evaluation results obtained before the mind mapping studies developed for 60-72-month-old children?

   H0: There is not a significant difference between the creativity pre-test scores of the students in the experimental and control groups.

   H1: There is a significant difference between the creativity pre-test scores of the students in the experimental and control groups.

2. Is there a significant difference between the total creativity pre-test and post-test score means of the students in the control group according to the evaluation results obtained before and after the mind mapping studies developed for 60-72-month-old children?

H0: The total creativity scores of the students in the control group did not rise significantly.

H1: The total creativity scores of the students in the control group rose significantly.

3. Is there a significant difference between the total creativity pre-test and post-test score means of the students in the experimental group according to the evaluation results obtained before and after the mind mapping studies developed for 60-72-month-old children?

   H0: The total creativity scores of the students in the experimental group did not rise significantly.

   H1: The total creativity scores of the students in the experimental group rose significantly.

4. Is there a significant difference between the creativity post-test scores of the students in the control and experimental groups according to the evaluation results obtained after the mind mapping studies developed for 60-72-month-old children?

   H0: There is not a significant difference between the creativity post-test scores of the students in the experimental and control groups.

   H1: There is a significant difference between the creativity post-test scores of the students in the experimental and control groups.

Method

In the research designed with the quantitative research method, the experimental model with a pre-test and post-test control group was used. In line with the aim of examining the effect of mind mapping on the creativity of children, this method was preferred in order to evaluate the gains of children based on their existing creative thinking abilities at the end of the mind mapping.

Study Group

The study group for the research was formed within a preschool in the Kadıköy District of Istanbul, which is easily accessible for the researcher and contained 2 classes of 60-72 month-old children. When determining the study group, in order to make it easier for the researcher to provide guidance during the process, the names of school who were state run and had a demographic of middle-higher income groups was obtained from the District Directorate of National Education. The preschools were listed to find sufficient number of classrooms. Two institutions were chosen from the list of preschools through random sampling and were contacted. The preschool in which studies would be conducted was determined on the basis of them volunteering to do so. The chosen preschool is an independent preschool which provides half day education. The Preschool Curriculum of the Ministry of National Education (2013) is applied in the preschool. One of the two classes at preschool was designated via random sampling as the experimental group while the other class was determined to be the control group. Thus, the participants consisted of 47 children 26 and 21 of who formed experimental and control groups, respectively. The experimental group of the research comprised of 13 girls and 13 boys whereas the control group was made up of 12 girls and 9 boys. The descriptive values of the age variable attained from 47 participants of the research are given in Table 1.

Table 1. Descriptive Values for Age

Group	n	Min	Max	$\bar{x}$	sd
Experimental	26	66.00	78.00	71.65	4.51
Control	21	65.00	78.00	71.29	4.98

As seen in Table 1, the arithmetic mean of the age variable of *the experimental group* is $\bar{x}$=71.65, the standard deviation sd=4.51, the minimum value min=66 months and the maximum value max=78 months. The results obtained for the age variable of *the control group* are as follows: arithmetic

mean $\bar{x}$=71.29, standard deviation sd=4.98, the minimum value min=65 months and the maximum value max=78 months.

During the interviews with the institution participating in the research, it was confirmed that the participants had not receive any training that supports their creative skills, but that they attended club activities carried out at the institution, twice a week in the current academic term. In line with this, the clubs which the children in the experimental and control groups attended and the distribution of the clubs are shown in Table 2.

Table 2. Distribution of the Participants by Clubs

Group	Folk Dancing	Modern Dance	Drama	English
Experimental	4	6	6	10
Control	2	4	7	8
Total	6	10	13	18

According to Table 2, in the case of the children in both the *experimental* and *control* groups attendance to the English club was highest and the folk dancing club was the lowest. Based on Table 2, it can be said that participation of the *experimental* and *control* groups in club activities have a similar distribution.

The distribution of participants by the period of utilising preschool education is provided in Table 3.

Table 3. Distribution of the Participants by the Period of Utilising Preschool Education

Group	3rd Year	2nd Year	1st Year	Total
Experimental	3	10	13	26
Control	4	6	11	21
Total	7	16	24	47

It is seen in Table 3 that most of the children both in the *experimental* and *control* groups are in their first year of institutional preschool education (experimental: 13, control: 11) and that the smallest group is formed of the children who have received preschool education for three years (experimental:3, control:4). It can be said, according to Table 3, that the institutional preschool education periods of the *experimental* and *control* groups have a similar distribution.

Data Collection Tools

The Creative Thinking Skills section of the Creative Thinking Skills of the Hybrid Creativity created by Lee and Lee (2002) and adapted to Turkish by Yuvacı (2017), was the from developed for use as the data collection tool for collecting demographic information for the children in the study.

Demographic Information Form: The form which includes information about the gender and age of the research participants was prepared by the researchers.

Creative Thinking section of the Creative Thinking Skills of the Hybrid Creativity: The Creative Thinking Skills of the Hybrid Creativity comprises of two sections: creative thinking ability and creative personality. Only the creative thinking skills part of the measurement tool developed by Lee and Lee (2002) were adapted to Turkish by Yuvacı (2017). This part is made up by two sub-parts: language and drawing. Language contains imagination, fluency, flexibility and originality factors, and drawing includes continuity, dependency, completion, adding new elements, theme and unusual dimension (Yuvacı, 2017; Yuvacı & Dağlıoğlu, 2018). The language part is made up of three parts, and scoring is based on the answers of the children about three stories. For example, scoring of the fluency sub-factor is based on the number of thoughts and methods utilized by the children to solve the problem related

to the specific case in the story. In the scoring of the imagination sub-factor, one point is given for each imaginary thought that a child can expand upon based on the real situation given. The drawing aspect comprises of one part and it is a free response scoring system, whereby points are given according to the completed drawings by the children. To illustrate the fact, the completion sub-factor is scored according to the linkage of five images to each other in the picture. Here, the scoring is as follows: 0 points – if there is one image or no images in the picture; 1 point – if there are two or three complete images which are/are not connected to each other; 2 points – if there are four complete images even if the overall completion and integrity are not sufficient and 3 points – if there are five complete images which are connected to each other. For the sub-factor of adding new elements, scoring is done based on the addition and inclusion of a new thought and concept. The following scoring is applied for this sub-factor: 0 points – nothing was added to the picture or one element was added; 1 point – two or three elements were added; 2 points – four or five elements were added and 3 points – more than six elements were added. The Cronbach alpha reliability coefficient of the Creative Thinking Test section of the Creative Thinking Skills of the Hybrid Creativity was determined as 0.83 (Yuvacı, 2017).

Data Collection Process

Managers and teachers of the school were informed about the research after obtaining the necessary permissions for the research (permission for using scale and permissions to be received from Provincial Directorate of National Education to perform activities with children). A parents' meeting was held at the institution which volunteered for participating in the study, to provide parents of the children the information regarding the study and that information obtained from their children will be used for only scientific purpose on the basis of confidentiality. It was stated in the meeting that equal opportunities will be offered to all children, by means of the children in control group performing mind mapping activities about the same themes at the end of the study. Written approvals of the parents who voluntarily accepted and permitted participation of their children in the research were received before the study started.

The research was performed in the 2018-2019 academic year. At the beginning of the research, a class was randomly chosen as the experimental group while the other class represented the control group. Both groups were subjected to the Creative Thinking Skills section of the Creative Thinking Skills of the Hybrid Creativity adapted to Turkish by Yuvacı (2017). Prior to the test, an introduction session was carried out with the children and the study was introduced to them using plain language. The applications which began in October continued for two weeks.

Teachers of the students in the experimental group who took part in the creativity test of the study organized in October of the 2018-19 academic year had training on mind mapping. In this training, teachers were taught what mind mapping is, how it is carried out and how it is taught to children. On the first day of the training, the theoretical structure of mind maps was explained, with examples. On the second day, the mind map examples prepared by children were reviewed and analysed in a detail way. On the third day, mind maps on the themes chosen were created with the teachers and each mind map was assessed. On the last day, an overall assessment study was conducted, and the training was finalized. In the initial stages of the research, a single mind map was created for the whole class in the presence of the researcher and under the guidance of the teacher in order to give the children the opportunity to experience mind mapping. Group mind mapping was performed with the whole class once a week for one month. During the activities, each of which lasted 30-45 minutes and was accompanied by music, children illustrated their new ideas and thoughts, using crayons. The researcher and teacher supported the individual mind mapping of children by working with them at the end of one month. The children prepared 4 individual maps each of which was prepared once a week, over the course of a month. Thus, the children made 5 mind maps during approximately one and a half months.

The children who learned mind mapping prepared individual mind maps about various subjects for 10 weeks in the spring period of the academic year 2018-2019. During the week, the children prepared and completed their mind maps as they started the day, devoting on average of 15-20 minutes

to doing this. In this way, each child would create one mind map within the week. Over the course of the study, the centres or materials in classrooms were not subject to any change. The subjects of the mind maps made during this process include play, school, friends, happiness, squares, clocks, summer, birds, trees and sports. The themes used in the study were selected collectively as a result of the conversations with the teachers who gave suggestions, ensuring that the themes were ones that the children are familiar with and can easily generate ideas about. Lastly, the themes were finalized in line with the curriculum of the school. In each case, the teacher accompanied each child during mind mapping and wrote under the drawings of the child. However, the teacher did not give any instruction. Due to the children not knowing how to read or write, the teacher wrote the words they sued to explain what they had drawn, next to the drawing. During the study, teachers of the control group continued to teach the Preschool Curriculum of the Ministry of National Education (2013). At the end of the study the Creative Thinking Skills section of the Creative Thinking Skills of the Hybrid Creativity was implemented as the post-test in June by the researcher. The implementation of the pre-tests and post-tests were carried out by the same researcher, the same environment was provided to all children and each child was taken to the room individually. On completion of the working part of the study through the carrying out of the post-tests, mind mapping training was given to the teacher of the control group and the teacher of the experimental group shared their experiences, allowing the control group to have an equal opportunity in education by carrying out mind mapping activities about the same themes.

Data Analysis

Data sets were formed by creating the necessary coding in analysis of the research data. First, descriptive analyses were conducted via the SPSS package program to determine the minimum and maximum values, arithmetic mean and standard deviation of the age variable of experimental and control groups, and to find out the minimum and maximum values, arithmetic mean, standard error, standard deviation and kurtosis and skewness values of the total pre-test and post-test scores obtained from the Creative Thinking Skills section of the Creative Thinking Skills of the Hybrid Creativity. Later, the Shapiro-Wilk analysis was carried out to test whether or not the distribution obtained from the pre-test and post-test scores of the Creative Thinking Skills section of the Creative Thinking Skills of the Hybrid Creativity applied to the experimental and control groups was different from normal distribution. It was revealed that the difference between the distribution for total post-test scores of Creative Thinking Skills of the Hybrid Creativity - Section of Creative Thinking Skills taken from the control group ($SW=.86; p<.01$), and theoretical normal distribution was significant while other scores met the normality assumptions (Tabachnick & Fidell, 2013). For this reason, base-10 logarithmic transformation was implemented.

The scores attained from the logarithmic transformation were subjected to the Shapiro-Wilk analysis. In consequence of the analysis, normality assumptions were met, so parametric comparison techniques were preferred. First, the means were compared with the independent samples t-test to determine whether or not there was a significant difference between the mean pre-test scores (the Creative Thinking Skills of the Creative Thinking Skills of the Hybrid Creativity) of the experimental and control groups. The difference between the arithmetic means of the groups was found to be significant as a result of the independent samples t-test ($t=2.29; p<.05$). During the comparison of post-tests, one-factor analysis of covariance (ANCOVA) was conducted with the aim of examining the possible effect of this difference on the post-tests.

Means were compared with paired sample t-test to determine whether or not there was a significant difference between the mean pre-test and post-test scores (Creative Thinking Skills of the Hybrid Creativity) of the experimental and control groups. Furthermore, independent sample t-tests was applied to reveal whether or not there is a significant difference between the mean post-test scores (HCT – CTS) of the experimental and control groups. Lastly, one-factor covariance analysis (ANCOVA) was implemented to designate whether or not the difference between the means of post-test arises from the independent variable application or the difference detected in comparison of the pre-tests.

To ensure internal validity of the research, research period was restricted with 10 weeks for the purpose of limiting the effect of the variables other than the independent variable on the dependent variable based on time and prevent the differentiation between the pre-test and post-test measurements of the study group due to maturation (Karasar, 2012). One of the cases that pose a threat for internal validity is loss of subject (Christensen, Johnson, & Turner, 2014). Any new student was not enrolled in the classes that make up the experimental and control groups during this research as well as any loss did not happen in the study group. Besides, one of the supportive factors of internal validity is that before the research, the participants did not receive any supportive special training which promotes their creativity skills (Büyüköztürk, Kılıç-Çakmak, Akgün, Karadeniz, & Demirel, 2019). To ensure external validity of the research, the institution subject to the research and the two classes within the institution were chosen with random sampling and the chosen classes were determined as the experimental and control group, using the same method (McMillan & Schumacher, 2006). This research was restricted with the study group that consisted of the experimental and control groups. Another limitation of the research was the lack of time for implementing the monitoring tests after children comprehended and applied the concepts of mind mapping studies for 10 weeks and completed them at the end. In addition, total scores of the children from Creative Thinking Skills of the Hybrid Creativity were analyzed and sub-factors were excluded, since the research aims to analyze effect of the mind mapping studies developed for the 60-72-month-old children on their creativity skills. This point can be regarded as a limitation of the research.

Results

In this study which examined the effect of mind mapping studies on creative thinking skills of 60 to 72-month-old children, the significant difference between pre-test scores of the Creative Thinking Skills of the Hybrid Creativity (HCT – CTS) of the experimental and control groups, the significant difference between pre-test and post-test scores of the experimental group and the significant difference between post-test scores of the experimental and control groups were analysed. Difference tests were utilised to evaluate the creativity of children who did work with mind maps and who did not work with mind maps in the research. The descriptive values regarding total pre-test and post-test scores of the Creative Thinking Skills of the Hybrid Creativity (HCT – CTS) sapplied to the experimental and control groups are shown in Table 4.

Table 4. Descriptive Values for total pre-test and post-test scores of the HCT – CTS

Group	Scores	n	Min	Max	$\bar{x}$	$sh_{\bar{x}}$	ss	γ_1	β_2
Experimental	HCT–CTS *pre*	26	13.00	27.00	19.81	.75	3.82	.06	-.75
	HCT–CTS *post*	26	15.00	46.00	29.92	1.59	8.09	.26	-.76
Control	HCT–CTS *pre*	21	12.00	33.00	17.24	1.11	5.10	1.41	3.26
	HCT–CTS *post*	21	15.00	38.00	23.14	1.35	6.18	.77	-.01

As seen in Table 4, arithmetic mean $\bar{x}$=19.81, standard error $sh_{\bar{x}}$=.75, standard deviation ss=3.82, the minimum score attained min=13.00, the maximum value =27.00, skewness value γ_1=-.06 and kurtosis value β_2=-.75 were found out for the experimental group's *total pre-test scores of Creative Thinking Skills of the Hybrid Creativity (*HCT–CTS *pre)* variable whereas arithmetic mean $\bar{x}$=29.92, standard error $sh_{\bar{x}}$=1.59, standard deviation ss=8.09, the minimum score attained min=15.00, the maximum value max=46.00, skewness value γ_1=-.26 and kurtosis value β_2=-.76 were calculated for the experimental group's *total post-test scores of Creative Thinking Skills of the Hybrid Creativity (HCT–CTSpost)* variable. The control group's *total pre-test scores of Creative Thinking Skills of the Hybrid Creativity (HCT-CTSpre)* variable is given below: arithmetic mean $\bar{x}$==17.24, standard error $sh_{\bar{x}}$ =1.11, standard deviation ss=5.10, the minimum score attained min=12.00, the maximum value max=33.00, skewness value γ_1=1.41 and kurtosis value β_2=3.26. The *Control group's total post-test scores of Creative Thinking Skills of the Hybrid Creativity (HCT–CTSpost)* variable was calculated as follows: arithmetic mean $\bar{x}$=23.14, standard error $sh_{\bar{x}}$=1.35, standard deviation ss=6.18, the minimum score attained min=15.00, the maximum value

max=38.00, skewness value y_1=.77 and kurtosis value β_2=-.01. The Control group's total pre-test scores of Creative Thinking Skills of the Hybrid Creativity indicates that the distribution of skewness and kurtosis values has a significant size compared to normal distribution.

According to Tabachnick and Fidell (2013), the distribution can be accepted as normal when skewness and kurtosis values are between ±1.50. Büyüköztürk (2012) thought that it is normal distribution when skewness and kurtosis values was between ±2.00. On the other hand, Lomax and Hahs-Vaughn (2012) stated that different approximate values were used to determine the limits of excess skewness and kurtosis and protect normal distribution relatively and that the kurtosis values within ±2.0 are regarded as relatively normal as a simple rule whereas conservative researchers and the researchers with stringent rules apply the limits of ±3.0 and ±1.0, respectively.

The above table of descriptive values show that sample size of the experimental and control groups is lower than 30. Çil (2008) specified that as part of central limit theorem, the sufficient diameter of sample accepted for its normality is about 30. Moreover, Armutlulu (2008) mentioned that distribution of $\bar{x}$ approaches to normal distribution regardless of the distribution of main mass when n≥30. The distributions cannot be accepted as normal based on these references, because the sample size of the experimental and control groups is below 30. In this context, it was decided to evaluate normality with a suitable hypothesis test, considering that both n and skewness and kurtosis values of the experimental and control groups point out the significant kurtosis of distributions compared to normal distribution. With this aim, the Shapiro-Wilk analysis was carried out to test whether or not the distribution obtained from the pre-test and post-test scores of Creative Thinking Skills of the Hybrid Creativity applied to the experimental and control groups was different from normal distribution. The use of the Shapiro-Wilk analysis (Shapiro & Wilk, 1965) is recommended to control the normality hypotheses if small sample groups (n≤35) are included in the study.

The Shapiro-Wilk analysis for pre-test and post-test scores of Creative Thinking Skills of the Hybrid Creativity applied to experimental and control groups was provided in Table 5.

Table 5. Shapiro Wilk's Analysis for Total Pre-test and Post-test Scores of Creative Thinking Skills of the Hybrid Creativity (HCT)

Group	Scores	n	y_1	β_2	SW	sd	p
Experimental	HCT–CTSpre	26	.06	-.75	.97	26	.710
	HCT–CTSpost	26	.26	-.76	.97	26	.616
Control	HCT–CTSpre	21	1.41	3.26	.86	21	.005
	HCT–CTSpost	21	.77	-.01	.94	21	.180

As a result of the Shapiro-Wilk analysis, it was found that the difference between the distributions for the experimental group's total pre-test scores of Creative Thinking Skills of the Hybrid Creativity (SW=.97; p>.05), experimental group's total post-test scores of Creative Thinking Skills of the Hybrid Creativity (SW=.97; p>.05) and the control group's total post-test scores of Creative Thinking Skills of the Hybrid Creativity (SW=.86; p>.05), and theoretical normal distribution is not significant. Moreover, it was discovered that the differences between the distribution for the control group's total post-test scores of the Creative Thinking Skills of the Hybrid Creativity (*SW=.86; p<.01*) and theoretical normal distribution was significant. Tabachnick and Fidell (2013) suggested that distributions can be normalized by means of rescaling, using various transformation methods (square or square root, reversion, logarithmic or arcsine, probit, logit, etc.) for each variable when normality assumptions cannot be met. In this regard, logarithmic transformation processes were preferred for all distributions used in the research. Ovla and Taşdelen (2012) stated that logarithmic transformation used as the transformation method for balancing variance, in the data sets which are right-skewed or left-skewed, have a very broad range and the symmetry in the central part is important, and that logarithmic transformation with base 10 ($\log_{10}$) are used most commonly and the logarithmic transformation with base e known as Napierian logarithm can be utilized as well.

Table 6 contains the Shapiro-Wilk analysis for total HCT – SCTS pre-test and post-test scores, following the logarithmic transformation.

Table 6. The Shapiro-Wilk Analysis for Total Pre-test and Post-test Scores of the Creative Thinking Skills of the Hybrid Creativity Following the Transformation

Group	Scores	n	γ_1	β_2	SW	sd	p
Experimental	HCT–CTSpre	26	-.29	-.67	.97	21	.752
	HCT–CTSpost	26	-.29	-.33	.98	21	.969
Control	HCT–CTSpre	21	.55	.23	.91	21	.060
	HCT–CTSpost	21	.32	-.72	.97	21	.671

As a result of the points gained from the Shapiro-Wilk analysis carried out after the logarithmic transformation process the experimental group total pre-test scores for the Creative Thinking Skills of the Hybrid Creativity were (SW=.97; p>.05), the experimental group's total post-test scores of the Creative Thinking Skills of the Hybrid Creativity (SW=.98; p>.05), the control group's total pre-test scores (SW=.91; p>.05) and control group's total post-test scores were (SW=.97; p>.05), and for these the distribution in terms of the theoretical normal distribution were not significant. These values indicate that the distributions began to resemble normal distribution after the transformation. According to these results, normality assumptions were met, so parametric comparison techniques were preferred. First, means were compared with the independent samples t-test to determine whether or not there was a significant difference between the mean pre-test scores (the Creative Thinking Skills of the Hybrid Creativity) of the experimental and control groups.

The pre-test comparison of the Creative Thinking Skills of the Hybrid Creativity which was conducted based on the first question of the research and applied to the experimental and control groups is shown in Table 7.

Table 7. Pre-test Comparison of the Creative Thinking Skills of the Hybrid Creativity between Experimental and Control Groups

Score	Groups	N	$\bar{x}$	SS	$Sh_{\bar{x}}$	t Test		
						t	Sd	p
HCT–CTSpre	Experimental	26	1.29	.09	.02	2.29	45	.027
	Control	21	1.22	.12	.03			

As seen in Table 7, the difference between the arithmetic means of groups was found to be significant after the independent samples t-test was performed to determine whether or not there was a significant difference between the pre-test scores (Creative Thinking Skills of the Hybrid Creativity) of the individuals in experimental and control groups (t=2.29; p<.05). This result demonstrates that the mean of the experimental group was significantly higher than that of the control group prior to the application of the independent variable. Therefore, the alternative hypothesis (H1) for the first question of the study was accepted. The application of one-factor covariance analysis (ANCOVA) was decided upon for the post-test comparison with the aim of checking the effect of such differences on the post-tests.

Means were compared with paired sample t-test to determine whether or not there is a significant difference between the mean pre-test and post-test scores (Creative Thinking Skills of the Hybrid Creativity) of the experimental and control groups based on the second and third questions of the study.

The pre-test comparison of the Creative Thinking Skills of the Hybrid Creativity between the experimental and control groups was provided in Table 8.

Table 8. Pre-test Comparison of the Creative Thinking Skills of the Hybrid Creativity between Experimental and Control Groups

Group	Groups	N	$\bar{x}$	SS	$Sh_{\bar{x}}$	t Test		
						t	Sd	p
Experimental	Pre-test	1.29	26	.09	.02	-8.68	25	.000
	Post-test	1.46	26	.12	.02			
Control	Pre-test	1.22	21	.12	.03	-7.01	20	.000
	Post-test	1.35	21	.11	.02			

According to Table 8, the difference between arithmetic means was found to be significant for both the experimental group (*t=-8.68; p<.001*) and control group (*t=-7.01; p<.001*) as a result of the paired sample t-test to determine whether or not there was a significant difference between the mean pre-test and post-test scores (Creative Thinking Skills of the Hybrid Creativity) for these two groups. Therefore, alternative hypotheses (H1) for the second and third questions of the study were accepted. The post-test means of both groups was significantly higher than their pre-test means. It can be said based on t values of both groups that the effect of the independent variable in the experimental group

Finally, for the fourth question of the study, in order to determine whether there was a significant difference between the HYT-YBD mean total scores of the experiment and control groups, the mean scores of the independent groups t-test were compared. Table 9 shows the post-test comparison of the Creative Thinking Skills of the Hybrid Creativity between the experimental and control groups.

Table 9. Post-test Comparison of Creative Thinking Skills of the Hybrid Creativity between the Experimental and Control Groups

Score	Groups	N	$\bar{x}$	SS	$Sh_{\bar{x}}$	t Test		
						t	Sd	p
HCT–CTSpre	Experimental	26	1.46	.12	.02	3.19	45	.003
	Control	21	1.35	.11	.02			

As seen in Table 9, a significant difference between the arithmetic means of the experimental and control groups was found as a result of the independent samples t-test conducted to determine whether or not there is a significant difference between the mean post-test scores (Creative Thinking Skills of the Hybrid Creativity) of both groups (t=3.19; p<.01). It was observed after the application of the independent variable that the arithmetic mean of the experimental group is significantly higher than that of the control group. Therefore, the alternative hypothesis (H1) for the fourth question of the study was accepted. In order to confirm whether such differences between the post-test means results from the application of the independent variable or the comparison between pre-tests, it was decided to carry out the comparison between the post-tests in the same control conditions as that which would have affected of the pre-tests. For this purpose, the one-factor covariance analysis, (ANCOVA) was applied.

The ANCOVA model is a form of the general linear model (GLM) (Lomax & Hahs-Vaughn, 2012). According to Baguley (2012), the major ANCOVA model involves the addition of a single corresponding variable to a two independent group system (analysis is made normally, using a t-test; but it is equivalent to one-way ANOVA applied for two categories). Whitley and Kite (2013) mentioned that ANCOVA presents the effect of an independent variable on group differences in pre-test scores via the regression analysis calculated based on the correlation between pre-test and post-test scores.

Prior to the application of ANCOVA, appropriateness of data for ANCOVA was checked by applying variance homogeneity with the Levene technique, and the variances were found to be homogeneous (L_F*=.873*; p>.05).

Results of Covariance Analysis performed for post-test scores of Creative Thinking Skills of the Hybrid Creativity are given in Table 10.

Table 10. Results of Covariance Analysis for Post-Test Scores of Creative Thinking Skills of the Hybrid Creativity

Variance Source	Sum of Squares	sd	Mean of Squares	F	p	η^2
Model	.39	2	.20	23.66	.000	.518
Pre-test (Reg)	.25	1	.25	30.46	.000	.409
Groups	.04	1	.04	4.41	.042	.091
Error	.37	44	.01			
Sum	94.35	47				
Corrected sum	.76	46				

It is seen that mean post-test scores of the experimental group which were corrected based on the pre-test were higher than those of the control group. It is understood from the eta squared values that 9% of the variability in post-test scores which is independent from pre-test scores can be explained with being in groups of different process.

On the other hand, it is clear that pre-test scores are substantial predictors of the post-test scores ($F_{(1, 44)}=30.46; p<.001$) and singly represent 40.9% of the change in post-test scores. Percentage of that pre-test scores and group variables explain the variability in post-test scores corresponds to 51.8%. Besides, ANCOVA model which defines this is significant ($F_{(2, 44)}=23.66; p<.001$). The research contained two groups which were the experimental and control groups, so multiple comparison analyses were not needed to determine the causes of difference.

Conclusion and Discussion

In line with the results of this research which examined the effect of mind mapping studies on creativity skills of 60-72-month-old children, there was a significant difference between pre-test scores of the children in the experimental and control groups. Namely, creative thinking skills of the experimental group was determined to be higher. When creative thinking skills of the children were examined again after 15 mind mapping activities, 5 of which were for the purpose of learning, was seen that the experimental group which performed mind mapping and the control group which kept with the Preschool Curriculum of the Ministry of National Education (2013) had both progressed during this time. However, the covariance analysis conducted to test the significance of the increase in arithmetic means of the experimental and control groups by keeping the pre-test results constant, showed that the children in the experimental group who performed mind mapping, progressed further than the children in the control group, who did not perform mind mapping.

The research revealed that the children who study with mind mapping technique have higher creativity skills than those who do not use the mind mapping technique. According to literature review, various researches that demonstrate positive effects of different education programs on creativity skills of young children were found (Bagherpour & Shamshiri, 2018; Cheung, 2018; Faizi et al., 2012; Kirkham & Kidd, 2015; Moedt & Holmes, 2018; Nadjla & Yasaman, 2016; Rizi et al., 2011; Vong et al., 2017). Nevertheless, application-based research which examines the effect of mind mapping studies on creativity skills of young children does not exist in literature.

It can be said, depending on the research conducted with different age groups, that mind mapping has a substantial positive effect on creativity skills. Zubaidah, Fuad, Mahana, and Suarsini (2017) showed the positive influence of science education, which was enhanced and differentiated through mind mapping, on creativity skills of the 7th-grade students. A study by Taadi, Raharjo, and Deliana (2019) aimed to determine the effect of the "Imindmap" application based on mind mapping

technique, on creativity and conceptual understanding of the primary school students. It was concluded in the study that mind mapping affects creativity and conceptual understanding positively. Hidayati, Zubaidah, Suarsini, and Praherdhiono (2019) revealed in their research that a curriculum integrated with problem-based learning and digital mind mapping affected creativity skills of the students in a positive way. A research of Vijayakumari and Kavithamole (2014) found positive effects of mind mapping studies on mathematical creativity skills of secondary-school students. In addition, Derelioğlu (2005) concluded in his study that mind mapping studies represent an influential technique in developing thinking skills and creativity of students in a primary school teaching department at university. The result of this study demonstrates that mind mapping studies promote creativity skills of the pre-schoolers as in the case of children of other age groups.

The visual structure of the mind maps boosts the development of creativity, establishing relationship, memory, analysis, focusing and thinking skills (Buzan & Buzan, 1996; Wen-Cheng et al., 2010). Children can correlate their past learning experiences with the existing materials through mind mapping (Long & Carlson, 2011) and organize the learning process by remembering their former learning reflections (Wheeldon, 2011). Mind mapping encourages children to discover ideas about the focus object or questions and associate them with each other. In this way, children understand and remember the materials or concepts experienced by themselves, more easily. Farrand, Hussain, and Hennessy (2002) uncovered in their study that mind mapping promotes more in-depth learning and supports remembrance skills when it is included especially in a learning process based on problem solving. It was shown by Jones et al. (2012) that studies performed with mind mapping techniques raise the motivation of students for learning. It can be said on the basis of research results that mind mapping studies make up a significant strategy to support creativity and many other skills.

In literature, there is research about the effect of mind mapping on various skills of preschool children. Koster, van der Wilt, van Kruistum, and van der Veen (2017) examined the effect of mind mapping studies on reading comprehension and vocabulary of children aged 4-6. The research results exhibited that mind mapping studies influence both reading comprehension and vocabulary significantly in a positive way. Positive effects of mind mapping in interactive reading book studies on vocabulary and listening skills of young children was discovered by van der Veen, van der Wilt, and Boerma (2018) in their study. Polat, Aksin Yavuz, and Ozkarabak Tunc (2017) analysed the influence of the mind mapping studies on numeracy and science skills of preschool children. As a result of the study conducted with 30 children in 48-60 month age group, it was found that numeracy and scientific skills of the children subjected to mind mapping are higher than those of the other children. Bilasa (2015) reached the conclusion in qualitative research which involved 34 children aged 4-6 years old, that mind mapping studies promote learning skills of preschool children and are appropriate for this age group. An experimental study of Daghistan (2016) aimed to examine the effect of mind mapping studies on attention deficit of preschool children. He revealed in consequence of the research that mind mapping creates a positive effect on attention concentrations of the children in the experimental group. It can be said in line with these researches that mind mapping studies reinforce numerous skills to be developed in preschool period. In addition, Polat, Akşin, and Özkarabacak (2013) analysed the effect of mind mapping studies on 48-60-month old children's perceptions of the concept of school. The mind maps produced by the children were measured via Mind Mapping Evaluation System (Evrekli, İnel, & Balım, 2010) and it was seen in mind maps which contained the perception of children on school concept that there was a significant difference between post-test scores of the experimental and control groups in favour of the former group. Furthermore, a study by Polat and Aydın (2020) revealed that mind mapping studies generate a positive and significant effect on the critical thinking skills of 48 to72-month old children. Based on the studies found in literature and the current result of this study, it can be said that mind mapping activities are quite effective in supporting different skills in children.

Thanks to their structure, mind mapping studies can be included in many educational approaches and programs. Especially, flexible and eclectic structure of the Preschool Curriculum of the Ministry of National Education (2013) allows for the carrying out of mind mapping studies. The flexible structure of the program means that teachers can bring the gains of the curriculum in various ways and enhance the education process, using different materials. The eclectic structure refers to regulation of the curriculum through synthesis of different approaches and models for the purpose of raising individuals needed in the 21st century. In this context, it can be said that mind mapping studies support and enrich the curriculum.

The use of mind mapping in the preschool period is an effective strategy for allowing children to develop original ideas and establish relationship between the existing information. Children utilise their imagination and creativity freely during mind mapping activities. As a result of this research, it was revealed that the mind mapping studies integrated into the Preschool Curriculum of the Ministry of National Education (2013) implemented in Turkey affect the development of children's creativity skills. It is thought that the use of mind maps as a visualization tool in preschool period is quite significant to enable children to concretize their abstract thoughts. It is seen in literature that mind mapping studies are majorly used in secondary education and higher education. At the first stage, mind mapping studies may bring challenges to especially young children. However this research presents findings about that pre-schoolers can learn mind mapping with the necessary support and assistance. Children find the opportunity to express themselves with visual materials via mind mapping. They are given the opportunity to see the big picture through relationships and links and to reflect the things they see while they depict their knowledge regarding a theme/concept/situation/fact on paper with an integrative perspective. This process established the ground for integrating knowledge via association from a broader perspective, ideational enrichment, generating new ideas from them and establishing relationship between their knowledge. From this point of view, findings of the research showed that creative thinking skills are supported with an active process. Therefore this research identified that mind mapping strategy is an influential learning strategy which is developmentally suitable for pre-schoolers. It is thought that mind mapping studies should be started from the preschool period in which learning speed is at its highest, and mind maps should be used in different phases of education, since they strengthen numerous developmental areas.

Suggestions

The skill to use one's own knowledge effectively, productive and creative traits in individuals come to the forefront in the skill set of the 21st century. The changing circumstances of this age show the significance of these traits, day by day. In this respect, it is inevitable that educational practices are structured to meet the needs of communal life. In consequence of the research, positive effect of the mind mapping studies on creativity skills of 60-72-month old children was seen. In addition, it can be said, based on the literature, that mind mapping supports the skills in many developmental areas, including creativity.

Raising the number of experimental studies will be important for revealing the influence of mind mapping activities on supporting different skills. To make mind mapping studies widespread in education by beginning from the preschool period, it is important to first provide preschool teachers with the necessary training on the mind mapping technique. However, the qualitative studies to be performed to scrutinize mind mapping processes further and to show how mind mapping promotes learning will be of equal significance due to being a learning strategy which requires activeness of children. To make mind mapping studies start from the basic step of education, the preschool period and to generalize them, teachers should be first equipped with the knowledge for applying and assessing the mind mapping studies. It is thought that the training activities to be carried out for this purpose will have a significant effect on reaching pre-schoolers by means of teachers.

Due to mind mapping maximising the brain's potential, it also promotes the development of various other skills. (Buzan & Buzan, 1996). In this context, the very limited number of the studies performed particularly with preschool children in literature is remarkable. It is thought that the amount of research in this field should be increased to develop, enhance and spread the mind mapping studies in the preschool period. Similarly, the performance of academic studies is suggested to determine and develop the advantages and limitations of mind mapping.

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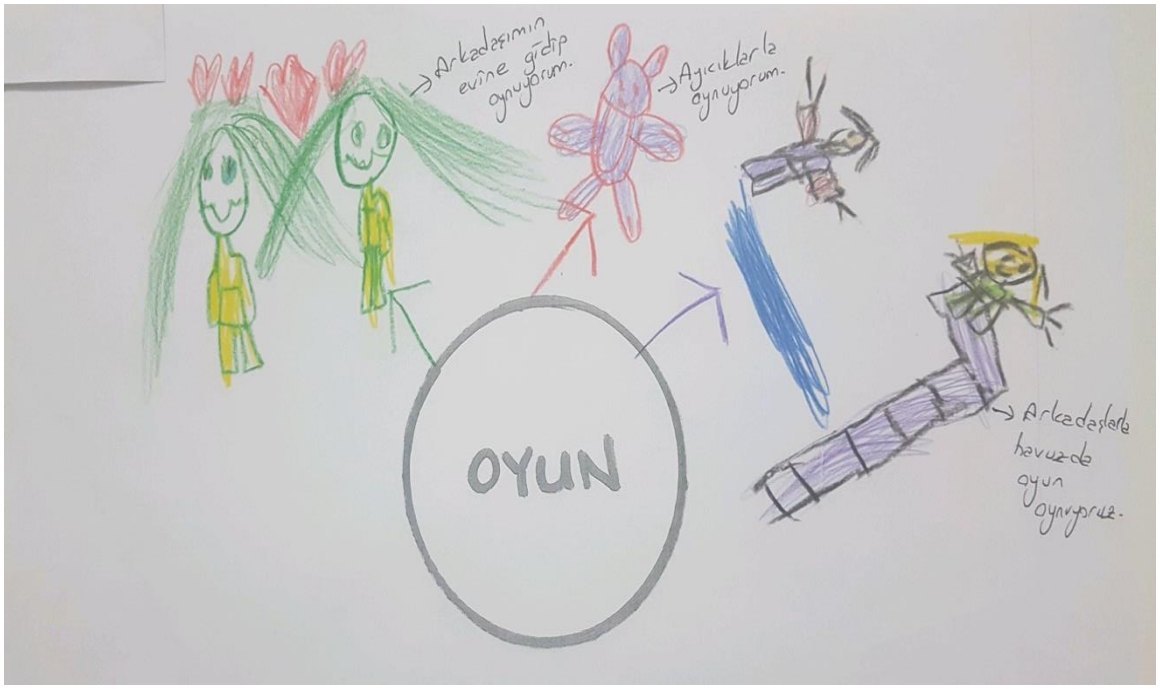
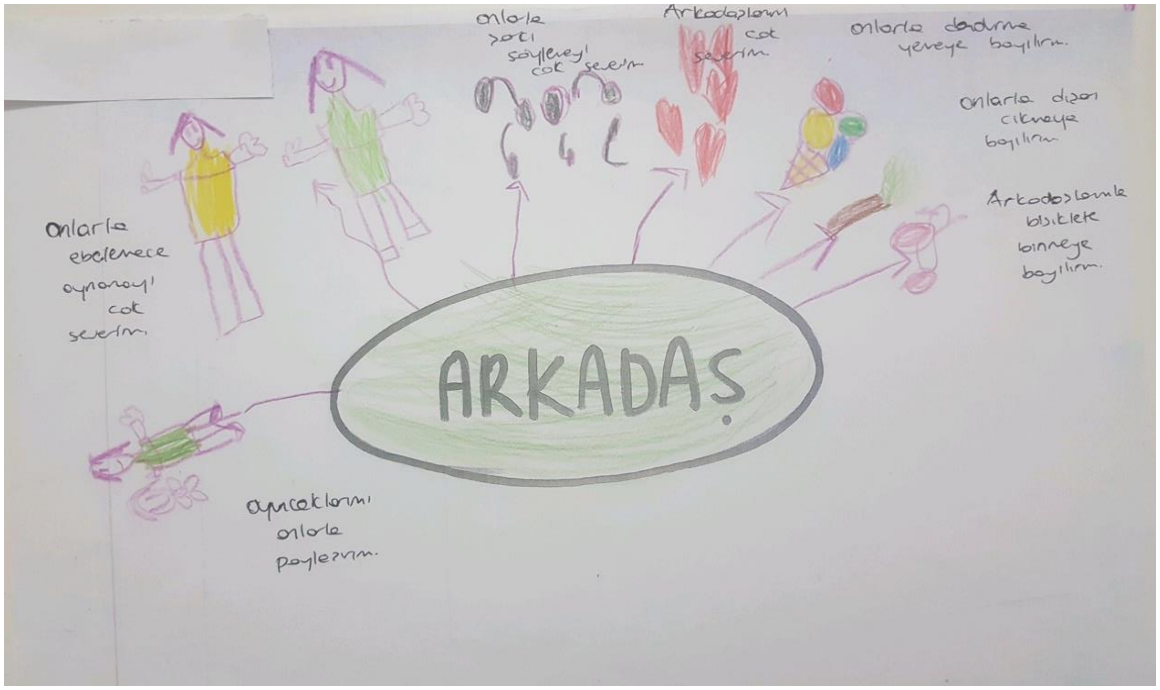
Appendices

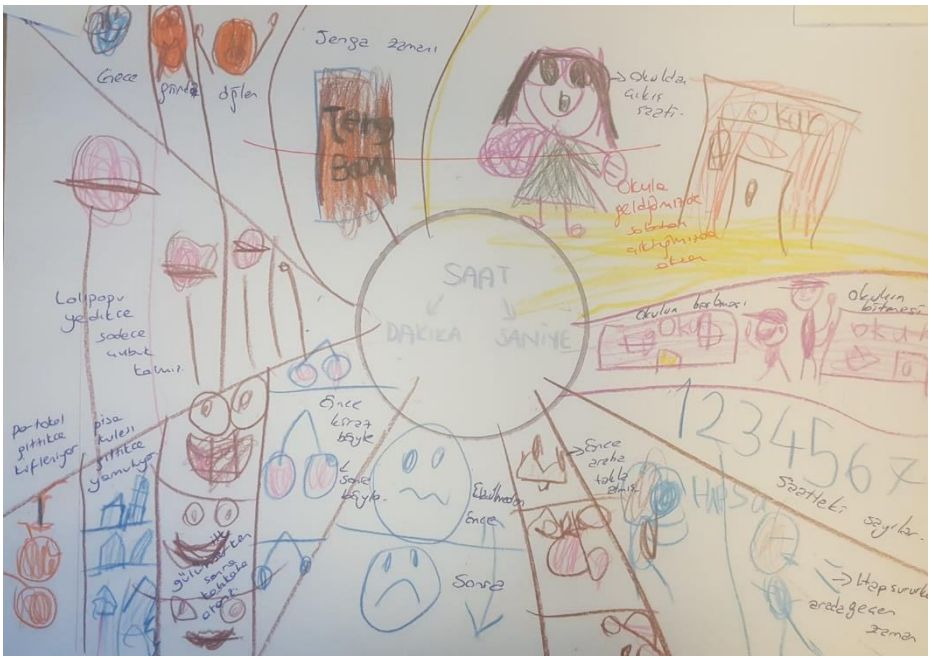


Appendix 1. Play-themed Mind Map of the Child Named G.C.

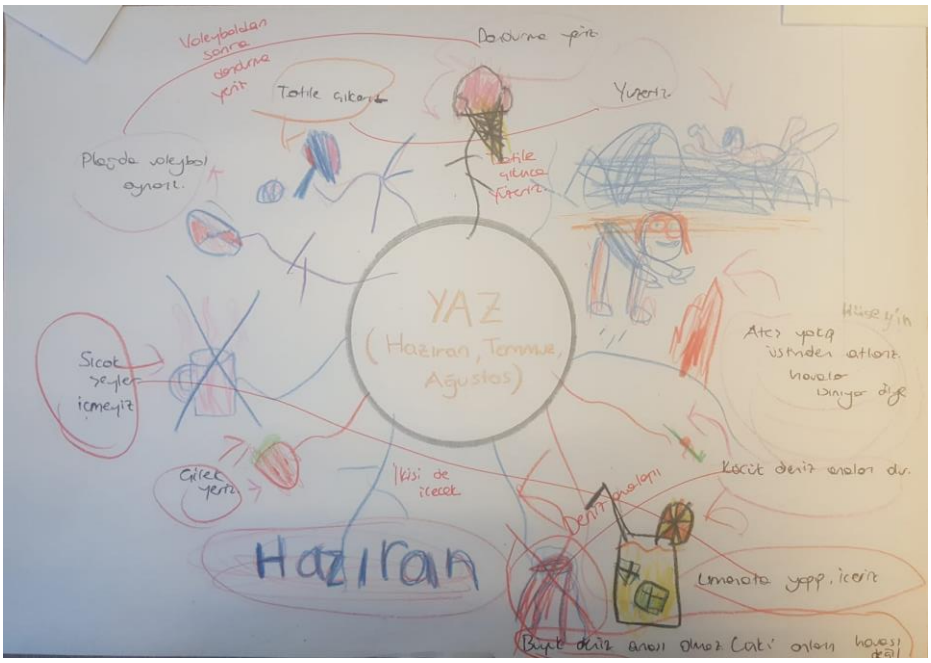


Appendix 2. Friend-themed Mind Map of the Child Named G.C.

The visual material about the theme of mind mapping studies is placed in the center. The participating child form branches by drawing the concept/word/object/situation which he associates with this theme, at the end of the arrow drawn from the central circle. They are the primary branches. As in the mind map of the participant with initials G.C. in Appendix 1 and Appendix 2, preschoolers generally make the mind maps that contain primary branches.



Appendix 3. Clock-themed Mind Map of the Child Named E.A.



Appendix 4. Summer-themed Mind Map of the Child Named H.A.

As in the mind maps prepared by the participant with initials H.A., children can gradually add sub-branches and visual materials to the branches coming from the center in the following activities (Appendix 3). In high level studies, the mapping in which cross links are used between branches (Appendix 4) is seen as well