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The Effectiveness of Storyline-Based Education Program on Critical Thinking Skills of Preschool Children *

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Abstract

The study was conducted to examine the effect of the education program, prepared based on storyline method, on critical thinking skills of five-year-old children. The study was designed using a quantitative model and experimental design. 43 children including 22 in the experimental group and 21 in the control group attending preschool education institutions in the city center of Kırklareli in the school year of 2017-2018 participated in the study. In addition to the existing education programs, the storyline education program was applied by the researcher to the children in the experimental group for 10 weeks (an hour in two days a week) between 19.03.2018 and 22.05.2018. The children in the control group continued their current education programs. In the study, "personal information form" and the "Critical Thinking Skills Test for 5-6 year-old Children (CTTC)" developed by the researcher were used. In the analysis of the data, experimental design with pretest, posttest, retention test, control group was applied to analyze the data. In order to determine the effect of experimental process in cases where the data had normal distribution and homogeneity of the assumptions was provided, two-way ANOVA method was used for mixed patterns that could address the inter-group, intra-group and common effect between the pretest and posttest. In cases where assumptions were not provided, it was examined whether or not posttest and pretest difference scores differed based on the experimental and control groups. For this, independent samples t test was used in the cases where the normality assumption was not provided; whereas, Mann Whitney U test was used for the other situations. It was found as a result of the study that the education program prepared with storyline method made a significant difference in the total score of the critical thinking skills test and in the scores of interpretation, explanation, inference, analysis, and self-regulation subscales of the critical thinking skills test in children in the experimental group. When assessing the effect size of the significance revealed, a high effect size was found in the total score of the critical thinking skills test,

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an effect size above moderate in the analysis and self-regulation subscales, a moderate effect size in the inference and explanation subscales, and a low effect size quantity in the interpretation subscale.

Introduction

The development of critical thinking skills of the children supports various qualities such as democracy and personal development; therefore, it has become one of the most important educational objectives worldwide (Beyer, 1987; Facione, 1992). Critical thinking signifies that an individual decides what to do or what to believe by questioning the source of the information (Ennis, 1985, 1989; Lewis & Smith, 1993). Critical thinking requires skills such as being able to make different logical inferences without thinking in order, to make evaluations, to present ideas by showing the causes and to make decisions by criterion (Lipman, 1988). The history of critical thinking dates back to the famous Greek philosopher Socrates (470 BC - 399 BC). The questioning technique developed by Socrates and today known as Socrates' method is based on revealing that the knowledge that is sure to be accurate may not be logical when questioned (Başarer, 2017). Critical thinking has been shaped by the opinions of John Dewey, the famous educational philosopher. Dewey (1933) attributed the individual's quality of thought to his/her interaction with his/her circle. In his theory, known as "learning by doing", he emphasizes that the experience encourages students' critical thinking (Dewey, 1933).

Critical thinking is one of the high-level thinking skills. There are routine applications in basic-level thinking such as listing and sorting of previously acquired information. In top-level thinking, there is a process that requires the individual to interpret, analyze and manipulate information by leaving the routine of the problem by taking advantage of the basic processes such as observation, measurement, inference, estimation, classification, data collection and recording (Lewis & Smith, 1993). Critical thinking makes the individual responsible for his/her thinking (Nosich, 2016). A person who thinks critically by evaluating evidences by considering multiple perspectives and contexts can actualize potential ideas (Murphy, Rowe, Ramani, & Silverman, 2014). The critical thinking skill that has been shaped from preschool years, develops children's communication skills, helps the children to realize the prejudices and errors, gives a free point of view to children, paves the way for creative thinking by developing different thinking skills, uncovers the individual's potential, and makes the person a good problem solver (Florea & Hurjui, 2015).

Each experience in the development process is built on the previous one. Most of the basic- level thinking skills are acquired in early childhood and the bases of critical thinking which is accepted as the top-level thinking skill are also founded during this period and continue to develop (Nosich, 2016). Critical thinking is not a product/result, but it is a process and continues to evolve through lifelong acquired skills and experiences (Bookfield, 1987; Tozduman Yaralı, 2019a, 2019b). The experiences, game, communication, social and emotional development, abstract thinking skill and mental representations of the environment experienced over time constitute the basis of critical thinking skills in children (Murphy et al., 2014). It can be observed that an adult with a high level of education cannot achieve critical thinking while a three-year-old child can display a skill for critical thinking (Demirel, 1999). Three-six year-old children can think about their own behaviors (Kuhn, 1999), explain their own and others' behaviors through their knowledge and experience (Epstein, 1993); question the misinformation said by the adults by reasoning (Heyman, 2008); realize the discrimination between the fair and unfair behaviors from the age of four, and begin to think about these behaviors and stereotypes at the age of five (Bredekamp, 2015).

Critical thinking can be developed with different ways (Lone, 2017). Kuhn (1999) states that in order to develop critical thinking, there are three conditions as metacognitive knowledge, metacognitive strategies, and epistemological knowledge. Accordingly, metacognitive knowledge requires being aware of knowledge, metacognitive strategy for a person is to express his/her knowledge about the use

of cognitive or behavioral strategy and epistemological knowledge for a person is to extend his/her understanding about information and knowing (Kuhn, 1999). "I can count up to twenty but I cannot count down" can be given as an example to metacognitive knowledge; "It is better to start from corners when making a puzzle" to metacognitive strategy; "How does a person know something?" to epistemological knowledge. The basic element in the development of critical thinking is free and democratic educational settings. In the study of Potts (1994 entitled as "Methods for teaching critical thinking", the methods that can be used for teaching critical thinking are stated as asking the students to examine the necessity and appropriateness of the information given during problem solving, asking them to find analogies between the information, asking for different solutions of a problem, increasing the communication between students, asking open-ended questions to students, and asking them to use the skills they have gained for different situations by giving enough time to answer the questions.

In the theory created by Vvgotsky with a socio-cultural perspective, it is stated that the child is in interaction with culture in the learning process and the tools like language offered by culture play a crucial mediating role in the child's mental development (Bodrova & Leong, 2013; Chandra, 2008; Daniel & Auriac, 2011). Vygotsky emphasizes that social interaction is an important factor on the basis of metacognitive functions (Louca, 2008). The studies on early childhood (Bell, 2010; Collier, Guanther, & Veerman, 2002; Fernández-Santín & Feliu-Torruell, 2020; Karadağ & Demirtaş, 2018; Scheau, 2012; Şahhüseyinoğlu, 2010), attract attention to the methods and approaches to be used while children develop their critical thinking skills and have revealed that different approaches to be used may affect the development of critical thinking skills positively. These studies have focused on the role of teaching strategies, questions, games, and curiosity. The constructivist approach seeking answer to the question, "How does human being learn?" states that the learner should interpret the knowledge and learn it by experiencing (Whitsed, 2004). Since an effective communication way is adapted with open-ended questions to develop problem solving skills and independent thinking skills of children in constructivist approaches, the child is given the opportunity to construct, form, interpret, and improve the knowledge (Yaşar, 1998).

Storyline, a method built on constructivist approach, allows children to learn by experiencing based on storytelling and taking part in the story and makes learning permanent (Bell, 2007; Harkness, 2007). The Storyline which was developed in Scotland in the early 1980s is an approach that adopts learning by doing and experiencing as a principle and aims to make learning permanent in children. In this approach, the learning process starts with a story, the story is processed in stepwise subjects by getting stronger through time, space, and character connections. Harkness (1997) states that storyline is the way helping children to think. In storyline method, the children are ensured to identify with the characters involved in the story process. In this way, children are given the opportunity to experience the story. Characters in the story process are created using children's creativity. Problems that emerge in the process are tried to be solved through children's use of scientific thinking processes. In addition, children can combine the new things they learn during an activity with their own experiences. (Tepetaş Cengiz, 2015). Storyline process has six dimensions. These dimensions are story sections, key questions, student activities, classroom organization, sources (tools), results and evaluation opportunities (Harkness, 2007). A title (library, school, etc.) is used in each of story sections. The key questions are prepared in a way to allow students to ask a lot of questions (why are there libraries?) and in a quality to set them in motion in each title. Students activities are planned to find answers to these questions. Class organization involves determining the group size that is the most appropriate for the activity. Sources are composed of a list of materials to be used in activities. In products and evaluations, products that come out after activities can be used for evaluation purposes (Tepetaş Cengiz, 2015. Storyline method has six principles including the principle of story, the principle of anticipation, the principle of the teacher's rope, the principle of ownership, the principle of theme, and the principle of the structure-before-activity and these principles are considered throughout the process. In the *story principle*, the fact that the children's experiences are in the center of learning is taken into consideration. *The principle of anticipation* is based on keeping the children's interest and curiosity alive during the story process. *The principle of the teacher's rope* reminds that the teacher and the student are always collaborators. *The*

principle of ownership allows children to feel valued by asking questions. *The principle of theme* allows children to construct interpretation processes from the known to the unknown. *The principle of the structure-before-activity* includes the ability of children to maximize their existing knowledge levels without learning new knowledge (Creswell, 1997. These principles become an effective tool for the storyline method to counter the negative consequences of constructivism (Solstad, 2006). Storyline method aims to develop high-level thinking skills of children in terms of structure and features and allow them to use these thinking skills in their daily lives (Yiğit & Erdoğan, 2008). In addition, it also provides the opportunity to be creative with limited resources to cooperate with others by acting and to make a choice by using imagination. By providing learning motivation, it encourages deep thinking with open-ended questions (Ahlquist, 2016).

Critical thinking stated to be likely taught at any age (Demirel, 1999) is not a skill spontaneously appearing in adulthood. Therefore, it should be supported and taught from early childhood (Daniel & Auriac, 2011). The importance of this matter is stated in the 13th principle of MEB Preschool Education Program as; "*Children's imagination, creative and critical thinking skills, behaviors of communicating and expressing their emotions should be developed*." (MoNE, 2013, p. 11). The results of the previous studies (Davis-Seaver, Smith, & Leflore, 2003; Heyman, 2008; Karadağ & Demirtaş, 2018; Kuhn, 1999; León, 2015) indicate that there are examples showing that children can think critically even in early childhood. The results also point out that the critical thinking skills of children can be developed using various methods via both intrafamilial and intraclass interactions. Supporting critical thinking skills of children, which is also the starting point of this study, is considered significant. Because selecting, evaluating and using correct information have become the characteristics the people of the 21th century, who are called as information society, should become characteristics an individual should have (Halpern, 2003). Such that the individuals needed by democratic societies should be socially-minded, empathetic and participatory people who have citizen consciousness, keep off dogmatic thoughts, and have adopted discussion and reconciliation culture. Critical thinking skills form the basis of all these characteristics (Gürkaynak, Üstel, & Gülgöz, 2003). For this reason, the importance of methods and techniques that will improve critical thinking skills of children is obvious. This study was conducted based on the idea that the critical thinking skills of the children should be supported from early ages in terms of socio-cultural theory of Vygotsky and the common points of storyline with critical thinking were taken into consideration. Considering that the storyline method encourages children to use the language and present real life problems; the problems have a place in the educational process; new knowledge are built on previous learnings and the child is as responsible for the learning process as the teacher; it is thought that the storyline method might create a positive effect on the critical thinking skills of children. For that purpose, the study focused on examining whether the curriculum application created via the storyline method had a significant effect on the critical thinking skills (interpretation, explanation, evaluation, inference, analysis, and self-regulation) of preschool children or not.

Method

Study Model

Quantitative model and quasi-experimental design were used in the study. The study was carried out as a quasi-experimental design because it was not possible to select randomly the children in the experimental group due to limitations such as process of education, time, and space (Büyüköztürk, Kılıç, Çakmak, Akgün, Karadeniz, & Demirel, 2018). In the study, "experimental design with pretest, posttest, retention test, control group" was used in order to investigate the effect of storyline-based education program on critical thinking skills of five-year-old children. While the dependent variable in the study was "critical thinking skills" of the children, the independent variable was the "education program prepared based on storyline method" whose effect on the critical thinking skills of children was investigated.

Sample Group

The children (experimental and control groups) in sample group were selected by using purposeful sampling method from the kindergartens of two primary schools assumed to have similar characteristics from preschool education institutions affiliated with the Ministry of National Education in the city center of Kırklareli. A total of 43 children from two primary schools participated in the study; the number of children in the experimental group was 22 (51.2%) and the number of children in the control group was 21 (48.8%). When considering that the children included into the control group could be affected indirectly from the program applied to the experimental group, a different school was preferred for the control group.

It was found that 48.8% (21) of the children participating in the study were girls and 51.2% (22) were male. Of the children participating in the study, 53.5% (23) had one, 4.7% (2) had two siblings and 41.9% (18) had no siblings. While mothers of 48.8% (21) of the children were employed, mothers of 51.2% (22) were unemployed. The educational levels of their mothers were secondary school at 4.7% (2), high school at 67.4% (29), were bachelor's or associate degree at 25.6% (11) and graduate degree at 2.3% (1). The year was the first year for 44.2% (19) of the participants, the second year for 41.7% (18), and the third year for 14.0% (6) in the preschool education.

Data Collection Tools

In the study, "Personal Information Form" prepared to collect information of the children and the "Critical Thinking Skills Test For 5-6-Year- Old Children" (CTTC) developed by the researcher to determine the effect of storyline-based education on critical thinking skills of the children were used.

Personal Information Form: In the study, the "Personal Information Form" prepared by the researcher to obtain some information (gender, age, mother's educational level, father's educational level, number of siblings, duration of receiving preschool education) about the children and their families was used**.**

Critical Thinking Skills Test For 5-6-Year-Old Children (CTTC): It was developed by Tozduman Yaralı and Güngör Aytar (2020) to evaluate the critical thinking skills of 5-6-year-old children. The test includes a total of 41 items. The test has six subscales (interpretation, explanation, evaluation, analysis, inference, and self-regulation). There are five stories (1st story is for interpretation, explanation, and evaluations skills; 2nd story is for inference and analysis skills; 3rd, 4th, 5th, and 6th stories are for self-regulation) and 10 drawings in CTTC. In CTTC, 3 drawings are used for the 1st story (interpretation, explanation and evaluation subscales), 3 drawings are used for the 2nd story (inference and analysis subscales) and one drawing is used for 3rd, 4th, 5th, and 6th stories (the self-regulation subscale).

The score range is 0-9 points for the interpretation subscale of CTTC, 0-7 for the explanation subscale, 0-5 for the evaluation subscale, 0-5 for the inference subscale, 0-6 for the analysis subscale and 0-20 for the self-regulation subscale. The score range of the overall CTTC is 0-53 points. It is accepted in CTTC that as the score increases, the critical thinking skill of the children increases. The test is applied individually with each child. It took approximately 25-30 minutes to apply the test for each child. The practitioner sits face to face with children while applying the test. While he/she is reading the story for children, he/she puts the drawings about the story in front of them. After the story is completed, he/she asks the questions in the subscale of critical thinking related to the story without putting the drawings aside. For example, after putting the drawings about the story in front of children, the practitioner who reads the story "The World of Piko" asks the first question "What do you think happened at the end of the story?" in "inference" subscale after the story ends. The answer given by children is marked in the assessment form according to its value in the grading key (0, 1, 2, or 3 points). If the answer of a child includes a reasonable inference, it gets 1 point. If a child does not answer the question or gives an unreasonable answer, it gets 0 point. So, the critical thinking skill score of children is obtained both for subscales and overall total with their scores in each question.

The validity and reliability studies of the test were carried out with 202 children in the age group of 5-6 years. Content validity index (CVI) of CTTC were determined for subscales as 0.80 in the interpretation subscale, 0.77 in the explanation subscale, 0.77 in the evaluation subscale, 0.81 in the inference subscale, 0.77 in the analysis subscale, and 0.98 in the self-regulation. Confirmatory factor analysis (CFA) was performed to investigate whether or not the data support the six-dimensional factor structure in the original scale. X2/df (1,19) value was found for the model fit of the test determined to be composed of 41 items and subscales of interpretation, explanation, evaluation, analysis, inference, and self-regulation. It was seen that this value was less than 5, GFI, AGFI, NFI and CFI values were higher than .90 and RMSEA value was less than 0.08. The correlation coefficients between the subscales of the test were found to be significant. It was determined that the correlations between the explanation, inference, analysis, self-regulation, and interpretation subscales were in moderate level and in positive direction but the correlations between the self-regulation subscale and the other subscales were weak and positive. In order to ensure the criterion validity of the test, the correlation between the Problem Solving Skill Scale (PSSS) developed by Oğuz and Köksal Akyol (2015) and CTTC was examined. The Spearman correlation coefficient value between CTTC and PSSS total scores was found to be higher than moderate level and positively ($r=0.66$; $p<0.05$) significant. Test-retest reliability was calculated and the correlation coefficients were found as 0.71 for interpretation, 0.78 for explanation, 0.74 for evaluation, 0.89 for inference, 0.79 for analysis, 0.68 for self-regulation and 0.82 for the overall critical thinking skills test. As a result of the analyses, it was determined that the "Critical Thinking Skills Test (CTTC) for 5-6-year-old children" was a valid and reliable measurement tool.

Data Collection

Application of Pretests: CTTC was applied between 12.03.2018 and 16.03.2018 for the children in the experimental and control groups. The children were included individually into the application and the application lasted for 25-30 minutes for each child. The applications were made in a separate environment independent from the classroom. Depending on the availability, the music room, the support training room or the guidance service were used for the application. The researcher and child seated face-to-face and the drawings related to the test were placed on the table facing to the child during the process. Drawings related to each story were placed in front of the child and the drawings of the previous story were removed in order not to distract the children. Except for the story switches, the attention was paid not to give a break. The researcher marked the scoring key according to the child's answers but the attention was paid not to worry the child by placing a neutral shape such as a dot rather than the symbols of plus-minus or check mark. In this period, the inter-rater reliability was calculated using the assessment form of a child on whom two different researchers performed application using [Agreement/ (Agreement + Disagreement) X 100] formula of Miles and Huberman (2015) and it was found to be 97.56%. Two practitioners discussed about the reason of scoring difference for the inconsistency on only one item in the test and the researcher continued the application with the other children after they came to an agreement.

The Education Program Prepared by Storyline-Based Technique

Based on a constructivist approach; storyline-based technique has a structure that facilitates story-telling and being involved in the story and allow to make learning more permanent (Bell, 2007; Creswell, 1997; Harkness, 2007). The purpose of the storyline-based education program is to support the critical thinking skills of children by establishing an educational environment suitable for the nature of critical thinking using the activities suitable for the storyline-based philosophy to improve their critical thinking skills. For this purpose, the content of the education program was prepared using the characteristics and definitions of critical thinking as well as the subscales included in "Critical Thinking Skills Test for 5-6 year-old Children (CTTC)". In the storyline-based education process, "children's library" was determined as the theme. The children's library was the theme preferred by the researcher due to the fact that it is a subject that attracts the attention of children, has the qualification to nourish the critical thinking process, has a rich content including many elements such as rules, visitors, and books, the idea of children's library has spread, and so on.

Firstly, the current education programs and contents prepared using story-line method were examined in the improvement process of the story-line based education program. While preparing the education program, all the activities have been prepared considering the story principle, anticipation principle, teacher's rope principle, ownership principle, theme principle, structure-before-activity principle of storyline. Thus, it was aimed to act in accordance with the philosophy of storyline-based education. In the program designed to last for 10 weeks, the applications to be performed each week were prepared within the scope of key questions, student activities, organization, tools, and learning outcomes, which are the parts of storyline-based education. While preparing the parts of storyline-based education, the age and developmental characteristics of the children were taken into consideration. For the education program prepared, approval was obtained from a total of three experts; two from the field of child development and one from the field of preschool education. The program was paid attention to be consistent with the gains, characteristics, and principles in the Ministry of National Education Preschool Education Curriculum.

Application Process of the Education Program: Education program prepared based on storyline method was applied to the experimental group between 19.03.2018 and 22.05.2018. The number of children which was 22 at the beginning of the application became 21 after the leave of a child from the school. Storyline based education was applied to 21 children in the experimental group for about one hour in two days a week for 10 weeks. The children in the control group continued their routine education and no education was given to them. Before the application of storyline-based education program, "family consent form" was sent by the researcher to the families of the children who would participate in the education program. The family consent form states the identity of researcher, the purpose of the study, the application process and that their children can leave/withdraw from the application at any time.

Prior to the pretest, the researcher went to the school where the children in the experimental group was studying and met with them. Within these activities, the researcher introduced herself and mentioned the work she was planning to do with them. Pretests were applied after meeting with children and a 10-week program prepared by the researcher using storyline method was applied (Table 1). During the application of the activities in the education program, the class teacher stayed in the classroom and played a passive role during the activity period. During the application process, the children in the experimental and control groups continued to carry out their activities in daily education plans. No additional application was applied to the control group and the current education processes were continued for the control group. The education was applied during the day at appropriate times of the children in the experimental group without breaking the daily activity plan of the classroom teacher. An interview was conducted with the classroom teacher and the activity breaks and the daily gaps were used in accordance with the daily plan. For this purpose, the classroom teacher of the experimental group was interviewed in the week before the application in order to determine the hours when the researcher could do the application in the classroom.

The idea and the framework of the story were formed by the researcher before the application. The researcher identified the framework of the story, but the content was detailed by the children. At this stage, the researcher explained to the children the learning purpose, conditions and how the process would proceed before starting the story. A library field visit was organized with the children and parents in the first week in order to form preliminary information and prepare the children for the later stages of the process. In this section being the first stage of the storyline process, the library was introduced to the children, librarians were interviewed, and they answered the children's questions about the library. In addition, the children and parents were ensured to be members of the library and an interactive book-reading activity was conducted in the library by the researcher (the story of "Happy Hippo" was read). The researcher mentioned about the libraries to the children in the first week and answered their questions such as "what are the purposes of the library? And they examined the visuals related to the subject together with the children.

Table 1. Examples related to the storyline-based education program

Storyline Sections	Key Questions	Student Activities	Organization	Equipment	Learning Outcomes
Forming the library space (1st Week)	- Why do libraries exist?-what kind of library do you dream?	Forming the library by brainstorming…	All class Big Group	Blackboard, notepads, waste materials, parcels …	Explanation , interpretation..
Children's books (2nd Week)	-How are children's books? -Which characters/heroes are there?	Presentation of the book brought by each child to the class in terms of its subject and heroes to his/her friends...	All Class Individual	Various children's books …	Inference, explanation …
Book design (3rd Week)	-- if you had designed a book, What characters would it have?	Prediction of the end of the story by the children…	All class Small Group	Waste materials, colored crayons…	Explanation, interpretation, inference …
Daily life in the library (4th Week)	- What do you think what is happening in the library during the day ?	Answering the questions about daily life ...	All class Big Group	Waste materials …	Explanation, interpretation …
The rules in the library (5th Week)	-Should we set rules for the library? –How/what rules we can set?	Reading and discussing a story related to the rules and their reasons and preparing the rules proposed for the library…	All class Small Group	Blackboard, notepads, colored A4 papers …	Inference, evaluation, self-regulation, analysis…
Events in the library (6th and 7th Week)	- What kind of problem do you think a child going to a library may have?	Trying and implementing various solutions through creative drama and improvisation …	All class Small Group	Materials required for drama and improvisation are kept ready.	Problem solving, inference, analysis…
Presentation and advertisement of the library (8th Week)	-Why are there ads? -What do you think how we can introduce our library to other kids at school?	Listening and recording of suggestions on the subject … Presentation of an introductory tool (brochures, ads, posters, newspaper etc.) by each group to the other groups…	All class Small Group	Notebooks, colored cardboards …	Creative thinking, evaluation, inference …
Opening of the Library (9th Week)	-How the opening of our library should be?	Planning the things necessary for the opening...	All class	Music, party decorations, handcrafted papers…	Interpretation, inference, explanation…
Evaluation (10th Week)	- What do you think about we have learned in this process ?	A discussion environment is created. Teacher and children seek answers to the questions together.	All class	Blackboard, notepad …	Explanation, Analysis, evaluation…

According to Table 1, the principles of the storyline (the principle of story, the principle of anticipation, the principle of the teacher's rope, the principle of ownership, the principle of theme, and the principle of the structure-before-activity) were taken into account during the 10-week education period. The rules required be obeyed in these principles were considered. The following applications were conducted by considering the principles:

The principle of story: "Children's library" was determined as the storyline theme in order to contribute the spread of children's library idea since it has the quality to nourish their critical thinking skills.

The principle of anticipation: It was paid attention that the story was not very simple and not too complicated and the children were given opportunities to guess what would happen next in the story. For this purpose, questions like "What do you think will happen next?" were asked to the children at the end of the story processes.

The principle of the teacher's rope: The relationship between teacher and child was paid attention and cooperation was taken as the basis. The children's desire to read a book with the researcher and discuss it with questions every week was applied within the scope of the storyline process.

The principle of ownership: Each storyline section started with questions like "What kind of library do you imagine?" so that a process where children feel responsible for and motivated by the process was tried to be established.

The principle of theme: In order to strengthen the children's relationship with the books, to benefit from the characters in the books and associate them with their preliminary knowledge, different methods and techniques such as children's book, library images, drama, and brainstorming were benefited under the theme of "children's library".

The principle of the structure-before-activity: A library field tour was organized to provide children's readiness and maximize their level of preliminary knowledge about children's libraries. Different techniques such as drama, brainstorming, question-answer were utilized in the storyline process. Since family involvement is important in the development of critical thinking skills, family participation activities are also included in the education program process.

Application of the posttests: Posttest data were collected between 23.05.2018 and 25-05.2018 after the completion of the storyline-based education program to evaluate the critical thinking skills of the children after the education program was implemented. Posttest was performed by applying the "Critical thinking skills test for 5-6 year-old children" to the experimental and control groups.

Application of Retention Test: In order to test the retention of the storyline-based education, the "Critical thinking skills test for 5-6 year-old children" was applied again to all children in the experimental group who were subjected to pretest and posttest between 06.06.2018 and 08.06.2018 two weeks after the applications of posttests. As the closing date of schools was 08.06.2018, the retention test was applied two weeks after the posttest application.

Data Analysis

The packaged software was used for the analysis of the data. For this purpose, the design with pretest, posttest and control group consisting of experimental and control groups was formed. In order to decide the parametric/nonparametric tests to be used in the study, whether or not the score distributions complied with normality and homogeneity assumptions was tested by calculating the pretest, posttest and follow-up test scores of the experimental and control groups. For this purpose, skewness and kurtosis values of the total scores of pretest, posttest and retention test obtained for each group were examined in order to determine whether or not the normality assumption is met. If these coefficients are between -2 and +2, it is assumed that the distribution of the scores is normal (Hair, Black, Babin, Anderson, & Tatham, 2010). The Levene's test was used to test the homogeneity assumption. It was accepted that the significance scores were higher than 0.05 as a result of the test, that is, variances were accepted to meet homogeneity assumption when there was no significant difference between the variances of the scores. The two-factor ANOVA method was used for mixed designs that can address

inter-group, intra-group and common effect between the pretest and posttests in order to determine the effect of experimental process when the normality and homogeneity assumptions were met (Büyüköztürk, 2011). In cases where assumptions were not met, it was examined whether or not posttest and pretest difference scores differed according to the experimental and control groups. For this purpose, independent samples t test was used for the other conditions. In addition, in order to determine whether pretest and posttest scores of the children in both experimental and control groups differed or not, paired samples t test was used in cases where the normality assumption was met and Wilcoxon test was used for the other condition. It was aimed to determine retention test scores obtained two weeks after application of posttests for children in the experimental group and whether the effect of the education program continued or not. Skewness and kurtosis values of the distributions were examined to determine whether or not the normality assumption of score distributions was met in identifying statistical test to be used in meeting pretest, posttest, and retention test measurements. ANOVA test for repeated measurements was used in cases where the normality assumption was met. Otherwise, Friedman test was used. In order to assess the effect size of the significance revealing as a result of the education program, the eta squared formula (η^2) for the independent samples t-test and the t-test effect size formula [r= √t2/ (t2+ SD)] were used. The effect size is assessed to be low between 0-0.2, moderate around 0.5 and high around 0.8 and above.

Ethical Issues

Within the scope of the study, ethics committee approval, permission from MEB (the Ministry of National Education), and informed consent forms were signed by parents. Children's volunteerism was taken into consideration during the study and children were not forced for any application. Information about the application was given to children, school management, teachers and families. The right to withdraw from the application was given to the children during the application period.

Results

The results obtained as a result of the study investigating the effect of education program prepared with storyline method on the critical thinking skills of five-year-old children are presented in this section.

Table 2 shows Independent Samples t test Mann Whitney U test results performed to examine whether or not the pretest scores obtained by the children in the experimental and control groups for the subscales of the critical thinking skills test differed.

Table 2. Results of t-test and Mann Whitney U test Related to The Investigation Of The Difference Of The Pretest Scores Of The Subscales Of The Critical Thinking Skills Test Between The Experimental And Control Groups.

t test	**Group**	**n**	$\bar{X}$	**sd**	**t**	**p**
Interpretation	Experimental	22	5.23	41	-0.33	**0.74**
	Control	21	5.43			
Evaluation	Experimental	22	3.68	41	-0.44	**0.67**
	Control	21	3.81			
Inference	Experimental	22	4.18	41	-0.62	**0.54**
	Control	21	4.43			
Analysis	Experimental	22	4.09	41	-1.61	**0.12**
	Control	21	4.71			
Self-regulation	Experimental	22	12.27	41	-1.11	**0.28**
	Control	21	13.43			
Critical thinking Skills Overall Total	Experimental Control	21	36.14	41	-1.13	**0.27**
Mann Whitney U test	**Group**	**n**	**Mean rank**	**Total rank**	**U**	
Explanation	Experimental	22	21.95	483.00	**230.00**	**0.98**
	Control	21	22.05	463.00		

When the results of independent sample t-test and Mann Whitney U-test in Table 2 were examined, it was determined that the pretest scores related to the interpretation, explanation, evaluation, inference, analysis, and self-regulation of CTTC and critical thinking skills total score did not show a statistically significant difference in terms of the experimental and control groups ($p>0.05$). Therefore, it can be asserted that the children in the experimental and control groups showed similar characteristics before the education.

Table 3 shows descriptive statistics of pretest and posttest scores for the interpretation, explanation, evaluation, inference, analysis, self-regulation skills and overall total of critical thinking skills formed from all of these skills of the children in the experimental and control groups before and after the education program application.

Table 3. Descriptive Statistics Related to the Pretest and Posttest Scores of the Critical Thinking Skills Test Subscales.

	CTTC	Group	n	$\bar{X}$	S. Deviation	Min.	Max.	Skew.	Kurt.
Critical Thinking Skill	Pretest	Experimental	22	33.68	7.11	17.00	44.00	-0.95	0.82
		Control	21	36.14	7.16	19.00	49.00	-0.09	0.53
	Posttest	Experimental	22	47.45	5.39	31.00	53.00	-1.66	3.07
		Control	21	40.38	6.19	27.00	51.00	-0.08	-0.33
Interpretation	Pretest	Experimental	22	5.23	2.18	1.00	8.00	-0.47	-1.06
		Control	21	5.43	1.80	2.00	8.00	-0.49	-0.67
	Posttest	Experimental	22	7.36	1.65	3.00	9.00	-1.28	1.40
		Control	21	6.10	1.70	3.00	9.00	-0.43	-0.62
Explanation	Pretest	Experimental	22	4.23	1.51	1.00	6.00	-0.42	-0.71
		Control	21	4.33	0.97	2.00	7.00	0.71	3.38
	Posttest	Experimental	22	6.00	1.51	1.00	7.00	-2.00	4.67
		Control	21	5.14	0.91	3.00	7.00	-0.31	0.56
Evaluation	Pretest	Experimental	22	3.68	1.09	1.00	5.00	-0.76	0.35
		Control	21	3.81	0.81	2.00	5.00	-0.24	-0.22
	Posttest	Experimental	22	4.55	0.74	3.00	5.00	-1.34	0.38
		Control	21	4.24	0.83	3.00	5.00	-0.49	-1.36
Inference	Pretest	Experimental	22	4.18	1.40	1.00	6.00	-1.15	0.75
		Control	21	4.43	1.21	2.00	6.00	-0.19	-0.88
	Posttest	Experimental	22	5.59	0.67	4.00	6.00	-1.43	0.98
		Control	21	4.90	1.00	2.00	6.00	-1.14	2.22
Analysis	Pretest	Experimental	22	4.09	1.19	2.00	6.00	-0.19	-0.25
		Control	21	4.71	1.35	2.00	6.00	-0.78	-0.46
	Posttest	Experimental	22	5.73	0.63	4.00	6.00	-2.23	3.90
		Control	21	5.14	1.06	3.00	6.00	-0.86	-0.60
Self-regulation	Pretest	Experimental	22	12.27	2.88	7.00	16.00	-0.58	-0.78
		Control	21	13.43	3.92	4.00	20.00	-0.08	0.56
	Posttest	Experimental	22	18.23	1.95	13.00	20.00	-1.20	0.91
		Control	21	14.86	3.24	8.00	20.00	-0.08	-0.22

When the pretest mean scores of the overall total of critical thinking skills in Table 3 were considered, it was determined that the mean score of the experimental group was $\bar{X}$=33.68 and the mean score of the control group was $\bar{X}$=36.14. The posttest mean scores of the overall total of the critical thinking skill were $\bar{X}$=47.45 in the experimental group and $\bar{X}$=40.38 in the control group. According to the obtained results, the experimental group had the highest posttest mean score for critical thinking skill.

Results Regarding the Overall Total of The Critical Thinking Skills Test

Table 4 shows t test results related to the investigation of the difference of the overall pretest-posttest scores of the critical thinking skills test between experimental and control groups.

Table 4. T test results Related to the Investigation of the Difference of the Total Pretest-Posttest Scores of the Critical Thinking Skills Test between Experimental and Control Groups

t test	Group	N	Mean	df	t	p
Critical thinking difference	**Experimental**	22	13.77	41	9.50	0.00*
(Posttest - Pretest)	**Control**	21	4.24			

As is seen in Table 4, pretest-posttest scores of the critical thinking skills test showed a statistically significant difference in the experimental and control groups according to t test ($t_{criticalthinkingdifference}(41)=9.50$. $p=0.00$. $p<0.05$; $r= 0,82$) and this difference can be said to be in favor of the experimental group. When the effect value of this difference indicating the effect size of the education program was examined, it was observed to be at a high level ($r=>0.50$). Table 5 shows the results of paired samples t test and Wilcoxon test performed to determine whether or not pretest and posttest scores of children in the experimental and control groups differed to examine the effectiveness of the education program.

Table 5. Results of Wilcoxon Test and Paired Samples t test for the Difference of the Pretest-Posttest Scores of the Experimental and Control Groups Related to the overall Critical Thinking Skills Test

t test	Test	n	Mean	sd	t	p
Control	Pretest	21	36.14	20	-8.78	0.00
	Posttest	21	40.38			
Wilcoxon	**Pretest-Posttest**	**n**	**Mean rank**	**Total rank**	**z**	**p**
	Negative rank	0	0.00	0.00		
Experimental	Positive rank	22	11.50	253.00	-4.11	0.00
	Equal	0				

When the Wilcoxon test results in Table 5 were examined, the scores of the children in the experimental group showed a significant difference before and after the education program ($z_{experimental}=-4,11$, $p=0.00$. $p<0.05$). When the mean rank and total rank were considered, it was determined that this observed difference was in favor of positive ranks, i.e., posttest scores. According to Table 5, total scores of the children in the experimental group for the critical thinking skills increased after the storyline-based education program. When the paired samples t-test results were examined, the scores of the children in the control group showed a significant difference before and after the experimental procedure ($t_{control}(20)=-3.29$, $p=0.00$. $p<0.05$). In other words, the scores of the critical thinking skills of the children in the control group differed in favor of the posttest. Considering that the pretest scores of the overall total of the critical thinking skills test did not show difference, posttest pretest score differences showed a difference in favor of the experimental group and the posttest pretest scores of the children in the experimental group differed in favor of the posttest scores, it can be asserted that the storyline-based education program had a positive effect on the differentiation of total scores of the children from the critical thinking skills test.

Results Regarding the Interpretation Subscale of The Critical Thinking Skills Test

Table 6 shows the results of the 2*2 ANOVA pattern in the experimental and control groups for the pretest-posttest scores of interpretation subscale of the critical thinking skills test.

Table 6. ANOVA Analysis Results of the Pretest-Posttest Scores of the Interpretation Subscale of the Critical Thinking Skills Test in the Experimental and Control Groups

Variance Source	KT	Sd	KO	F	p
Inter-group					
Group (Experimental-Control)	6.12	1	6.12	1.08	0.31
Error	232.28	41			
Intra-group					
Measurement (Pretest-Posttest)	42.21	1	42.21	36.33	0.00*
Group* Measurement	11.60	1	11.60	9.99	0.00*
Error	47.63	41			

$p < 0.05$

As is seen in Table 6, the group (Experimental-Control) effect related to the pretest and posttest interpretation scores of the children in the experimental and control groups did not show a significant difference ($p>0.05$). When the measurement (pretest-posttest) effect was considered, a statistically significant difference was found between the pretest and posttest interpretation mean scores of the children ($F_{measurement}(1\text{-}41)=36.33$; $p=0.00<0.05$). When the common effect of group*measurement performed to determine the effectiveness of the storyline-based education program was considered, it was determined that the common effects of repeated measurement (pretest-posttest) factors on interpretation scores of the participants in the experimental and control groups were statistically significant ($F_{group*measurement}(1\text{-}41)=9.99$; $p=0.00<0.05$; $\eta^2=0.20$). This result indicated that the storyline-based education program had a positive effect on increasing the interpretation scores of children. It was observed that this effect was at a low level ($\eta^2=<0.30$). When considering the changes in the interpretation mean scores (Experimental posttest-pretest=2.13>Control posttest-pretest =0.67), it was determined that the increase in the interpretation scores of the children in the experimental group was higher than the children in the control group.

Results Regarding the Explanation Subscale of the Critical Thinking Skills Test

Table 7 shows the t-test results related to the examination of pretest-posttest difference scores of the explanation subscale of the critical thinking skills test in terms of the experimental and control groups.

Table 7. T-Test Results Regarding the Investigation of the Differences between the Pretest-Posttest Scores of Explanation Subscale of the Critical Thinking Skills Test In Terms of Experimental and Control Groups

t test	Group	N	Mean	df	t	p
Explanation difference (Posttest - Pretest)	**Experimental**	22	1.77	41	2.83	0.01*
	Control	21	0.81			

As is seen in Table 7, pretest-posttest difference scores of the explanation subscale of the critical thinking skills test showed a statistically significant difference between experimental and control groups ($t_{explanationdifference}(41)=2.83$, $p=0.01$, $p<0.05$; $r=0,44$) and this difference can be said to be in favor of the experimental group. When the effect value of this difference was examined, it was observed to be at a moderate level ($r=>0.30$).

Table 8 shows the results of the Wilcoxon test applied to determine whether or not the pretest and posttest scores of the children in both experimental and control groups differed.

Table 8. Wilcoxon Test Results Related to the Pretest and Posttest Scores of the Explanation Subscale of the Critical Thinking Skills Test in the Experimental and Control Groups

Wilcoxon	Posttest-Pretest	n	Mean rank	Total rank	z	p
Experimental	Negative rank	0	0.00	0.00	-3.87	0.00
	Positive rank	19	10.00	190.00		
	Equal	3				
Control	Negative rank	2	7.50	15.00	-3.12	0.00
	Positive rank	15	9.20	138.00		
	Equal	4				

When the Wilcoxon test results in Table 8 were examined, the scores of the children in the experimental group before and after the education program showed a significant difference ($z_{experimental}$=-3.87, p=0.00. p<0.05). When the mean rank and total rank were considered, this observed difference was in favor of positive ranks, that is, in favor of posttest scores. The explanation subscale scores of the children in the experimental group increased after the education program. Similarly, when the Wilcoxon test results were examined, the scores of children in the control group before and after the education program showed a significant difference ($z_{control}$=-3.12, p=0.00. p<0.05). In other words, the explanation subscale scores of the children in the control group differed in favor of the posttest. When considering the results, it can be asserted that the storyline-based education program had a positive effect on the differentiation of the scores obtained by the children from the explanation subscale of the test.

Results Regarding the Evaluation Subscale of the Critical Thinking Skills Test

Table 9 shows the results of the 2*2 ANOVA pattern in the experimental and control groups for the pretest-posttest scores of evaluation subscale of the critical thinking skills test.

Table 9. ANOVA Analysis Results of the Pretest-Posttest Scores of the Evaluation Subscale of the Critical Thinking Skills Test in the Experimental and Control Groups

Variance Source	KT	Sd	KO	F	p
Inter-group					
Group (Experimental -Control)	0.17	1	0.17	0.15	0.70
Error	48.41	41			
Intra-group					
Measurement (Pretest-Posttest)	8.97	1	8.97	24.74	0.00*
Group*Measurement	1.02	1	1.02	2.80	0.10
Error	14.87	41			

p < 0.05

As is seen in Table 9, the group (experimental-control) effect of evaluation subscale of the critical thinking skills test was not statistically significant (p>0.05). This result indicated that the evaluation levels of the children did not differ between the groups (experimental-control) without the discrimination of pretest and posttest. When the measurement (pretest-posttest) effect was considered, a statistically significant difference was obtained between the pretest and posttest mean scores of the children ($F_{measurement(1-41)}$=24.74; p=0.00<0.05). According to the result, it can be said that the evaluation levels of all the children without group (experimental-control) discrimination changed significantly according to the measurements (pretest-posttest). When the group*measurement common effect conducted to determine the effectiveness of the education program was considered, it was determined that the common effects of the repeated measurement (pretest-posttest) factors on the evaluation levels of the students in the experimental and control groups were not statistically significant ($F_{group*measurement(1-41)}$=2.80; p=0.00>0.05). This result indicated that the education did not have any significant effect on increasing the evaluation skills of the children.

Results Regarding the Inference Subscale of the Critical Thinking Skills Test

Table 10 shows t test results regarding the investigation of the difference of the pretest-posttest scores of the inference subscale of the critical thinking skills test between the experimental and control groups.

Table 10. Mann Whitney U Test Results Regarding the Investigation of the Difference of the Pretest-Posttest Scores of the Inference Subscale of the Critical Thinking Skills Test in the Experimental and Control Groups

Mann Whitney U Test	Group	N	Mean rank	Total rank	U	p
Inference difference	**Experimental**	22	27.64	608.00	107.00	0.00*
(Posttest-Pretest)	**Control**	21	16.10	338.00		

As seen in Table 10, a statistically significant difference was observed between the experimental and control groups in terms of pretest-posttest difference scores of the inference subscale of the critical thinking skills test ($U_{inferencedifference}$=107.00. p=0.00. p<0.05; r=0,49). In other words, it can be asserted that the pretest-posttest difference scores showed a difference between experimental and control groups and this difference was in favor of the experimental group. When the effect value of this difference was examined, it was observed to be at a moderate level (r=>0.30). Table 11 shows the results of the paired samples t test and Wilcoxon test applied to investigate whether or not the pretest and posttest scores of the children in the experimental and control groups differed.

Table 11. The Results of Paired Samples t test and Wilcoxon Test for the Difference of the Pretest-Posttest Scores of the Experimental and Control Groups in the Inference Subscale of the Critical Thinking Skills Test.

t test	Test	n	Mean	sd	t	p
Experimental	Pretest	22	4.18	21	-6.56	0.00
	Posttest	22	5.59			
Wilcoxon	**Posttest-Pretest**	**n**	**Mean rank**	**Total rank**	**z**	**p**
	Negative rank	0	0.00	0.00		
Control	Positive rank	10	5.50	55.00	-3.16	0.00
	Equal	11				

When the paired samples t test results in Table 11 were examined, the scores of the children in the experimental group before and after the storyline-based education showed a significant difference ($t_{experiment}(21)$=-6.56, p=0.00. p<0.05). In other words, the scores of the children in the experimental group from the inference subscale of the critical thinking skills test increased after the education program. When Wilcoxon test results were examined, the scores of the children in the control group showed a significant difference before and after the education ($z_{control}$=-3.16, p=0.00. p<0.05). When the mean rank and total rank were considered, this observed difference was seen to be in favor of positive ranks, that is, in favor of posttest scores. When the results were taken into consideration, it can be asserted that the education program had a positive effect on the differentiation of the scores obtained by the children from the inference subscale of the test.

Results Regarding the Analysis Subscale of the Critical Thinking Skills Test

Table 12 shows t test results related to the investigation of the difference between the pretest-posttest scores of the analysis subscale of the critical thinking skills test.

Table 12. t test results Related to the Investigation of the Difference of the Pretest-Posttest Scores of Analysis Subscale of the Critical Thinking Skills Test in the Experimental and Control Groups

t test	Group	N	Mean	df	t	p
Analysis difference	**Experimental**	22	1.64	41	3.87	0.00*
(Posttest - Pretest)	**Control**	21	0.43			

As is seen in Table 12, pretest-posttest difference scores of the analysis subscale of the critical thinking skills test showed a statistically significant difference between the experimental and control groups ($t_{analysisdifference}(41)=3.87$, p=0.00. p<0.05; r=0,51). In other words, it can be asserted that the pretest-posttest difference scores show a difference between the experimental and control groups and this difference was in favor of the experimental group. When the effect value of this difference was examined, it was observed to be slightly above a moderate level (r=>0.30). Table 13 shows the results of the paired samples t test and Wilcoxon test applied to investigate whether or not the pretest and posttest scores of the children in both experimental and control groups showed a difference in order to investigate the effectiveness of the education program.

Table 13. Results of Paired Samples t Test and Wilcoxon Test for the Related Samples for the Differences of the Pretest-Posttest Scores of the Experimental and Control Groups in the Analysis Subscale of the Critical Thinking Skills Test

T test	Test	n	Mean	sd	t	p
Control	Pretest	21	4.71	20	-3.29	0.00
	Posttest	21	5.14			
Wilcoxon	**Posttest-Pretest**	**n**	**Mean rank**	**Total rank**	**z**	**p**
	Negative rank	0	0.00	0.00		
Experimental	Positive rank	16	8.50	136.00	-3.59	0.00
	Equal	6				

When the Wilcoxon test results in Table 13 were analyzed, it was observed that the scores of the children in the experimental group before and after the education program showed a significant difference ($z_{experimental}$=-3.59, p=0.00. p<0.05). When the mean rank and total rank were considered, it was seen that this difference was in favor of positive ranks, that is, in favor of posttest scores. The analysis subscale scores of the children in the experimental group increased after the education program. When the paired samples t test results were examined, the scores of the children in the control group showed a significant difference before and after the education program ($t_{control}(20)$=-3.29, p=0.00. p<0.05). In other words, the analysis subscale scores of the children in the control group differed in favor of the posttests. When the results were considered, it can be asserted that the storyline-based education program had a positive effect on the differentiation of the scores obtained by the children from the analysis subscale of the test.

Results Regarding the Self-regulation Subscale of the Critical Thinking Skills Test

Table 14 shows the results of the 2*2 ANOVA pattern in the experimental and control groups for the pretest-posttest scores of self-regulation subscale of the critical thinking skills test.

Table 14. ANOVA Results of the Pretest-Posttest Scores of the Self-regulation Subscale of the Critical Thinking Skills Test in the Experimental and Control Groups

Variance Source	KT	Sd	KO	F	p
Intergroup					
Group (Experimental-Control)	26.34	1	26.34	1.56	0.22
Error	693.89	41			
Intragroup					
Measurement (Pretest-Posttest)	292.84	1	292.84	153.83	0.00*
Group*Measurement	110.04	1	110.04	57.81	0.00*
Error	78.05	41			

p < 0.05

As is seen in Table 14, the group (Experimental-Control) effect for the pretest and posttest self-regulation scores of the children in the experimental and control groups did not show a statistically significant difference (p>0.05). This result indicated that the self-regulation pretest and posttest scores of the children did not differ between the groups (Experimental-Control). When the measurement

(pretest-posttest) effect was considered, a statistically significant difference was obtained between the pretest and posttest self-regulation mean scores of the children ($F_{measurement(1-41)}$=153.83; p=0.00<0.05). According to the result, self-regulation scores of all of the children can be said to change significantly in terms of the measurements (pretest-posttest) without making group discrimination (Experimental-Control). When the common effect of group*measurement conducted to determine the effectiveness of the education program was considered, it was determined that the common effects of the repeated measurement (pretest-posttest) factors on the self-regulation scores of the children in the experimental and control groups were statistically significant ($F_{group*measurement(1-41)}$=57.81; p=0.00<0.05; η2=0.59). This result showed that the storyline-based education program was an effective factor in increasing children's self-regulation scores. It was observed that this effect was above the moderate level (η2=>0.50). When the change in the self-regulation mean scores was considered ($Experimental_{posttest-pretest}$=5.96 > $Control_{posttest- pretest}$ =1.43), it was found that the self-regulation scores of the children in the experimental group had a higher increase compared to the children in the control group.

Results About the Retention of the Storyline-based Education Program

In the study, CTTC applied as the pretest and posttest was applied again to the experimental group two weeks after the posttest. Table 15 shows the results of One-way ANOVA for the Repeated Measures and Friedman Test applied to determine whether or not the differences between the pretest, posttest and retention test mean scores obtained by the children in the experimental group from the interpretation, explanation, evaluation, inference, analysis, self-regulation subscales of the critical thinking skills test and from the overall test were significant.

Table 15. Results of Friedman Test and One-Way ANOVA Related to the Pretest, Posttest, and Retention Test Scores of the Children in the Experimental Group from the overall CTTC and its Subscales

Friedman Test	**Test**	**n**	**Mean rank**	**Sd**	χ^2	**p**	**Significant Difference**
	Pretest	22	1.00				
Overall Total	Posttest	22	2.09	2	42.29	0.00*	3>1. 2>1. 3>2
	Retention test	22	2.91				
	Pretest	22	1.11				
Explanation	Posttest	22	2.30	2	36.40	0.00*	3>1. 2>1
	Retention test	22	2.59				
	Pretest	22	1.41				
Evaluation	Posttest	22	2.20	2	20.12	0.00*	3>1. 2>1
	Retention test	22	2.39				
	Pretest	22	1.16				
Inference	Posttest	22	2.36	2	35.62	0.00*	3>1. 2>1
	Retention test	22	2.48				
	Pretest	22	1.23				
Analysis	Posttest	22	2.32	2	32.44	0.00*	3>1. 2>1
	Retention test	22	2.45				
ANOVA	**Variance Source**	**KT**	**Sd**	**KO**	**F**	**p**	**Significant Difference**
	Measurement	74.82	2	37.41			
Interpretation	Error	50.52	42	1.20	31.10	0.00	3>1. 2>1
	Total	138.34					
	Measurement	558.51	2	279.11			
Self-regulation	Error	88.46	42	2.11	132.53	0.00	3>1. 2>1. 3>2
	Total	646.97					

According to Table 15, it was observed that the difference between the posttest ($\bar{X}_S = 7{,}36$) and retention test scores ($\bar{X}_K = 7{,}59$) in interpretation subscale of CTTC was not significant; the difference between the posttest (($SO_S = 2.30$) and retention test scores ($SO_K = 2.59$) in the explanation subscale was not significant; difference between the posttest ($SO_S = 2.36$) and retention test scores ($SO_K = 2.48$) in the inference subscale of the test was not significant, and there was no significant difference between the posttest ($SO_S = 2.32$) and retention test mean scores ($SO_K = 2.45$) in the analysis dimension. This result showed that the storyline-based education program kept its effect. It was observed that the difference between the posttest ($SO_S = 2.30$) and retention test scores ($SO_K = 2.59$) in the self-regulation subscale of the test was significant and there was a significant difference between the posttest ($\bar{X}_S = 18.23$) and retention test mean scores ($\bar{X}_K = 18.64$) related to the CTTC total score. This result showed that the effect of the program increasingly continued for CTTC overall and self-regulation subscale.

Discussion, Conclusion and Suggestions

In accordance with the results of the study investigating the effect of the storyline-based education program on the critical thinking skills of preschool children, the storyline-based education program was determined to have a positive effect on the interpretation, explanation, inference, analysis, self-regulation skills and the general critical thinking skill levels of the children. The storyline-based education program caused a score increase in the evaluation subscale of the critical thinking skills but it did not cause a significant difference. This can be explained with the fact that the evaluation is more comprehensive and a difficult-to-acquire skill. When examining the evaluation subscale in terms of Bloom's taxonomy; it is observed to be one of the skills that is more difficult and time-consuming to gain in the taxonomy (Bümen, 2006).

When the literature on this subject is examined, it is seen in the studies that the critical thinking skills of the children can be improved by using difference methods (Akköse, 2008; Bodur, 2010; Chandra, 2008; Demir, 2006; Dovigo, 2016; Duran & Dökme, 2016; Karadağ & Demirtaş, 2018; Koç, 2007; Tonus, 2012). When examining this matter from interpretation and explanation skills, being the subscales of critical thinking as examined in this study, Karadağ and Demirtaş (2018) found that the "Philosophy with Children" education program positively affected the development of language and cognitive skills of preschool children in the context of critical thinking skills. In the study by Dovigo (2016), it was found that the argumentation technique might be used in developing the discussion skills of preschool children and the explanation skill, which is among the subscales of critical thinking. On the other hand, Tonus (2012) investigated the effect of argumentation technique on critical thinking skills of children residing in different regions and determined that the argumentation technique did not cause a significant effect on interpretation skills of the children residing in shantytown but affected positively interpretation skills of the children residing in the city center. In the study by Demir (2006), it was determined that the "training program of social studies" improved interpretation and explanation skills, being subscales of critical thinking, in children attending fourth and fifth grades. As a result of the study by Bodur (2010) examining the effect of content-based critical thinking education on the critical thinking skills of children, it was determined that content-based critical thinking education increased children's use of interpretation skills, which are among critical thinking strategies they use in the classroom. As a result of the study conducted by Koç (2007) to investigate the effectiveness of traditional learning methods and active learning methods on children's critical thinking skills, it was stated that children used explanation skills more in cases where active learning methods were used. When examining the evaluation subscale of critical thinking, it was observed that the related studies had similarities with the results obtained from the present study. Demir (2006) determined that the training program of social studies did not create a significant difference in evaluation subscale, one of critical thinking skills of fourth-grade children. In the study by Bodur (2010) it was found that content-based thinking education developed the evaluation skill as a critical thinking strategy at moderate level. Tozduman Yaralı and Güngör Aytar (2018) examined critical thinking skills in terms of gains in the MoNE (Ministry of National Education) Preschool Education Curriculum and determined that least involved skills in the curriculum were analysis and evaluation.

When examining analysis and inference subscales of critical thinking, Chandra (2008) conducted a study with preschool children using Vygotskian approach to examine the effect of mother-child interaction on critical thinking skills of children and determined that the mother-child interaction affected positively critical thinking skills in the preschool period by improving reasoning skill of children. Similarly, Murphy et al. (2014) also revealed that parent-child interaction was important in development of inference and critical-analytic thinking skill of children. Akköse (2008) found that creative drama had a positive effect on preschool children's skills of establishing a cause-effect relationship for natural events during scientific activities. In the study conducted by Ayvacı (2010) for preschool children, it was found that activities based on scientific process skills developed the inference skills of children. Duran and Dökme (2016) found that the inquiry-based learning approach improved all the subscales of critical thinking including analysis subscale.

When considering critical thinking with the self-regulation subscale; Butler, Pentoney, and Bong (2017) compared intelligence and critical thinking skill in terms of their predictive effect on life events in their study. As a result of their study, they found that critical thinking had a greater predictive effect on life events than intelligence and individuals with higher critical thinking skill and intelligence scores reported fewer negative life events compared to individuals with lower scores. Based on their study results, Butler et al. (2017) stressed that critical thinking was a teachable skill and indicated that negative life events could be prevented by bringing critical thinking skills in individuals. In their study, Fernández-Santín and Feliu-Torruell (2020) used the Regio Emilia philosophy to develop the critical thinking skills of preschool children. As a result of their study, they revealed that critical thinking might be developed in early childhood by playing games, making decisions, trying, reflecting, discussing to obtain results and expressing art in various ways. It is believed that the Regio Emilio philosophy with its child-sensitive atmosphere enabling children to express themselves in various ways, provides the necessary climate for critical thinking. In the study by Davis-Seaver (1994) aiming to determine in which environments children mostly used the critical thinking skills, it was found that children used the critical thinking skills mainly out of school time. They explained this result of the study with the fact that children use the thinking processes more actively outside school and the thinking processes were under their control. Thus, it can be asserted that while democratic and unstructured environments where children can control their learning, pave the way for developing the critical thinking skills of children, traditional school curricula restrict the opportunities of structuring thinking and mental relationships (Causey, 2016). Because critical thinking skills develop in a democratic trust environment where the individual is appreciated (Bookfield, 1987; Hart, 2016; Williams Howe, 2016). When assessing the effect size according to the results of the study, it was seen that the storyline-based education method highly affected critical thinking skills of the children with all subscales. In addition, it was determined that there was an effect size above moderate in the analysis and self-regulation subscale of critical thinking, a moderate effect size in the explanation and inference subscales; and a low effect size in the interpretation subscale. The fact that the lowest effect size was observed in the interpretation subscale can be explained with a relative increase in the interpretation scores of the children in the experimental and control groups after the education program, compared to the other subscales. And the fact that the effect size was above moderate in the analysis and self-regulation subscales can be explained with the more content of the education program to support these subscales. The high effect size revealing for the general total of critical thinking skill indicates sufficiency of the storyline-based education program and its effectiveness on critical thinking skill.

As a result of this study, it was concluded that the education program prepared with storyline method was effective on the critical thinking skills of five-year-old children. The theoretical limitation of the study is that the critical thinking skills of the children were examined within the context of six subscales/skills (interpretation, explanation, evaluation, inference, analysis, and self-regulation)

prepared under the leadership of Facione (1990). Methodological limitation of the study is that the critical thinking skills of the children were assessed by using "Critical Thinking Skills Test for 5-6-year-old children" and the children in the study group could not be randomly assigned. In addition, one of the limitations on the method was that the retention test application could not be delayed more and it was performed two weeks after the application of the posttest as the closing date of schools was 08.06.2018. It can be recommended for further studies to assess critical thinking skills of children residing in different regions to be selected via random method by using various assessment tools. Additionally, when the results of the study were taken into account, it can be recommended to

- Conduct studies based on parent-child interaction in order to develop critical thinking skills of children attending a preschool education institution.
- Investigate the effect of education programs to be developed within the scope of interactive reading activities or philosophy studies with children, on critical thinking skills of children.
- Carry out in-class activity observations in preschool classrooms to determine which strategies and methods are used in the classrooms in order to determine how teachers support the critical thinking skills of the children,
- Conduct studies on how the critical thinking skills of children from different educational grades affect the educational process (academic achievement, social skills, etc.),
- Conduct studies examining how the critical thinking skills in early childhood predict the developmental areas in the next years of life via longitudinal studies.

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