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The Effect of Philosophy Education on Mathematics Success*

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Abstract
The aim of this study reveal the effect of philosophy education on students' mathematics achievement. The research sample consists of a total of 38 students, 18 of whom are experimental and 20 of them are control groups, studying in the 7th grade in Şehit Koray Akoğuz Secondary School in İpekyolu, Van in the second semester of the academic year 2019-2020. The mixed method was used in this study because the data of the research were collected both quantitatively. In the quantitative study part of the study, pretest and posttest quasi-experimental design with experimental and control groups was used, and special case design was used in the qualitative study. At the end of the application, individual interviews were made with 6 students in the experimental group using a semi-structured interview form. While in the analysis process of quantitative data independent groups t-test was used, in the analysis of qualitative data, codes were created and data were analyzed. In the process of collecting the data, the experimental group students were given speeches and discussions on philosophy related concepts in elective courses 2 hours a week for 8 weeks by the teacher of Religious Cukture and Ethics who was educated in the field of philosophy education and students were taught books on philosophy for children. Control group students continued with the normal curriculum in this process. An achievement test of 22 questions was developed by taking expert opinion after its validity and reliability were made by the researcher. The achievement test was applied to both groups as a pre-test before the application and as a post-test at the end of the application. In the analysis of qualitative data, a semi-structured interview consisting of 4 questions prepared by the researcher with expert opinion was applied with 6 students from the experimental group. As a result of the quantitative analysis, it was concluded that philosophy education had a positive effect on students' mathematics achievement. As a result of qualitative analysis, philosophy education improved students' sense of curiosity, helped in solving math problems, and improved students in reading comprehension. Also, another result is that students' interest in philosophy has increased.

Keywords: Philosophy, Philosophy Education, Mathematics and Philosophy, Mathematics Education

1. Introduction

Today, mathematics is not perceived as a collection of abstract concepts and skills that need to be learned, as it used to be, but as knowledge that is based on modeling reality, formed through the process of problem solving and interpretation, and skills that develop in this process. In line with this understanding, the goal of learning

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mathematics has been to provide mathematical disposition rather than isolated mathematical concepts and skills (De Corte, 2004). Mathematical aptitude, or in other words, a tendency to do mathematics, well-organized instructional content, mastery in using problem-solving strategies, cognitive and affective self-regulation skills, It is directly related to beliefs about mathematics and problem solving, and it requires the development of these abilities of students first (Altun, 2010).

Philosophy is another branch of science that develops the student's ability to ask questions and develops their ability to question and criticize. The general purpose of philosophy is the field of interest of people who seek knowledge, try to learn, and do it with love. The most important feature that distinguishes philosophy from other branches of science is its self-questioning. From this point of view, philosophy appears as an educational process. According to Çotuksöken (2005), philosophy education is related to asking questions, turning to the existing with questions, looking at the existing by changing the point of view, and a special kind of thinking and expressing education. Thinking philosophically, knowing philosophically, living philosophically, always accompanies the in-between person in her actions and relationships. This way of thinking is also functional in evaluating it as an educational context. This functional dimension is related to the critical thinking dimension. The center of philosophy education lies in certain questions that the reflective human mind finds. Naturally, the best way to start philosophy education with surprising questions is to think (Nagel, 1987).

Various methods have been tried in order to increase the quality of education in our country and in the world. Many studies have been done for this, the factors affecting the success levels have been examined and many researches have been done in this sense. When necessary solutions can be produced for these factors, students' mathematics achievement can reach the desired level. The following objectives are expected from the students in the general objectives of the MEB mathematics curriculum:
Will be able to develop and use mathematical literacy skills effectively.
Will be able to use mathematical terminology and language correctly to explain and share mathematical ideas in a logical way.

By using the meaning and language of mathematics, she will be able to make sense of the relations between people and objects and the relations of objects with each other.

They will be able to develop their metacognitive knowledge and skills and consciously manage their own learning processes.

In the problem solving process, they will be able to easily express their own thoughts and reasoning, and will be able to see the deficiencies or gaps in the mathematical reasoning of others.

Considering these items, students are expected to use what they have learned in mathematics rather than memorizing in daily life, to establish relationships between objects and people, to reveal their own original ideas, and to be able to realize their own deficiencies and produce solutions for them. Likewise, the aim of philosophy education is; It is to raise courageous modern people who know how to think, who make meaningful criticism, who doubt, who try to learn and question, who are in an effort to learn rather than getting information directly (Taşdelen, 2007).

When the results of PISA (The Program for International Student Assessment), one of the international exams held in our country, are analyzed, Turkey was ranked 50th out of 72 countries in terms of mathematical literacy. Mathematical literacy focuses on measuring students' ability to use, interpret and mathematical logic in mathematics (PISA, 2015).

The fact that mathematics and philosophy are in a close relationship, the expectations of the Ministry of National Education in the mathematics curriculum are parallel to this, the deficiencies in mathematics education considering the situation of our country in international platforms and the fact that there are very few studies on this subject in the literature review, and the fact that philosophy education in England has a positive impact on students. The results of a study examining the effect of this issue necessitated the study of this subject (Gorard, Siddiqui & See, 2015).

In the study of Badri and Vahadi (2017), in which they examined the effect of the philosophy teaching program to children, they aimed at the effect on the spiritual intelligence of female students. According to the pre-test and post-test results, it was observed that there was a significant increase in the psychological intelligence of the girls in the experimental group.

Erfani and Rezai (2016) studied with female students of a school in Hamedan in the academic year 2010-2011 to determine the effect of teaching philosophy on students' critical thinking. As a result of the research, it has been shown that teaching philosophy can improve students' critical thinking.

Sare, Luik, and Tulviste (2016) examined the effect of the philosophy program for children on the verbal reasoning skills of preschool children. The students in the experimental group showed an increase in their reasoning, verbal reasoning, reasoning and analogy skills.

In their study, Abaspour, Nowrozi, and Latifi (2015) examined the effect of philosophy in children on the spiritual development of female students. The findings of this study showed that the practice of philosophy activities led to students' spiritual development in terms of God awareness, majesty, and instability, but did not affect students' spiritual development in terms of impression management and realistic acceptance.

In their study, Ghaedi, Mahdian, and Fomani (2015) aimed to teach children the elements of creative thinking according to Torrance's creative thinking framework in preschool children. As a result of this study, an increase was observed in children's creative thinking skills, their ability to gain a different perspective and produce original ideas.

Pourtaghi, Hosseini, and Hejazi (2014) examined the effect of philosophy on children's creativity in their study. It has been concluded that philosophy in children increases children's creativity.

In the study of Polat and Akay (2020) on the effect of philosophy education on the brain development of early children, it was concluded that the philosophical education to be given in the pre-school period would enable children to start primary school with equal opportunities in terms of development. In addition, the idea has emerged that the way to raise generations that will make a difference in the future is through the individual's philosophical thinking skills.

Dirican (2018) examined the effect of philosophy education activities applied to preschool children on the philosophical attitudes and behaviors of children. As a result of the research, it was concluded that the philosophy education activities contributed to the development of the philosophical attitudes and behaviors of the children in the experimental group. In addition, it has been observed that children have a positive effect on their ability to make predictions, realize their thoughts, express different opinions, be tolerant, be curious about what is happening around them, and ask questions.

Koyuncu (2018) investigated the effectiveness of philosophy of mathematics activities on students' attitudes towards mathematics, beliefs and mathematical thinking variables. At the end of the analysis; It was observed that Philosophy of Mathematics Activities increased students' attitudes and beliefs towards mathematics positively, but did not cause any statistically significant difference in mathematical thinking skills.

Taş (2017) examined the effect of the Philosophy Education Program for Children on the theory of mind and creativity of 48-72 months old children. As a result of the research, a statistically significant difference was found in favor of the experimental group between the total scores of the children in the experimental group and the control group, and the scores obtained from the creativity post-test and the scores of the creativity sub-dimensions. According to the results of the research, Philosophy for Children has positive effects on the theory of mind and creativity of 48-72 months old children.

Kartalcı, Acar, Merve, and Işık (2021) conducted a study on 9th and 10th grade students' philosophical thoughts about the nature of mathematics and their mathematical resilience.

Yazıcı (2015), in his study to examine the relationship between music education and philosophy and to reveal the necessity of philosophical-based music education, partially included the philosophy course in the music teaching departments until today, that it is one of the problems in our national music education system, that an attitude towards philosophy is exhibited, He concluded that these sections prevent them from being places where information is used and how to use information is taught rather than places where information is obtained. As a result of this, it has been seen that the music educator cannot raise individuals who can solve problems and think critically, creatively and reflectively, therefore, cultural-artistic gains cannot be achieved on the right basis.

Kılıç (2019) conducted a study of pre-service mathematics teachers to reveal their philosophical views on the nature of mathematics, and concluded that the pre-service teachers had views on quasi-experimental philosophy, which could be due to the impressions they had in the field education courses they took during the pedagogical formation certificate program.

Yeşilyurt-Çetin (2021) aimed to determine the place and importance of philosophy of mathematics in mathematics education in her study to reveal expert opinions on philosophy of mathematics and mathematical thinking. According to the results of the research, the instructors explained mathematical thinking as an abstract and coherent thinking for generating new information and solving problems using previous knowledge and high-level thinking skills. They defined the philosophy of mathematics as the act of questioning the nature and concepts of mathematics, thinking about mathematics in order to understand mathematics, discussing and explaining mathematical concepts. Instructors stated that the philosophy of mathematics course, which is important in terms of understanding, explaining and applicability of mathematical knowledge, also increased the interest and admiration for mathematics and suggested that this course should be included in the curriculum.

1.1 Purpose and Importance of the Research

The aim of this research is to examine the deficiencies in the literature and the effect of philosophy education on the mathematics achievement of seventh grade students in order to improve the level of students in mathematics education.

When the literature is examined, there are almost no studies on philosophy education at secondary school level. Most of the studies in Turkey remain at the qualitative level and the sample of most studies is pre-school students. In addition, in retrospect, although philosophy and mathematics are in a very close relationship, it is important to study the subject that there are very few studies on this subject.

On the other hand, the findings of the study and the blending of philosophy with mathematics to gain a new perspective, the students' development of a positive perspective towards philosophy, and the use of philosophy in order to prevent negative attitudes towards mathematics in Turkey are other important points.

1.2 Research Problem

The main problem statement of this research is to examine the effect of philosophy education on mathematics achievement. In line with this main problem, the following sub-problems were determined.

1.2.1 Subproblems

1. Is there a significant difference between the pretest and posttest achievement scores of the experimental group?
2. Is there a significant difference between the pretest and posttest achievement scores of the control group?
3. Is there a significant difference between the posttest achievement scores of the students in the experimental and control groups?
4. How does philosophy education affect the reasoning skills of the experimental group students?

2. Method

2.1 Population and Sample of the Research

As seen in Table 1, a pre-test was applied to both groups before the application, and the experimental group was taught about philosophy education for two hours a week for eight weeks. The effect of philosophy education on mathematics achievement was examined by applying an achievement test eight weeks after the application.

Table 1: Representation of the Research Model

Groups	Pretest	Working Process	Lasttest
Experimental Group	Achievement test consisting of 6th grade subjects	Two hours of elective courses were taken from the elective courses without interruption of the education-training program, and a course on philosophy was taught to the children by the Religious Culture and Moral Knowledge Teacher, who was educated in the field of philosophy, and this process lasted for 8 weeks.	Achievement test consisting of 6th grade subjects
Control Group	Achievement test consisting of 6th grade subjects	In the control group, normal education was carried out for 8 weeks without any study on philosophy education.	Achievement test consisting of 6th grade subjects

In the section where the qualitative research method was applied, the participants were determined according to purposive sampling, which is one of the non-random sampling methods. In this method, it is used in cases where the sampling units, that is, the probability of being selected for the sample, are not the same. Since it was desired to select situations that would provide diversity in terms of information in accordance with the purpose in order to conduct in-depth research, this sampling was applied (Büyüköztürk, Kılıç Çakmak, Akgün, Karadeniz, & Demirel, 2015). The participants of this sample consist of a total of 6 students from the experimental group. The students participating in the study were selected on a voluntary basis

Table 3: Topics Covered by Experimental Group Students Every Week

1th week	In the first week, speeches and discussions were held on the concept of love. Questions were asked to the students at the beginning of the lesson on this subject, and it was tried to arouse their curiosity. Parallel to the teaching of the lesson, the teacher asked What is Love? A part of the book called "The book" was read and the students were asked to express their thoughts on the subject and the opportunity to discuss with their friends was provided and students' participation in the lesson was ensured.
2th week	In the second week, speeches and discussions were held on the concept of friendship. What is Friendship on this topic? chapters from the book were read. The course content has progressed as in the previous week.
3th week	In the 3rd week, there were speeches and discussions on the concept of success and failure. Chapters from the book Success and Failure on this subject have been read. The course content has progressed as in the previous week.
4th week	The topic covered with the students in the 4th week was related to the development of the students' sense of self. About this Who Am I? The book was used. The course content has progressed as in the previous week.
5th week	The subject covered with the students in the 5th week was about human behavior. How Should I Behave About This Issue? and Do I Need Others? certain parts of his books were read. The course content has progressed as in the previous week.
5th week	In the 6th week, the subject discussed with the students was about goodness and evil. On this subject, the books What is Goodness? What Is Moral and What Is Not have been used. The course content has progressed as in the previous week.
7th week	In the 7th week, the subject of death and life was discussed with the students. The book

	Life and Dying as a book determined the content of the course. The course content has progressed as in the previous week.
8th week	The subject covered by the students in the 8th week was on the concept of time. The book on this subject, Time is Too Much and No Time is the content of the course. The course content has progressed as in the previous week.

The content of philosophy education consists of topics such as love, friendship, goodness, friendship at a level that children can understand. First of all, the students were asked questions about these concepts at the beginning of the lesson and it was tried to arouse the curiosity of the students. Afterwards, certain stories from philosophy books for children were read by the teacher. The students were allowed to talk about the story, and the opinions of the other students were taken to the questions asked by the students and it was tried to ensure the participation of the students in the lesson. Apart from the discussions in the lesson, the books suitable for the level of the students were given and they were allowed to read them alternately. These books are: The Philosopher Boy/How Should I Behave? The Philosopher's Machine and a Roadmap: How to Make Philosophy for Children (P4C)?, The Philosopher Boy/Who Am I?, The Philosopher Boy/What Is Love?, The Philosopher Boy/Do I Need Others? , The Philosopher Child/What is Friendship? Word and Silence/Crispy Philosophy, Me and Others/ Crunchy Philosophy, Believing and Knowing/Crummy Philosophy, Philosopher Child/ What is Kindness?, Moral and Non-Moral/ Crunchy Philosophy, Success and Failure/ Crispy Philosophy, Life and Dying/ Crispy Philosophy, Too Much Time and No Time/ Crispy Philosophy. At the end of this process, a post-test was administered to the experimental group students.

The control group did not receive any training during this period and continued with the normal education program. In the process of obtaining qualitative data, a semi-structured interview was applied by going to the homes of 6 experimental group students. A voice recorder was used in the interviews and the duration of the interviews lasted approximately 5-10 minutes.

2.4 Data Collection Tools

As a data collection tool in the research, an achievement test of 25 questions covering 6th grade mathematics was prepared. In order to determine the content validity of the test, the opinions of an expert lecturer and three mathematics teachers were consulted. A pilot study was conducted with 7th grade students to determine the reliability of the achievement test. 70 students in a secondary school in Van province İpekyolu district participated in this pilot application. As a result of the application, the reliability of this test was found to be 0.76. However, since the item difficulty of the 4th, 22nd and 23rd questions in the test was below 0.20, they were excluded from the test. Thus, the Cronbach Alpha coefficient was calculated as 0.80.

In the qualitative part of this research, semi-structured interview was used as a data collection tool. The reason for using this data collection tool is that the interviews are more flexible and provide the opportunity to ask additional questions depending on the course of the interview. Thus, the meeting became more efficient. Six open-ended questions were initially determined by the researcher, but the number of questions was reduced to four with the contribution of an expert academician and two mathematics teachers who had a master's degree in measurement and evaluation. In this way, the questions were given their final form. Interviews were conducted with six students from the experimental group in the study, and the interview took approximately 5-10 minutes. Interview questions are as follows:

1. What are your thoughts on developing the sense of questioning and curiosity about these applications made in elective courses?
2. What do you think about the philosophy books you have read within the scope of this application to give a different perspective on solving mathematical problems?
3. What are your thoughts on whether this application is helpful in solving the problems you encounter in daily life?
4. When we consider the benefits of these applications within the scope of mathematics, what can you say about this subject?

2.5 Analysis of Data

The aim of the research is to examine the effect of philosophy education on mathematics achievement. The study is a quasi-experimental study and an achievement test was applied to the students. SPSS.22 package program was used in the analysis of the study.

Before starting the application, it was checked whether the pretest achievement scores of the experimental and control groups were normally distributed. The achievement test scores applied to the students were entered into the SPSS.22 package program and the normality status was examined. To examine whether a test is normally distributed, one of the Kolmogorov-Smirnov or Shapiro-Wilk tests should be performed. It is expected that Kolmogorov-Smirnov (K-S) test will give more reliable results in cases where the sample size is above 50, and Shapiro-Wilk test will give more reliable results when the sample size is below 50 (Büyüköztürk, 2015).

Since the control group consisted of 18 students in the study, the Shapiro-Wilk significance value was checked in the normality test and this value was found to be 0.953. Since the normality analysis was greater than 0.05, the pre-test scores of the control group showed a statistically normal distribution. In the study, this value was found to be 0.275 in the Shapiro-Wilk significance test of the experimental group, whose sample number consisted of 20 students. Since the normality analysis was greater than 0.05, the pre-test results of the experimental group showed a statistically normal distribution. The normality test analysis results for the experimental and control groups are shown in Table 4.

Table 4: Experimental and Control Group Pre-Test Normality Analysis Results

		Kolmogorov-Smirnov			Shapiro-Wilk		
	Group	Statistics	Sd	p	Statistics	Sd	p
Pretest	Control	.156	18	.200	.980	18	.953
	Experiment	.149	20	.200	.943	20	.275

Before starting the research, it was checked whether the groups were equivalent according to their pretest scores. For this purpose, data entry was made to the SPSS.22 package program and it was examined whether the success scores of the two groups were significant. The results of the analyzes performed with the Independent Sample t-Test are shown in Table 5.

Table 5: Independent Sample t-Test Results Showing the Equivalence of the Groups

	Group	N	$\overline{X}$	S	t	Sd	p
Pretest	Class A	18	10.06	3.72			
	Class C	20	11.35	2.46	-1.279	36	.209
	Total	38					

When Table 5 was examined, the p value was found to be 0.209 (>0.05). Considering this result, it is seen that the experimental and control groups are equivalent to each other according to the pretest success score.

In the post-application analyzes, it was checked whether the post-test achievement scores of the experimental and control groups were normally distributed. SPSS.22 package program was used for analysis.

Table 6: Experimental and Control Group Post-Test Normality Analysis Results

	Kolmogorov-Smirnov			Shapiro-Wilk		
Posttest	Statistics	Sd	p	Statistics	Sd	p
	.092	38	.200	.969	38	.372

When Table 6 is examined, it shows the normality analysis made for the experimental and control group post-test. According to the Shapiro-Wilk normality analysis, the significance value was found to be 0.372. According to this result, the post-test achievement scores of the experimental and control groups show a normal distribution.

The data obtained in the qualitative part of this research were found by content analysis method. The data obtained in content analysis is examined more closely and it is aimed to make these data more understandable (Yıldırım & Şimşek, 2008). For this purpose, codes and themes were extracted from the data obtained from the participants, and the raw data were arranged and made more understandable. The raw data were coded by three experts. Two of the experts had a master's degree in measurement and evaluation, and the other expert consisted of a lecturer who gave the "Qualitative Data Analysis in Science Education" course for her master's degree. Three researchers came together and then compared the coding. As a result of this comparison, it was understood that the coding similarity was 79%. The data obtained are supported by tables and presented in a way that readers can understand.

3. Results

3.1 Findings and Comments on the First Sub-Problem

The first sub-problem of the study was "Is there a significant difference between the pre-test and post-test scores of the experimental group?" expressed as.

The application data consists of the answers to the 22-question achievement test applied to 20 experimental group students. Studies on 8-week philosophy education were carried out to the experimental group students. Students were given an achievement test before and after the application. The results of the dependent sample t-test analysis applied to the pre-test and post-test scores of the experimental group are given in Table 7.

Table 7: Analysis of Experimental Group Pretest and Posttest Success Scores

	N	$\bar{X}$	S	t	Sd	p
Pretest	20	11.35	2.46	-5.33	19	.00
Posttest	20	14.20	2.69			

When Table 7 is examined, the arithmetic mean of the pretest scores of the experimental group was 11.35, while the arithmetic mean of the posttest scores was 14.20. The significance value between the pretest and posttest scores was found to be .00 (< .05). As a result of the study, a statistically significant difference was found between the pretest and posttest scores of the experimental group consisting of 20 people. This difference was in favor of the post-test.

3.2 Findings and Comments on the Second Sub-Problem

The second sub-problem of the study was "Is there a significant difference between the pre-test and post-test scores of the control group?" expressed as.

The application data consists of the answers of the 22-question achievement test presented to 18 control group students. The normal education curriculum was applied to the control group. Pre-test and post-test were administered to the students at 8-week intervals. The results of the dependent sample t-test analysis applied to the pre-test and post-test scores of the control group are given in Table 8.

Table 8: Analysis of Control Group Pretest and Posttest Success Scores

	N	$\bar{X}$	S	t	Sd	p
Pretest	18	10.06	3.72	-1.42	17	.174
Posttest	18	11.11	3.87			

When Table 8 is examined, the arithmetic mean of the pretest scores of the control group was 10.06, while the arithmetic mean of the posttest scores was 11.11. The significance value between the pretest and posttest scores was 0.174 (> .05). As a result of the study, no statistically significant difference was found between the pretest and posttest scores of the control group consisting of 18 people.

3.3 Findings and Comments on the Third Sub-Problem

The third sub-problem of the study was *"Is there a significant difference between the post-test scores of the students in the experimental and control groups?"* expressed as.

The data group of the third sub-problem consists of a total of 38 students, of which 20 are in the experimental group and 18 in the control group. The application data consists of the results of the 22-question achievement test. The results of the independent groups t-test analysis applied to the posttest scores of the experimental and control groups are given in Table 9.

Table 9: Deney ve Kontrol Grubu Son-Test Başarı Puanlarının Analizi

	Group	N	$\overline{X}$	S	t	Sd	p
Posttest	Class A	18	11.11	3.87	-2.885	36	.007
	Class C	20	14.20	2.69			
	Total	38					

When Table 9 is examined, the arithmetic mean of the posttest scores of the control group was 11.11, while the arithmetic mean of the posttest scores of the experimental group was 14.20. A statistically significant difference was found between the experimental and control group posttest scores ($p = .007 < .05$). In other words, the difference between the arithmetic mean of the posttest scores of the experimental group and the control group was found to be 3.09, and this difference is statistically significant.

3.4 Findings and Comments on the Fourth Sub-Problem

Table 10: The Opinions of the Experimental Group Students on Philosophy Education on Developing the Sense of Inquiry and Curiosity

Codes	S1	S2	S3	S4	S5	S6
The student's ability to take their thoughts to the next level	+	-	+	-	-	+
Build self-confidence in students	+	-	+	-	+	-
Students can freely express their thoughts	+	-	-	+	-	-
Students can express themselves better	+	-	-	-	+	-
Giving a different perspective	-	+	-	+	+	-
Developing empathy in students	+	-	-	+	-	-
Encouragement to learn something new	-	+	-	-	-	+
Developing a positive attitude towards the lesson	-	+	-	-	+	-
Creating a sense of curiosity in the students outside of the lessons learned	+	-	+	-	+	-
The sense of curiosity creates feedback on the student	-	-	+	+	-	-
Making inquiries more efficient	-	-	+	-	+	-
Developing a sense of curiosity towards books	+	+	-	-	-	+
Developing a sense of curiosity towards life	-	+	-	-	+	+
To question life	-	-	-	+	+	-
Increasing the authority to ask questions	+	-	-	+	-	-
Creating a research request	-	-	-	+	+	-
Learning by questioning	-	-	-	-	+	+

When Table 10 is examined, the effects of the practices on students consist of two sub-themes. Considering the general effects of these practices, it is determined that most of the students gain different perspectives, the students feel more self-confident, and they carry their thoughts to a higher level.

Regarding taking their thoughts to an advanced level and expressing their thoughts freely, the student with the code S1 said, *"For example, it has taken our thinking level to an advanced level, you know, it has increased our self-confidence and expressing our thoughts more freely."* he expressed his opinion.

The student with the code S4 about gaining a different perspective of philosophy *"When we dealt with the subject of philosophy, it gave us different perspectives, not just our opinions, It has given us a different perspective, that is, other people look at an object we look at differently"* he expressed his opinion.

In the sub-theme of the applications to develop a sense of questioning and curiosity in students, the majority of the students stated that they were more curious about books, their sense of curiosity towards life developed, and they learned by questioning.

Regarding the development of the student's sense of curiosity towards books, the student with the code S3 said, *"I also developed an extreme sense of curiosity. After our discussions in the lessons, when I came home, I was taking notes on the subject on the computer and I had created a notebook for myself. Thus, I was asking the remaining questions to the teacher."* expressed his opinion as. Similarly, the student with the pseudonym S5 said, "I have a sense of curiosity. We were doing more research on the subjects we did not know, we presented our thoughts on it. Thanks to these lessons, we learned what to expect and how." expressed an opinion.

Regarding the sense of curiosity towards life and questioning life, the student with the pseudonym S6 said, *"I started to wonder more about the things around me, I started to question more."* expressed an opinion.

Table 11: Opinions of Experimental Group Students on the Books They Read Gain A Different Perspective in Solving Mathematical Problems

Codes	S1	S2	S3	S4	S5	S6
Developing processing skills	-	-	-	+	+	+
Speeding up problem solving	+	-	-	+	+	-
Discovering different solutions	+	-	-	+	-	-
Provide a more persistent approach to solving questions	-	-	+	-	-	+
Better understanding of the meaning relationship in questions	-	+	+	-	+	+
Searching for causality in the solution of the problem	-	-	+	-	-	+
Realizing that mathematics has a logical basis	-	+	-	+	-	-
Understanding that mathematics is not an abstract course	-	+	-	+	-	-
Developing verbal logic	+	-	-	-	+	-
Realizing that the questions are more understandable and clear	-	-	+	-	-	+

When Table 11 is examined, in Table 11, there are codes for the books that the students in the experimental group read about philosophy to gain a different perspective in solving mathematical problems. Most of the students stated that they noticed the meaning relationship in the questions more, they could understand even the questions well, they accelerated the problem solving and the questions had a logical basis.

Regarding the realization of the semantic relationship in the questions and the logical basis in mathematics, the student with the code S3 said, *"I focused more on the mathematics questions, about the meaning relationship, for example, why did I solve this question like this, why did I do it, these developed better with philosophy."* expressed an opinion.

Likewise, the student with the pseudonym S2 said, *"After reading the philosophy books, I tried to do mathematics more on logic rather than numerical memorization."* expressed an opinion.
Regarding the code of discovering different solutions in mathematical problems, the student with the nickname S1 said, *"First of all, we started with the examples we saw first. So we realized that we could solve these tests in two or three ways, not just one method."* expressed an opinion.

Regarding speeding up mathematical problems by reading philosophy books, student S4 said, *"We normally spent two hours doing operations in mathematics, but with philosophy we both improved our reading and gained speed in operations. So it accelerated us."* presented the idea.

Table 12: Student Opinions on the Points where the Application Helped Students in Solving Daily Life Problems

Codes	S1	S2	S3	S4	S5	S6
The books read accelerate the students in other areas as well.	+	-	-	-	-	+
Developing a different perspective on life	+	-	-	+	+	-
Destroying prejudice against people	+	-	+	-	-	-
Fostering the development of empathy	+	+	-	+	-	+
Developing an understanding of life and people	+	-	-	+	-	-
Using the learned information in daily life	-	+	+	+	-	-
Raising awareness in family, friends and environment	+	+	+	+	+	-
Providing better solutions to problems	+	+	+	-	+	-
Providing healthier solutions in friendship relations	-	+	+	+	+	-
Development of exchange of ideas in problem solving	-	-	+	-	+	-
Recognizing the importance of speaking in solving problems	-	-	-	-	+	+

When Table 12 is examined, it is seen that thanks to the application, most of the students have developed a sense of empathy, awareness in friendship relations with their families and their surroundings, and they can produce better solutions for problems.

Regarding the development of empathy, the student with the letter S1 said, *"Instead of acting prejudiced against a person, he filtered a person and showed empathy by empathizing with him."* expressed his opinion. Parallel to this code, the student with the code S4 said, *"We used to think that we were right when we had an argument with someone, but after thinking about such matters, we realized that we might be wrong, and we needed to be in his place a little bit."* expressed an opinion.

The student with the nickname S2, who said that the discussions in the classroom created awareness in his relations with his friendship, family and environment, said, *"I was sharing the information I learned from there with my friends and family, I could find a better solution in the face of a problem."* expressed an opinion.

In terms of producing healthy solutions in friendship relations, the student with the pseudonym S3 said, *"When we had problems with friends, we immediately thought of the topics we talked about in the class or from those books in the group. We were getting everyone's ideas and trying to find a common solution."* presented the idea. Similarly, the student with the nickname S5 said, *"We used to get angry with our friends when we argued with them, but now I think our capacity has increased enough to solve the problem."* used an expression.

Table 13: Student Opinions on the Benefits of the Application within the Scope of Mathematics

Codes	S1	S2	S3	S4	S5	S6
Increasing comprehension capacity	+	+	+	+	+	+
Increasing problem solving speed	-	-	-	+	+	-
Developing the ability to go into detail	-	+	-	+	+	+
Recognizing the verbal aspect of mathematics	-	+	+	-	-	-
Helps in transitioning from abstract to concrete	-	+	+	-	-	-
Making math lesson more understandable	-	+	-	-	+	-
Better understanding of cause and effect relationship in math questions	+	+	-	-	+	+
Developing reasoning skills	-	+	-	-	+	+
Going deeper in solving questions	-	-	-	-	+	+

When Table 13 is examined, most of the students emphasized that the first of the benefits of philosophy education within the scope of mathematics is that it increases their understanding capacity. Apart from this, they stated that they went into detail in the questions, they noticed the cause-effect relationship more in the problems, and their reasoning skills improved.

While S6 students stated that their comprehension capacity increased, *"I started to understand problems more easily"*, S1 student said *"Not only in mathematics but also in Turkish, for every lesson, this was like the second step of our life. While reading the question at first, looking blankly, now thinking and understanding that question, this application helped to solve it."* presented the idea.

The student with the pseudonym S2 explained that *"Usually it was more helpful in the face of problems. I started to understand mathematics better, I started to go into the details of the questions. After the subject was explained in mathematics, we were thinking about the reason for that subject, not just memorizing it numerically. This made the math more meaningful."* made a statement.

Apart from that, student with the nickname S3 said, *"Mathematics was difficult before, I only thought of it as a problem or an operation, but thanks to this application, mathematics is no longer registered numerically for me, but also verbally. For example, I took out the meaning in the sentence, so this helped me a lot. It was a transition from abstract to concrete for me."* While using the expression *"S5, we used to think while reading the questions, what does he mean here, but now I can understand faster. When I read a question, I used to skip some details, but now I understand every detail."* expressed an opinion.

Apart from this question, the student with the pseudonym S5 said, *"Philosophy has gained a different perspective. It prompts people to questions, it satisfies my curiosity, and it improved me a little more."* used an expression.

4. Conclusion, Discussion and Recommendations

In this section, the findings obtained from the sub-problems of the research are discussed with the findings obtained from other similar studies, the results obtained from the sub-problems, and suggestions for practice and researchers based on the findings obtained.

4.1 Discussion and Conclusion

In this study, in which the effect of philosophy education on the mathematics achievement of 7th grade students was examined, experimental design with pretest posttest control group was used. Before starting the research, it was checked whether the experimental and control groups were equivalent to each other in terms of levels, by applying a pretest. As a result of the analysis, no statistically significant difference was found between the experimental and control groups, and the groups were found to be equivalent to each other.

When philosophy education is examined, there are many studies on the effects of philosophy education on students (Badri & Vahadi, 2017; Erfani & Rezai, 2016; Sare, Luik & Tulviste, 2016; Marashi, 2009; Matsuoka, 2007; Polat & Akay 2020; Dirican, 2018). ; Taş, 2017; Sönmez, 2016; Çayır, 2015; Kefeli & Kara, 2008; Okur, 2008; Yazıcı, 2015); Few studies have been published on its effect on mathematics achievement (Daniel, Lafortune, Pallascio, Splitter, Slade, & Garza, 2005; Koyuncu, 2018; Kartalcı, Acar, Merve, & Işık, 2021; Kılıç, 2019; Yeşilyurt-Çetin, 2021). Looking at the literature review, the original side of the research emerges.

In the first sub-problem of the study, a statistically significant difference was found between the pre-test and post-test scores of the experimental group. The arithmetic mean in the post-test scores of the students in the experimental group increased compared to the arithmetic mean in the pre-test scores. This increase was statistically in favor of the post-test. According to this result, it can be said that philosophy education had an effect on the mathematics achievement of the experimental group. This result is similar to the experimental studies of Trickey and Topping (2004) on the mathematics achievement of students and the study of Overton (1993) regarding the effect of teaching thinking skills on students' academic success. In these studies, a statistically significant difference was found between the post-test and pre-test application of the experimental group in favor of the post-

test. Williams (1993) did not find a statistically significant difference in the experimental group in her study examining the effect of philosophy on secondary school students. She interpreted the reason for this as the fact that the study lasted 8 months and 27 hours in total. In our study, the study lasted 8 weeks and a total of 16 hours, and a significant difference was found. It can be said that this difference will increase if the study lasts longer.

In the second sub-problem of the study, the arithmetic mean of the post-test scores of the control group students showed a slight increase compared to the arithmetic mean of the pre-test scores, but there was no statistically significant difference between the pre-test and post-test scores of the control group. Similar results were obtained in some experimental studies (Trickey & Topping, 2004; Daniel, Lafortune, Pallascio, Splitter, Slade & Garza, 2005; Koyuncu, 2018). The reason for the increase in the post-test scores of the control group students is that it is difficult for the selected students to be selected by the random assignment method. In order not to disrupt the teaching flow, quasi-experimental design was used in the research since it is not possible for the students to be equal in every respect. In this design, the experimental and control group students are not equal in terms of all variables. As a matter of fact, Akdağ and Tok (2010) listed similar reasons as the reason for the increase in the post-test scores of the control group students in their study in which they examined the effects of traditional teaching and powerpoint presentation supported teaching on students.

In the third sub-problem of the study, a significant difference was found between the post-test scores of the students in the experimental and control groups. It can be said that this difference is effective on the mathematics achievement of the students of philosophy education. As a matter of fact, the difference of 3.09 between the post-test scores of the experimental and control groups shows this. In-class discussions with the students, the books they read about philosophy, improved the questioning skills of the students and developed different perspectives in the students. As a result of this, students' academic success in mathematics increased and this was reflected in the post-test. This finding indirectly supports the research findings of Trickey and Topping (2004). Daniel, Lafortune, Pallascio, Splitter, Slade, and Garza (2005) obtained similar results in the study in which students examined critical thinking processes through discussion by using philosophy in mathematics activities. The use of philosophy in classroom discussions has increased students' mathematics achievement, and besides, it has had positive results such as improving students' critical thinking, questioning and reasoning skills. As a result of the research conducted by Gorard, Siddiqui, and See (2015), the students' ability to produce questions, ask questions, and think through the thoughts and ideas of others is consistent with our research.

A question was prepared about how philosophy education affects the reasoning skills of experimental group students, and four sub-questions were formed within the scope of this question. In the first of these questions, the students were asked, “What are your thoughts on developing the sense of questioning and curiosity of these applications made in elective courses?” question has been asked. In most of the answers given by the students, they stated that their thoughts developed better, their self-confidence improved, their sense of curiosity increased, especially thanks to the books they read, and they became more curious about everything. As a matter of fact, in the study conducted by Reznitskaya and Glina (2013) on the effectiveness of dialogue teaching, it was concluded that students studying philosophy participate more in discussions and like to express this more when they have different opinions. Based on this information, it can be concluded that philosophy education increases students' self-confidence. The studies conducted by Gasparatou and Kampeza (2012) and Yeşilyurt-Çetin (2021) regarding the fact that philosophy education develops students' sense of inquiry and curiosity and develops their mathematical thinking skills are also supportive. In addition, as a result of these studies, it has been observed that children's sense of questioning develops, and their skills such as justifying their ideas, making judgments, and expressing opinions increase.

Ask the students, “What do you think about the philosophy books you have read within the scope of this application that will give you a different perspective in solving mathematical problems?” On the other hand, they stated that the students generally improved their processing skills, the meaning relationship in the questions was better understood, and they discovered different solutions. Marashi (2009) found that philosophy education with children improves reasoning skills among male students as a result of his study examining the effect of philosophy education on students' reasoning power. Similarly, Sare, Luik, and Tulviste (2016) examined the effect of the philosophy for children program on the verbal reasoning skills of preschool children. As a result of the research, an increase was observed in the students in the experimental group in their reasoning, verbal reasoning,

justification and inference skills. Apart from this, Ghaedi, Mahdian, and Fomani (2015) stated in a similar study that students developed their ability to gain a different perspective and produce original ideas. It can be said that the books read about philosophy improve the relationship of meaning in students, give students a different perspective and develop solutions.

Prepared for this sub-problem, "What are your thoughts on whether this application is helpful in solving the problems you encounter in your daily life?" Experimental group students stated that their sense of empathy developed, they understood family, friends and the events around them better, they used the information they learned in solving their daily problems, and they were able to produce better solutions for problems. Parallel to these results, the studies of Daniel, Lafortune, Pallascio, Splitter, Slade and Garza (2005) and Overton (1993) are supportive. In his study examining the effect of teaching thinking skills on academic achievement, Overton concluded that teaching thinking skills significantly increased academic achievement in the fields of language and mathematics. In addition, Dirican (2018) observed that there was an increase in students' ability to make predictions, justify their thoughts, express different opinions, be tolerant, be curious about what's going on around them, and ask questions. It can be said that philosophy education helps students in solving the problems they encounter in their daily life and in family, environment and friendship relations.

Finally, the students were asked, "What can you say about this subject when we consider the benefits of these applications within the scope of mathematics?" On the other hand, they stated that their understanding capacity increased in the solution of mathematical problems, their ability to go into detail improved, they increased the speed of problem solving and improved their reasoning skills. They also emphasized that they understood better the cause-effect relationship in mathematics questions. Similar to these data, Gorard, Siddiqui, and See, (2015) obtained similar results in a study in which philosophy education aimed to improve children's reasoning, social skills and general academic performance. In addition, as a result of the research, the skills of producing questions, asking questions, and thinking over the thoughts and ideas of others have developed. Although the study did not aim to increase the mathematics and literacy levels, it is another result that the mathematics achievement of the students increased. Overton (1993), in her study examining the effect of teaching thinking skills on academic achievement, concluded that teaching thinking skills significantly increased academic achievement in the fields of language and mathematics. These studies support the data obtained.

4.2 Suggestions

In this section, the suggestions developed for the findings are gathered under two headings as suggestions for practitioners and researchers.

4.3 Recommendations for Researchers

1. In this study, the effect of philosophy education on mathematics achievement was examined. In future studies, the success of philosophy education on other branches can be evaluated.
2. The effect of philosophy education on academic achievement can be examined for students at high school or university level.
3. Philosophy education can be compared with other learning styles.
4. The effect of philosophy education on students' attitudes towards the lesson can be examined.
5. Data on the effect of philosophy education on academic achievement can also be made with only qualitative data.

4.4 Recommendations for Practitioners

1. The first of the positive effects of philosophy education on mathematics achievement is the discussion on the concepts related to philosophy for children. Therefore, teachers can benefit from philosophy education to increase the success of students in both mathematics and other branches.
2. Philosophy education can be given to teachers so that teachers can guide students and benefit more from philosophy.

3. Even if the subjects of the philosophy course remain abstract for primary school students, the content of this course can be reduced to the level of the students under the name of the basic rules of philosophy and can be taught as a course.
4. In parallel with the course of the lesson, teachers can contribute to the development of students' reasoning skills by discussing the basic concepts in philosophy with the students before the lesson.

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