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The Effectiveness of Montessori Education Program in Pre-School Period: A Meta-Analysis Study

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Abstract

In this study, the findings of quantitative studies conducted in Turkey and abroad between 2002 and 2022, in which the effect of the Montessori Education Program (MEP) in the pre-school period was examined, were combined through meta-analysis. Master's theses, doctoral dissertations, and articles published nationally and internationally between 01.01.2002-15.05.2022 with pre-test and post-test control group mean scores, standard deviation values, and sample sizes were included. As a result of the searches made in the Council of Higher Education (CoHE) National Thesis Center, Web of Science (WOS), and Proquest databases, 40 studies and 22 sub-studies meeting the inclusion criteria were included in the study. The effect size values of the studies were calculated one by one. Microsoft Excel 2010 and Statistical Package for Social Sciences 27 (SPSS) programs were used for statistical calculations. The calculated data were analyzed using Comprehensive Meta-Analysis (CMA) software. Due to the heterogeneity of the data, the random effects model was used in the calculations. Based on the random effects model, study findings indicate that the overall effect size of MEP on pre-school education was 1.737, which is positive and strong. This indicates that the MEP applied to the experimental groups was significantly more effective than the other methods applied to the control groups.

Keywords: Montessori Education Program, education, early childhood, meta-analysis, pre-school education.

Introduction

Plato defined education as "giving birth to the mind". According to him, education helps children to find the right knowledge in themselves with the right questions and to express this knowledge. Montessori emphasizes the significance of the individuals responsible for the education of children, highlighting their mission as pivotal in shaping the educational journey of each child. Adults need to pay attention to the developmental characteristics of children who are trying to form their own personalities. Montessori referred to the interaction between children and adults as the "pole of humanity". Because children need adults and adults need children (Poussin, 2015).

The main purpose of education, which has great and effective importance in every stage of a child's development starting with birth, is to help children recognize the outside world, discover new things, reveal their existing talents, express themselves, and recognize the social roles in their environment (Cinel, 2006). Education, which develops around multiple factors such as teachers' skills, the resources they use, and the program, is a multidimensional phenomenon of vital importance in children's lives (Al et al., 2012).

Pre-school education is defined as an important educational process that includes the childhood years starting with birth and continuing until the beginning of primary education, in which children are raised in accordance with social and cultural values in an environment consisting of rich stimuli in accordance with their developmental periods and individual differences (Oğuzkan & Oral, 2002). According to Gürkan (1979), pre-school education is the basic level of education that provides various environmental conditions in accordance with the personal characteristics and developmental levels of children between the ages of 0-6, contributes to their physical, cognitive, emotional, and social

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development, and prepares children for primary education by developing them in the light of cultural values. Turan (2004) defines pre-school education as a period in which children between the ages of 0 and 6 are provided with an educational environment full of rich stimuli appropriate to their developmental levels, which supports all development of children, especially creativity, and in which behaviors reflecting the cultural and social values of the society in which they live are acquired in a planned manner.

The quality of education is as important as the education. It depends on the improvement and development of education programs. It is of great importance for children to participate actively in learning processes, be selective, and make their own decisions. Teachers' encouraging and facilitating personalities will increase the quality of education (Erişen & Güleş, 2007; Temel, 2005).

In today's education programs developed to improve the quality of education, it is argued that a person has the potential to achieve anything if respect, love, and freedom are taken as the basis and appropriate educational conditions and environments are provided (Yücesan, 2017). This potential of children should be recognized and developed in accordance with their development. According to Begde (2015), if appropriate conditions are provided, children's problem-solving skills will also improve. In this way, children will be able to solve the problems they face or will face throughout their lives. Thus, children's sense of responsibility will also develop and they will be able to establish positive relationships with their environment.

Raising children as conscious and healthy individuals is closely related to the education given in the pre-school period. The education given during the pre-school period is of great importance for the individual's future. Today, traditional methods have been replaced by contemporary approaches in pre-school education, which are understood to have a great contribution to learning and development. The most common and most important of these contemporary approaches is the education system developed by Maria Montessori, who was born in Ancona, Italy, in 1870, when she realized that it was important and valuable to look at the world through the eyes of a child (Keppler, 2009). Montessori emphasized the importance of stimuli in the new education system she developed and stated that stimuli contribute to cognitive development in children's education (Biswas-Diener, 2011).

Montessori's biggest educational reform was that she focused on the development of the human mind rather than the development of the human body. In this direction, she first started to conduct research on individuals with mental disabilities. According to Montessori, children's minds are not completely unusable. They are only prevented from using it. Based on this idea, she prepared special education programs and materials to be used in the education of mentally disabled individuals. She developed her own education program (MEP) as a result of the observations she made for two years with these programs and materials. Having obtained positive results in her applications to mentally disabled individuals, Montessori made a few adaptations and additions and applied the education program she developed to children with normal development. This education program, whose starting point is child nature, was developed as a result of observing the pure and clean nature of children (Topbaş, 2004; Wilbrandt, 2009).

Since Maria Montessori was not an educator, she did not have ideas that were fixed like those of teachers. The most important feature that distinguishes her from others is that she did not try to apply the method by introducing a method. Montessori developed a modern education program that aims to develop the child in its entirety by putting the child at the center (Keppler, 2009). This educational program encouraged Montessori to create a school environment that was different from the traditional schools where the teacher was at the center. For this purpose, the free educational institution opened under the leadership of Montessori in 1907 in the San Lorenzo neighborhood of Rome under the name "Children's House (Casa dei Bambini)" was a great revolution in education. This educational program, which Montessori developed in the light of the knowledge she gained from her education in Philosophy, Psychology, and Anthropology at the University of Rome and her observations of children in the Children's House, contributed to making it the most widely used educational method in the history of pedagogy (Pollard, 1996).

The difference between the schools where the education program developed by Montessori is implemented is the use of materials that prepare children for real life. In the Children's House, chairs designed for children's height are used instead of desks, and the cabinets are at a height accessible to children. All educational environments are adapted and organized for children. In addition, children are allowed to pick up and use the materials of their choice at any time and return them to their places at any time. Every object included in the educational environment is mounted low so that children can access it independently. Educational materials developed by Montessori for individuals with intellectual disabilities were also made available to children. According to Montessori, since children are eager to learn by nature, effective and permanent learning will take place if there are necessary facilities and a free educational environment (Schilling, 2011; Thayer-Bacon, 2011).

The unlimited and unique knowledge that children possess is the result of their unconscious internalization of all

the information they acquire from the environment. In this way, children's environment provides them with the support of an educator. The pre-school period, where the acquired knowledge is absorbed like a sponge, is an important period in which children acquire knowledge effortlessly (Montessori, 2015). Freedom and love are very important in the formation of personality. Montessori argued that the education given to children with different learning speeds should be given at different paces. Faster and more permanent learning takes place in environments where individual learning is encouraged by providing instructor support when necessary (Poussin, 2015).

Experience is the most effective way for children to gain different life experiences through their innate desire to explore (Poussin, 2015). Montessori Education Program (MEP) aims to provide quality learning experiences through materials that prepare children for the real world by putting them at the center (Keppler, 2009). According to Montessori, it is possible to leave permanent traces in the child's life with the knowledge gained through experience. This is because education in natural environments with real objects is more effective and comprehensive.

In this study, an answer to the question "Is MEP effective in pre-school education?" will be sought. It has been determined that independent studies on MEP from past to present have contributed to the world of education and science, but the results of these studies have not been handled from a general perspective. In the research, a general perspective of the studies on MEP was obtained by the meta-analysis method, and a stronger conclusion was reached by combining the results of the studies and eliminating the contradictions in the studies.

Aim of the Study

This study aims to combine the studies investigating the effect of the Montessori Education Program in the pre-school period between 2002-2022 with a meta-analysis method and to determine the common effect size. For this purpose, studies in Turkey and abroad in which MEP was applied in the pre-school period between 2002 and 2022 were evaluated with a holistic approach. Meta-analysis, a powerful statistical method, was used to synthesize the findings of the studies included in the study and to provide a general perspective for future studies. In this study, answers to the following questions were also sought:

- What effect does MEP have on pre-school children?
- What is the distribution of the studies included in this research according to the independent variables (year of publication, type of publication, place of publication, sample size, method of developing the measurement tool used, duration of the experimental procedure, and the implementer of the experimental procedure)?
- What is the individual effect size value and direction (positive, negative, and zero) of the included studies?
- Is there a significant difference in the effect size values of the studies included in the research according to the year of publication, type of publication, and the place where they were conducted?
- Is there a significant difference in effect size values according to the size of the study samples included in the research?
- Is there a significant difference in effect size values according to the development methods of the measurement tools used in the studies, the implementer of the experimental procedure, and the duration of the experimental procedure?

Significance of the Study

Research on MEP in Turkey and around the world has always been popular. However, there is no meta-analysis study in which these analyses are evaluated, and we can see the missing pieces of the big picture. This situation constituted the starting point for the planning of the current study. It is thought that a meta-analysis study created by combining the results obtained from experimental and quasi-experimental studies conducted in Turkey and abroad in which the effectiveness of MEP is measured will fill an important gap in the literature. This study will be useful to see the results of the studies in which MEP was implemented between 2002 and 2022.

Method

Research Design

In this study, the meta-analysis method was used. Meta-analysis is a comprehensive statistical analysis by bringing together the results obtained from different study findings (Glass, 1976). It is seen that scientists obtain different findings from each other in repeated studies on a field or subject. These differences occur because researchers have trouble storing, organizing, and putting together their findings. To understand why these obstacles arise in scientific progress, a summary or review of research in the relevant field would be very helpful for researchers (Şen & Yıldırım, 2020).

Sampling, Determination of Selection Criteria and Collection of Data

The data to be used in this study, in which the effect of the Montessori education program in the pre-school period was

investigated, were accessed through national and international databases. The data collection process was carried out by considering the criteria determined in accordance with the research questions. The data collection process consists of two main stages.

In the first stage, the studies investigating the effect of MEP in the pre-school period were accessed from national and international databases. The search in databases started with master's and doctoral theses archived in the National Thesis Center. Since an international meta-analysis study was conducted, Google Scholar, the most comprehensive search engine, was used. Subsequently, detailed searches were conducted on databases such as CoHE Academic (for articles, theses, and projects), Ulakbim Discovery (articles and books), ProQuest Dissertation and Theses (international theses), Web of Science, ERIC (database of educational research), and EBSCO. The words "early childhood, pre-school, Montessori, education, pre-school, early childhood, education" were used as keywords. Firstly, the titles of the studies obtained as a result of the searches in the databases were evaluated and sifted. The second elimination was made by examining the abstracts of the studies. The third and final elimination was made by examining the content of the studies in their entirety to determine their suitability for the inclusion criteria.

In the second stage, the discussion and bibliography sections of the studies accessed from the databases were examined in detail to check whether there were any studies that were overlooked in the first stage. In this way, it was aimed to reach all studies meeting the inclusion criteria. In order to reach the most up-to-date publications, scans were made at regular intervals, and the data collection process was completed on May 15, 2022. As a result of the scans, a total of 40 studies, including 18 articles, 18 master's theses, and four doctoral dissertations, were included in the study. The following criteria were taken into consideration to determine the studies to be included:

- The studies conducted within the last twenty years (01.01.2002-15.05.2022),
- Including only quantitative studies in the research
- Having a control group and experimental group in the studies
- The Montessori education program was applied in the experimental group
- Including the data (standard deviation, sample size, mean value, etc.) necessary to calculate the effect size value

Forty studies meeting the above conditions were included in the study. The flow chart of detailed explanations regarding the results of the literature review is given in Figure 1.

Data Coding

While applying the meta-analysis method, the studies that were decided to be included in the study were identified according to the coding form developed by the researchers according to the inclusion criteria reported in Table 1. The first section of the coding form includes information about the study identity. In the second section, the characteristics of the study and in the third section, the statistical data of the study were evaluated. The studies that will form the content of the study were first entered into this form, and then all of the studies were coded in this form. Data such as the types of the studies, years of publication, places where they were conducted, variables, sample sizes, descriptive statistical information about the experimental and control groups, effect sizes, and effect classes were written in detail on this form. Microsoft Excel 2010 program was used to transfer the coding form to the electronic environment.

Data Analysis

The studies included in the study were listed in accordance with the criteria to be measured. Statistical analysis of the information in the list was shown in graphs and tables.

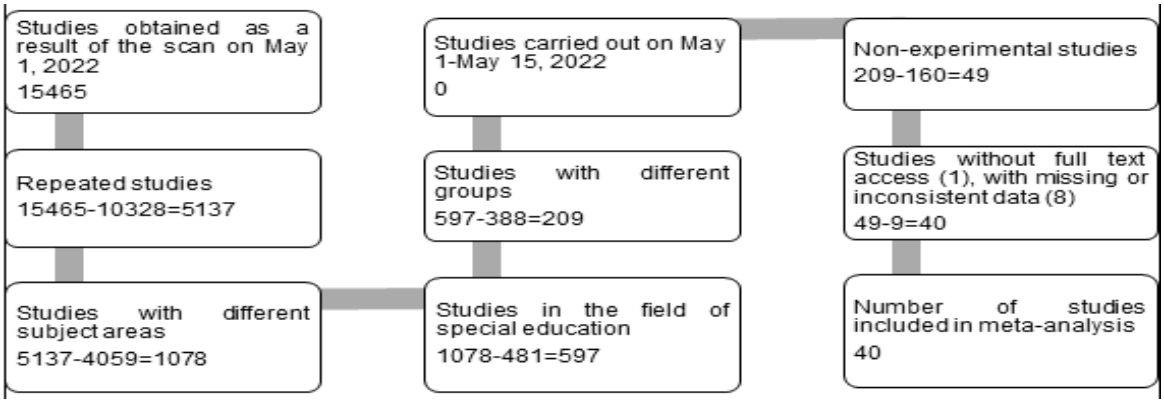


Fig. 1. Flow chart for the studies included in the research.

Microsoft Excel 2010 program was used for statistical calculations of the data obtained from the study and tabulation of variables. After the raw data of the included studies were obtained, the data were entered into the CMA software, and the analyses were evaluated.

The data analysis of this study was conducted using the study effect method. The study effect method can be used when the dependent variables of the included studies are obtained from different scales by summing and averaging the dependent variables arithmetically in case of group differences (Cohen, 1988; Huffcutt, 2002; Lipsey & Wilson, 2001). In this method, the formula d=(Xe-Xc)/SD is used to calculate the mean differences between experimental and control groups in experimental studies (Hunter & Schmidt, 2015). The Cohen d value expressed here is the effect size. Cohen's d value (Effect Size) is obtained by dividing the difference between the arithmetic means of the experimental and control groups by the total standard deviation (Ergene, 1999).

The effect size value is used to interpret and evaluate how dependent variables affect independent variables. Before the actual effect size value of the studies is calculated, the effect sizes of all studies are calculated individually. After the individual effect sizes of the studies are calculated, the actual effect size is calculated. This meta-analysis study was conducted to find the true effect of the Montessori education program in pre-school period.

Statement of Research and Publication Ethics

Since the research is a meta-analysis study, the field of application is not directly humans or animals but previously conducted studies. Therefore, there is no need for ethics committee approval. In addition, in accordance with the decision of Necmettin Erbakan University Social and Human Sciences Scientific Research Ethics Committee dated 13.01.2023 and numbered 2023/26, it was decided that the research does not require ethics committee approval. However, the principles of research and publication ethics were adhered to at all stages of this study.

Table 1: Coding Procedure.

Part One (Identity of the Study)	*Part Two (Features of the Study)*	*Part Three (Statistical Data of the Study)*
Study No	Variable of the Study	Sample Size of the Study (N)
Name of the Study	Implemented Region	Group Mean of the Study (X)
Author of the Study	Publication Status	Standard Deviation of the Study (SD)
Year of Publication		Effect Size of the Study
Type of Study		Impact Class of the Study

FINDINGS

The findings of the meta-analysis are discussed under two headings: descriptive findings and meta-analysis findings.

Descriptive Statistics on the Effect of Montessori Education Program in Pre-school Period

In order to determine the effectiveness of the Montessori education program in the pre-school period compared to other education programs, a total of 40 individual studies, which were determined to meet the inclusion criteria, were conducted with a total of 2492 participants consisting of 1261 experimental and 1231 control groups. The frequencies and percentages of the research characteristics of the independent variables of the study are given in Table 2 and Table 3.

As shown in Table 2, the studies included in the meta-analysis were conducted between 2005 and 2021. The years in which studies were not included are 2002, 2003, 2004, 2006, 2007, 2013, 2014 and 2022. The years with the fewest number of studies included with one study each were 2005 and 2011, while the years with the highest number of studies included with five studies each were 2015 and 2016. Since 2015, the number of studies has increased, and the total number of studies for the years 2015-2016 is 10.

According to Table 3, four of the 40 studies included in the study were doctoral dissertations (10%), 18 of the remaining 36 studies were master's theses (45%), and 18 were articles (45%). The majority of the studies (67.5%) were conducted in Turkey, and the number of studies abroad (32.5%) was low. It was determined that the scales developed by the researchers who conducted the study were used in nine studies (22.5%), the scales used in 24 studies (60%) were developed by other researchers, and in seven studies (17.59%), there was no information about the developer of the measurement tools used. Regarding the size of the sample groups, it was seen that there were 12 studies with a sample size of one to 39 individuals, 19 studies with 40-79 participants, and nine studies with a sample size of 80 or more. It was determined that six studies in which the implementation period of the training programs lasted between one to eight weeks at the shortest and 11 studies in which the implementation period lasted 18 weeks or more at the longest were included, nine studies were conducted between 9-17 weeks, and no information was given about the implementation period of

Table 2: Distribution of Included Studies by Years.

Year	*Number of Studies (n)*	*Percentage (%)*	*Year*	*Number of Studies (n)*	*Percentage (%)*
2002	0	%0	2013	0	%0
2003	0	%0	2014	0	%0
2004	0	%0	2015	5	%12,5
2005	1	%2,5	2016	5	%12,5
2006	0	%0	2017	3	%7,5
2007	0	%0	2018	4	%10
2008	3	%7,5	2019	3	%7,5
2009	3	%7,5	2020	3	%7,5
2010	3	%7,5	2021	3	%7,5
2011	1	%2,5	2022	0	%0
2012	3	%7,5			
			Total	40	%100

Table 3: Descriptive Statistics of the Studies Examining the Effect of the Montessori Education Program.

Variable	*Levels*	*Number of Studies (n)*	*Percentage Value (%)*
Publication Type	Article	18	%45
	Master Thesis	18	%45
	Doctoral Thesis	4	%10
Location	Domestic	27	%67,5
	Abroad	13	%32,5
Developing the measurement tool	Researcher	9	%22,5
	Other	24	%60
	Unspecified	7	%17,5
Sample size	1-39 people	12	%30
	40-79 people	19	%47,5
	80 and above	9	%22,5
Duration of the experimental procedure	1-8 weeks	6	%15
	9-17 weeks	9	%22,5
	18 weeks and over	14	%35
	Unspecified	11	%27,5
Implementer	Researcher	13	%32,5
	Lesson Teacher	6	%15
	Researcher and Lecturer	3	%7,5
	Unspecified	18	%45
Total		40	%100

11 studies. The number of studies in which the researchers participated in the implementation activities and conducted the research is 13. In six studies included in the meta-analysis, the implementations were carried out not by the researcher but by the classroom teacher. In three studies, it was determined that the researcher and the classroom teacher carried out the training together. In 18 studies, it was determined that the implementations were not specified by whom.

Meta-Analytic Effect Analysis on the Effect of Montessori Education Program in Pre-school Period

In order to investigate the meta-analysis effect in the study, calculations were made after determining the sample numbers, arithmetic means, arithmetic mean differences, and standard deviation values of experimental or quasi-experimental studies consisting of pre-test and post-test control groups. The statistical significance levels of the studies were accepted to be at p=.05. The effect size values (Hedges's g), standard errors, variances, lower and upper limits of 95% confidence intervals, Z and p values for the individual studies included in the meta-analysis are presented in Table 4.

Table 4: Findings on the Effect Size of the Studies Included in the Research on an Individual Basis.

					95% Confidence Interval			
No	*Study Name*	*Hedges's g(ES)**	*Standard Error*	*Variance*	*Lower Limit*	*Upper Limit*	*Z Value*	*p Value*
1	Acay, 2018(a)	0,657	0,325	0,105	0,021	1,293	2,024	0,043
2	Acay, 2018(b)	1,938	0,383	0,147	1,187	2,689	5,056	0,000
3	Aghajani et al., 2021	1,223	0,224	0,050	0,784	1,662	5,464	0,000
4	Ahmadpour, 2015	0,900	0,235	0,055	0,440	1,360	3,837	0,000
5	Aral et al., 2015	-0,241	0,208	0,043	-0,649	0,167	-1,157	0,247
6	Aslıyüksek, 2015	1,217	0,344	0,119	0,542	1,892	3,535	0,000
7	Aydoğan, 2016	0,517	0,344	0,118	-0,157	1,191	1,504	0,133
8	Aygün, 2020(a)	0,453	0,246	0,060	-0,029	0,934	1,842	0,066
9	Aygün, 2020(b)	0,429	0,245	0,060	-0,052	0,910	1,748	0,080
10	Aygün, 2020 (c)	0,080	0,243	0,059	-0,395	0,556	0,331	0,740
11	Azevedo, 2019(a)	0,164	0,159	0,025	-0,148	0,476	1,030	0,303
12	Azevedo, 2019(b)	0,253	0,165	0,027	-0,071	0,576	1,533	0,125
13	Bahatheg, 2010(a)	0,356	0,411	0,169	-0,451	1,162	0,864	0,388
14	Bahatheg, 2010(b)	0,122	0,409	0,167	-0,679	0,922	0,297	0,766
15	Bahatheg, 2010(c)	0,272	0,410	0,168	-0,532	1,076	0,662	0,508
16	Bahatheg, 2010(d)	0,398	0,412	0,170	-0,410	1,206	0,965	0,335
17	Bayer, 2015	0,775	0,328	0,108	0,132	1,417	2,363	0,018
18	Beken, 2009	8,317	1,098	1,206	6,165	10,469	7,574	0,000
19	Bezirci, 2017	-0,029	0,254	0,065	-0,527	0,469	-0,115	0,908
20	Bülgür, 2018	-0,738	0,263	0,069	-1,254	-0,223	-2,807	0,005
21	Dedeoğlu, 2018(a)	1,662	0,367	0,135	0,944	2,381	4,532	0,000
22	Dedeoğlu, 2018(b)	-0,037	0,316	0,100	-0,657	0,583	-0,117	0,907
23	Dedeoğlu, 2018(c)	-0,157	0,317	0,100	-0,778	0,464	-0,495	0,620
24	Dedeoğlu, 2018(d)	0,027	0,316	0,100	-0,593	0,647	0,085	0,933
25	Dereli, 2017	0,763	0,164	0,027	0,442	1,084	4,658	0,000
26	Güven et al., 2020	0,483	0,187	0,035	0,117	0,849	2,586	0,010
27	Harris, 2005(a)	4,148	0,416	0,173	3,333	4,962	9,980	0,000
28	Harris, 2005(b)	2,812	0,361	0,130	2,104	3,520	7,787	0,000
29	Harris, 2005(c)	3,225	0,406	0,165	2,429	4,020	7,947	0,000
30	Kayılı & Arı, 2016(a)	2,127	0,411	0,169	1,320	2,933	5,168	0,000
31	Kayılı & Arı, 2016(b)	4,379	0,632	0,400	3,319	5,618	6,923	0,000

					95% Confidence Interval			
No	*Study Name*	*Hedges's g(ES)**	*Standard Error*	*Variance*	*Lower Limit*	*Upper Limit*	*Z Value*	*p Value*
32	Kayılı & Koçyiğit, 2008	0,609	0,185	0,034	0,246	0,972	3,287	0,001
33	Kayılı & Kuşçu, 2012	2,823	0,534	0,285	1,776	3,870	5,286	0,000
34	Kayılı, 2010(a)	6,927	0,748	0,560	5,460	8,393	9,258	0,000
35	Kayılı, 2010(b)	3,465	0,447	0,200	2,589	4,342	7,747	0,000
36	Kayılı, 2010(c)	6,037	0,667	0,444	4,730	7,343	9,055	0,000
37	Kayılı, 2010(d)	2,363	0,369	0,136	1,640	3,085	6,411	0,000
38	Kayılı, 2016	0,729	0,270	0,073	0,201	1,258	2,705	0,007
39	Kayılı et al., 2010	6,446	0,750	0,563	4,976	7,917	8,590	0,000
40	Ön Hallumoğlu & Karsak, 2020(a)	3,942	0,626	0,392	2,715	5,170	6,294	0,000
41	Ön Hallumoğlu & Karsak, 2020(b)	5,106	0,754	0,568	3,629	6,582	6,776	0,000
42	Öngören & Turcan, 2009	2,278	0,406	0,165	1,482	3,074	5,611	0,000
43	Öngören, 2008(a)	2,353	0,582	0,338	1,212	3,493	4,044	0,000
44	Öngören, 2008(b)	2,176	0,564	0,318	1,070	3,281	3,856	0,000
45	Şahintürk, 2012	2,695	0,416	0,173	1,879	3,511	6,471	0,000
46	Selçuk, 2016	1,782	0,374	0,140	1,049	2,515	4,768	0,000
47	Şimşek, 2017	13,078	1,496	2,238	10,146	16,010	8,742	0,000
48	Tayfun & Aydoğan, 2021	1,288	0,352	0,124	0,598	1,978	3,660	0,000
49	Tepeli & Yılmaz, 2012(a)	0,962	0,334	0,112	0,306	1,617	2,876	0,004
50	Tepeli & Yılmaz, 2012(b)	1,839	0,364	0,132	1,126	2,553	5,055	0,000
51	Tiryaki et al., 2021	0,369	0,194	0,038	-0,012	0,749	1,900	0,057
52	Toran, 2011	2,321	0,373	0,139	1,589	3,053	6,215	0,057
53	Üstündağ, 2019	1,616	0,340	0,115	0,950	2,282	4,754	0,000
54	Yiğit, 2008(a)	3,745	0,742	0,551	2,290	5,199	5,047	0,000
55	Yiğit, 2008(b)	3,577	0,721	0,520	2,164	4,991	4,961	0,000
56	Yıldırım Doğru, 2015	1,194	0,562	0,315	0,093	2,295	2,126	0,033
57	Yıldırım, 2021	0,601	0,417	0,174	-0,217	1,419	1,441	0,150
58	Yıldız, 2018(a)	2,045	0,571	0,326	0,926	3,164	3,582	0,000
59	Yıldız, 2018(b)	1,207	0,504	0,254	0,218	2,195	2,393	0,017
60	Yıldızbaş & Aslıyüksek, 2016(a)	1,092	0,339	0,115	0,428	1,756	3,221	0,001
61	Yıldızbaş & Aslıyüksek, 2016(b)	1,217	0,344	0,119	0,542	1,892	3,535	0,000
62	Zengin, 2019	1,546	0,360	0,130	0,840	2,252	4,290	0,000

***ES:** Effect Size

Since some of the 40 experimental studies with pretest-posttest control groups included in the study had more than one data, the total number of studies used in meta-analyses was 62 when sub-studies were included. In this context, one doctoral dissertation and two master's theses were divided into four sub-studies, two master's theses into three sub-studies, one doctoral and four master's theses and 4 article studies were divided into two sub-studies. When Table 4 is examined, it was evaluated that 45 (72.58%) of the 62 studies included in the study had a statistically significant difference ($p<0.05$), while 17 (27.42%) did not have a significant difference ($p>0.05$). When Hedges's g values in each study analyzed on an individual basis are compared, it is seen that the study with the largest positive effect is study number 47 (ES=13.078), and the study with the smallest positive effect is study number 19 (ES=0.027).

When Table 5 is examined, it is determined that 91.93% of the 62 studies and sub-studies included in the study have a positive effect size, while 8.07% of the studies have a negative effect size. It was determined that there was no study with zero effect size value.

When the data in Table 6 were examined, it was determined that 36 studies (58.06%) were strong, nine studies (14.51%) were medium, nine studies (14.51%) were small, and eight studies (12.92%) were weak in the classification of the effect size values of 62 studies and sub-studies included in the study.

Table 5: Frequency and Percentage Values of the Effect Size Direction of the Studies.

Direction of Effect Size	*Frequency (f)*	*Percentage (%)*
Positive (+)	57	%91,93
Negative (-)	5	%8,07
Zero (0)	0	%0,00
Total	62	%100

Table 6: Frequency and Percentage Distribution of Studies in Terms of Classification of Effect Size Values.

Effect size level	*Frequency (f)*	*Percentage (%)*
Weak	8	%12,92
Small	9	%14,51
Medium	9	%14,51
Strong	36	%58,06
Total	62	%100

In this study, two methods were used to detect research bias. The first of these methods is the Funnel Plot, and the second is the Fail-Safe N value. Figure 2 shows the scatter plot between the sample size and effect size values of the studies included in the study, i.e. the Funnel Plot.

According to the funnel scatter plot of the studies included in the study, it is seen that the effect sizes and standard error distributions are homogeneous in Table 7. Therefore, it was determined that there was no publication bias in the study. According to the results of Duval and Tweedie's Trim and Fill test, it was determined that there were no theses that should be added to the research while eliminating research bias and the results of the funnel plot were supported.

In the study, along with the funnel scatter plot, the error protection number known as Classical Fail-Safe N was also calculated. In this context, it was determined that there should be 4878 studies that could invalidate this study, consisting of a total of 62 studies analyzing the relationship between the Montessori education program and the pre-school period. The screenshot of the Classical Fail-Safe N results is shown in Figure 3.

Upon examining Table 8, it is evident that the Q value of the total 62 studies and sub-studies involved in the analysis is 886,039 according to the fixed effects model. It was determined that this value corresponds to data well above the critical value with 61 degrees of freedom with a significance level of 95% in

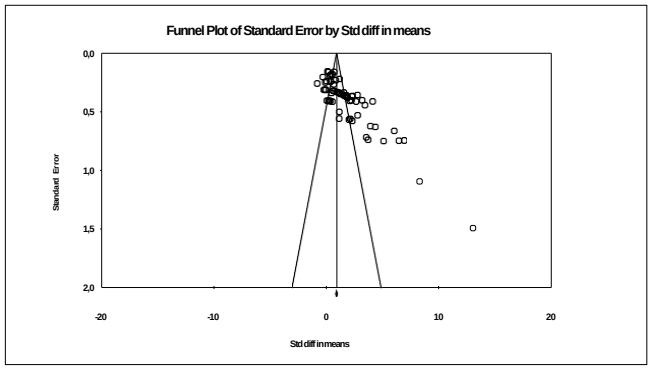


Figure 2. Effect size Funnel Scatter Plot (Funnel Plot).

Table 7: Duval and Tweede's Trim and Fill Test Results.

		Fixed Effects Model			*Random Effects Model*			
	Number of Studies Added	*ES (d)*	*Lower Limit*	*Upper Limit*	*ES (d)*	*Lower Limit*	*Upper Limit*	*Q Value*
Observed Values		0,932	0,854	1,011	1,736	1,425	2,047	886,038
Adjusted Values	0	0,932	0,854	1,011	1,736	1,425	2,047	886,038

the x^2 table. As a result, it was determined that the studies were heterogeneous according to the fixed effects model. In addition, the calculated p-value (p=0.000 and p<0.05) also shows that the included studies have a heterogeneous structure. These findings indicate that there are differences between the studies examining the effect of the Montessori education program and that the studies have a heterogeneous structure. Another evidence indicating that the studies are heterogeneous is the I^2 value. It was determined that there was a very high level of heterogeneity between the studies, with an I^2 value of 93.115%. According to these results, the findings were analyzed using the random effects model as a result of the heterogeneous structure of the research.

Table 9 shows that the fixed effects model effect size value for the 62 studies and sub-studies included in the study is 0.933, the standard error value is 0.040, the variance is 0.002,

Classic fail-safe N

Z-value for observed studies	30,42420
P-value for observed studies	0,00000
Alpha	0,05000
Tails	2,00000
Z for alpha	1,95996
Number of observed studies	62,00000
Number of missing studies that would bring p-value to > alpha	4878,00000

Fig. 3. Classical Fail-Safe n Values.

the lower limit is 0.854, the upper limit is 1.012, Z value is 23.260, and p-value is 0.000. The random effects model effect size value is 1.737, the standard error value is 0.158, the variance value is 0.025, the lower limit value is 1.426, the upper limit value is 2.049, the Z value is 10.947, and the p-value is 0.000.

In order to determine whether there is a difference in the effect sizes of the studies included in the meta-analysis research according to the publication years, the study data were analyzed by years. The studies were coded as 2005, 2008, 2009, 2010, 2011, 2012, 2015, 2016, 2017, 2018, 2019, 2020, and 2021 (2002, 2003, 2004, 2006, 2007, 2013, 2014, 2022 were not included because there were no studies from these years). In light of these evaluations, all 62 data from 40 studies were analyzed based on the research data within the scope of the analysis unit. In the analyses carried out in line with the publication year variable, the analysis of the variance between the studies within the groups was calculated by pooling the analysis of the variance between the studies within the groups

Table 8: Heterogeneity Test Findings According to the Fixed Effects Model of the Research.

Q Value	*Degrees of Freedom*	*p Value*	*I^2 Value*
886,039	61	0,000	93,115

Table 9: Effect Sizes of Fixed and Random Effects Models.

Model	*Effect Size*	*Standard Error*	*Variance*	*Lower Limit*	*Upper Limit*	*Z Value*	*p Value*
Fixed Effects Model	0,933	0,040	0,002	0,854	1,012	23,260	0,000
Random Effects Model	1,737	0,158	0,025	1,426	2,049	10,947	0,000

Table 10: Effect Size Values of Studies According to Publication Years.

		Effect Size and 95% Confidence Interval					*Statistical Test*	
Year	Frequency (f)	Effect Size	Standard Error	Variance	Lower Limit	Upper Limit	Z Value	p Value
2005	1	3,334	0,391	0,153	2,568	4,101	8,526	0,000
2008	3	2,306	0,668	0,447	0,997	3,616	3,451	0,001
2009	3	5,065	2,935	8,619	-0,668	10,840	1,732	0,083
2010	3	4,892	0,916	0,840	3,095	6,689	5,335	0,000
2011	1	0,686	0,422	0,178	-0,141	1,513	1,625	0,104
2012	3	1,986	0,433	0,187	1,138	2,834	4,591	0,000
2015	5	0,698	0,312	0,097	0,088	1,309	2,241	0,025
2016	5	1,547	0,347	0,121	0,866	2,228	4,454	0,000
2017	3	3,273	1,121	1,256	1,076	5,470	2,920	0,003
2018	4	0,662	0,326	0,106	0,022	1,301	2,029	0,042
2019	3	0,810	0,330	0,109	0,162	1,457	2,451	0,014
2020	3	1,427	0,440	0,194	0,565	2,289	3,244	0,001
2021	3	0,847	0,258	0,066	0,342	1,352	3,287	0,001

due to the constancy of the categories and the difference in the actual effect size in the subgroups, since most of the studies in the categories were less than 5. As a result of the calculations, it was determined that the highest effect size value belonged to 2009 (ES=5,065), and the lowest effect size value was found in the studies conducted in 2018 (ES=0,662) in Table 10.

The studies included in the study were coded as master's and Ph.D. theses and articles. As can be seen in Table 11, among the average effect size values obtained for the subgroups of the publication types variables, it was determined that the studies with the highest effect belonged to master's theses (EB=2,102). It was determined that the Ph.D. thesis (EB=1,132) had the lowest effect size value. The effect size value of article studies was found to be 1,388. As a general evaluation as a result of the examinations, it was concluded that the average effect sizes between the subgroups of publication types did not show positive and statistically significant differences.

The groups formed according to the place where the experimental process was carried out were divided into two different categories: domestic and foreign. The effect size value of the result obtained from the data of 27 studies conducted in Turkey was found to be 1.969, while the effect size value of 13 studies conducted abroad was found to be 1.265 in Table 12.

When Table 13 is examined, the developers of the measurement tool of the studies included in the meta-analysis were handled in three groups: the researcher, someone other than the researcher, and unspecified. The effect sizes for the subgroups of the developer of the measurement tool were determined as 3.614 for the researcher, 1.505 for someone else, and 0.561 for unspecified studies. It can be said that the measurement tool developed by the researcher has the highest effect size value because it was prepared in accordance with the purpose of the research.

As seen in Table 14, sample sizes are divided into three categories. The first category included studies in which 1-39 children participated, the second category included studies in which 40-79 children participated, and the third category included studies in which 80 or more children participated. When the data obtained were analyzed, it was determined that the effect size value of the study conducted with 1-39 participants was 2.166, the effect size value of the study conducted with 40-79 participants was 1.775, and the effect size value of the study conducted with 80 or more participants was 0.479. According to these data, the effect size value decreased as the number of people increased. Based on the results obtained, it can be said that working with small groups

Table 11: Effect Size Values for the Publication Type of the Studies.

		Effect Size and 95% Confidence Interval					*Statistical Test*	
Publication Type	*Frequency (f)*	*Effect Size*	*Standard Error*	*Variance*	*Lower Limit*	*Upper Limit*	*Z Value*	*p Value*
Article	18	1,388	0,195	0,038	1,005	1,771	7,101	0,000
Master's Thesis	18	2,102	0,280	0,079	1,553	2,652	7,499	0,000
Ph.D. Thesis	4	1,132	0,332	0,110	0,482	1,782	3,413	0,001

Table 12: Effect Size Values for the Location Where the Studies Were Conducted.

		Effect Size and 95% Confidence Interval					*Statistical Test*	
Location	*Frequency (f)*	*Effect Size*	*Standard Error*	*Variance*	*Lower Limit*	*Upper Limit*	*Z Value*	*p Value*
Domestic	27	1,969	0,213	0,045	1,552	2,386	9,250	0,000
Abroad	13	1,265	0,227	0,051	0,820	1,710	5,575	0,000

Table 13: Effect Size Values of the Ways in Which the Measurement Tools Used in the Studies Were Developed.

		Effect Size and 95% Confidence Interval					*Statistical Test*	
Measurement Tool Developer	*Frequency (f)*	*Effect Size*	*Standard Error*	*Variance*	*Lower Limit*	*Upper Limit*	*Z Value*	*p Value*
Researcher	9	3,614	0,485	0,235	2,663	4,565	7,449	0,000
Other	24	1,505	0,198	0,039	1,117	1,894	7,590	0,000
Unspecified	7	0,561	0,145	0,021	0,276	0,846	3,859	0,000

in the Montessori education program will be more effective than with large groups.

As seen in Table 15, the application periods of the experimental studies in which the Montessori education program was applied to the experimental group were evaluated in four different categories. In the first category, the data belonging to six studies applied for oneto eight weeks; in the second category, the data belonging to nine studies applied for 9-17 weeks; in the third category, the data belonging to 14 studies applied for 18 weeks or more, and finally, in the fourth category, the data belonging to 11 studies whose application period was not specified were included. When the effect size values obtained were analyzed, it was determined that the data with the highest effect belonged to the studies applied for 18 weeks or more (EB=3,270). The lowest effect size value was EB=0.171 in the studies conducted for one to eight weeks. Based on this information, it can be said that the Montessori education program should be implemented for a longer period in order to be effective.

When Table 16 is examined, it is determined that the studies included in the meta-analysis study were applied in three different ways. There were 13 studies administered by the researcher (EB=3,443), six studies administered by the lecturer (EB=0,781), and three studies administered by the researcher and the lecturer (EB=2,319). In addition, it was determined that there were 18 studies (EB=1,192) for which no information about the implementer was given. According to the results of the data obtained, it is seen that the highest effect size value belongs to the studies implemented directly by the researcher, with 3,443. It can be thought that this may be due to the fact that the researcher has more control over the studies to be conducted.

In order to see the general situation according to the data obtained as a result of the research, the forest plot showing the overall effect size together with the individual effect sizes of the studies examining the effect of MEP in the pre-school period and the study weights are shown in Figure 4.

The filled squares in the forest plot are proportional to the average effect size. The size of the squares is proportional to the sample size values. The intervals in the forest plot (-1 and +1; -2 and +2; -3 and +3; ; -8 and +8) were determined by the researcher. When the forest plot values are examined, it is seen that the values are concentrated between 0 and 3, but the range (-4, +4) was kept wide in order to see the whole

Table 14: Effect Size Values of The Sample Sizes of The Studies.

		Effect Size and 95% Confidence Interval					*Statistical Test*	
Sample Size	*Frequency (f)*	*Effect Size*	*Standard Error*	*Variance*	*Lower Limit*	*Upper Limit*	*Z Value*	*p Value*
1-39 people	12	2,166	0,342	0,117	1,495	2,837	6,328	00,000
40-79 people	19	1,775	0,237	0,056	1,311	2,239	7,498	0,000
80 and above	9	0,479	0,149	0,022	0,186	0,772	3,208	0,001

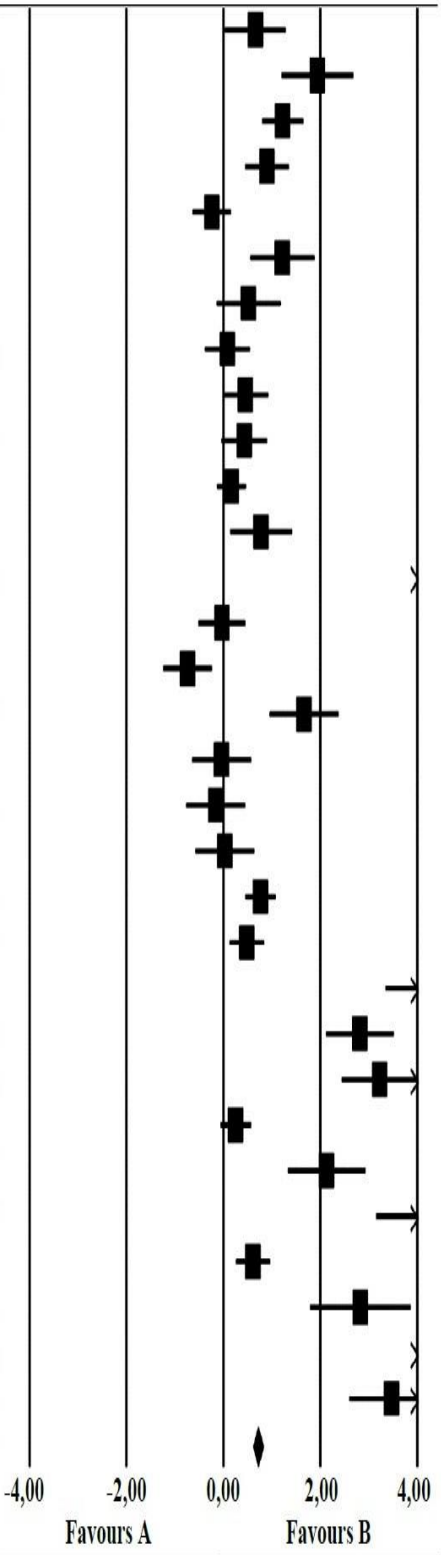
Table 15: Effect Size Values for Experimental Processing Time.

		Effect Size and 95% Confidence Interval					*Statistical Test*	
Duration	*Frequency (f)*	*Effect Size*	*Standard Error*	*Variance*	*Lower Limit*	*Upper Limit*	*Z Value*	*p Value*
1-8 weeks	6	0,171	0,128	0,016	-0,080	0,421	1,332	0,183
9-17 weeks	9	0,852	0,118	0,014	0,621	1,083	7,233	0,000
18 weeks and over	14	3,270	0,349	0,122	2,586	3,955	9,363	0,000
Unspecified	11	1,358	0,259	0,067	0,851	1,865	5,249	0,000

Table 16: Effect Size Values for the Implementer of the Experimental Procedure.

		Effect Size and 95% Confidence Interval					*Statistical Test*	
Implementer	*Frequency (f)*	*Effect Size*	*Standard Error*	*Variance*	*Lower Limit*	*Upper Limit*	*Z Value*	*p Value*
Researcher	13	3,443	0,412	0,170	2,636	4,250	8,358	0,000
Lecturer	6	0,781	0,221	0,049	0,348	0,751	7,164	0,000
Researcher and Lecturer	3	2,319	0,729	0,531	0,890	3,748	3,182	0,001
Unspecified	18	1,192	0,203	0,041	0,795	1,589	5,885	0,000

Study name	Statistics for each study							Std diff in means and 95% CI
	Std diff in means	Standard error	Variance	Lower limit	Upper limit	Z-Value	p-Value	
Acay, 2018(a)	0,657	0,325	0,105	0,021	1,293	2,024	0,043	
Acay, 2018(b)	1,938	0,383	0,147	1,187	2,689	5,056	0,000	
Aghajani, 2021	1,223	0,224	0,050	0,784	1,662	5,464	0,000	
Ahmodpour and Mujembari, 2015	0,900	0,235	0,055	0,440	1,360	3,837	0,000	
Aral, Bicakci and Tiryaki, 2015	-0,241	0,208	0,043	-0,649	0,167	-1,157	0,247	
Asliyüksek, 2015	1,217	0,344	0,119	0,542	1,892	3,535	0,000	
Aydogan,2016	0,517	0,344	0,118	-0,157	1,191	1,504	0,133	
Aygun.2020(c)	0,080	0,243	0,059	-0,395	0,556	0,331	0,740	
Aygun,2020(a)	0,453	0,246	0,060	-0,029	0,934	1,842	0,066	
Aygun,2020(b)	0,429	0,245	0,060	-0,052	0,910	1,748	0,080	
Azevedo, 2019(a)	0,164	0,159	0,025	-0,148	0,476	1,030	0,303	
Bayer, 2015	0,775	0,328	0,108	0,132	1,417	2,363	0,018	
Beken, 2009	8,317	1,098	1,206	6,165	10,469	7,574	0,000	
Bezirci, 2017	-0,029	0,254	0,065	-0,527	0,469	-0,115	0,908	
Bulgur, 2018	-0,738	0,263	0,069	-1,254	-0,223	-2,807	0,005	
Dedeoglu, 2018(a)	1,662	0,367	0,135	0,944	2,381	4,532	0,000	
Dedeog1u, 2018(b)	-0,037	0,316	0,100	-0,657	0,583	-0,117	0,907	
Dedeoglu, 2018(c)	-0,157	0,317	0,100	-0,778	0,464	-0,495	0,620	
Dedeoglu, 2018(d)	0,027	0,316	0,100	-0,593	0,647	0,085	0,933	
Dereli, 2017	0,763	0,164	0,027	0,442	1,084	4,658	0,000	
Guven etc., 2020	0,483	0,187	0,035	0,117	0,849	2,586	0,010	
Harris, 2005(a)	4,148	0,416	0,173	3,333	4,962	9,980	0,000	
Harris, 2005(b)	2,812	0,361	0,130	2,104	3,520	7,787	0,000	
Harris, 2005(c)	3,225	0,406	0,165	2,429	4,020	7,947	0,000	
Azevedo, 2019(b)	0,253	0,165	0,027	-0,071	0,576	1,533	0,125	
Kayili and Ari, 2016(a)	2,127	0,411	0,169	1,320	2,933	5,168	0,000	
Kayili and Ari, 2016(b)	4,379	0,632	0,400	3,139	5,618	6,923	0,000	
Kayili and Kocyigit, 2008	0,609	0,185	0,034	0,246	0,972	3,287	0,001	
Kayili and Kuscu, 2012	2,823	0,534	0,285	1,776	3,870	5,286	0,000	
Kayili, 2010(a)	6,927	0,748	0,560	5,460	8,393	9,258	0,000	
Kayili, 2010(b)	3,465	0,447	0,200	2,589	4,342	7,747	0,000	
	0,702	0,048	0,002	0,608	0,797	14,586	0,000	



Study name	Std diff in means	Standard error	Variance	Lower limit	Upper limit	Z-Value	p-Value
Kayili, 2010(c)	6,037	0,667	0,444	4,730	7,343	9,055	0,000
Kayili, 2010(d)	2,363	0,369	0,136	1,640	3,085	6,411	0,000
Kayili, 2016	0,729	0,270	0,073	0,201	1,258	2,705	0,007
Kayili etc., 2010	6,446	0,750	0,563	4,976	7,917	8,590	0,000
Hallumoglu and Karsak, 2020(a)	3,942	0,626	0,392	2,715	5,170	6,294	0,000
Hallumoglu and Karsak, 2020(b)	5,106	0,754	0,568	3,629	6,582	6,776	0,000
Ongoren and Turcan, 2009	2,278	0,406	0,165	1,482	3,074	5,611	0,000
Ongoren, 2008(b)	2,353	0,582	0,338	1,212	3,493	4,044	0,000
Ongoren, 2008(a)	2,176	0,564	0,318	1,070	3,281	3,856	0,000
Bahatheg, 2010(a)	0,356	0,411	0,169	-0,451	1,162	0,864	0,388
Bahatheg, 2010 (b)	0,122	0,409	0,167	-0,679	0,922	0,297	0,766
Bahatheg, 2010(c)	0,272	0,410	0,168	-0,532	1,076	0,662	0,508
Bahatheg, 2010(d)	0,398	0,412	0,170	-0,410	1,206	0,965	0,335
Sahinturk, 2012	2,695	0,416	0,173	1,879	3,511	6,471	0,000
Selcuk, 2016	1,782	0,374	0,140	1,049	2,515	4,768	0,000
Simsek, 2017	13,078	1,496	2,238	10,146	16,010	8,742	0,000
Tayfun and Aydogan, 2021	0,002	0,320	0,103	-0,626	0,629	0,006	0,006
Tepeli and Yilmaz, 2012(a)	0,962	0,334	0,112	0,306	1,617	2,876	0,004
Tepeli and Yilmaz, 2012(b)	1,839	0,364	0,132	1,126	2,553	5,055	0,000
Tiryaki etc.,2021	0,369	0,194	0,038	-0,012	0,749	1,900	0,057
Toran, 2011	2,321	0,373	0,139	1,589	3,053	6,215	0,000
Ustundag, 2019	1,616	0,340	0,115	0,950	2,282	4,754	0,000
Yigit, 2008(a)	3,745	0,742	0,551	2,290	5,199	5,047	0,000
Yigit, 2008(b)	3,577	0,721	0,520	2,164	4,991	4,961	0,000
Yildirim Dogru, 2015	1,194	0,562	0,315	0,093	2,295	2,126	0,033
Yildirim, 2021	0,601	0,417	0,174	-0,217	1,419	1,441	0,150
Yildiz, 20180(b)	1,207	0,504	0,254	0,218	2,195	2,393	0,017
Yildiz, 2018(a)	2,045	0,571	0,326	0,926	3,164	3,582	0,000
Yildizbas and Asliyuksek, 2016(a)	1,092	0,339	0,115	0,428	1,756	3,221	0,001
Yildizbas and Asliyuksek, 2016(b)	1,217	0,344	0,119	0,542	1,892	3,535	0,000
Zengin, 2019	1,546	0,360	0,130	0,840	2,252	4,290	0,000
	1,390	0,072	0,005	1,248	1,531	19,247	0,000

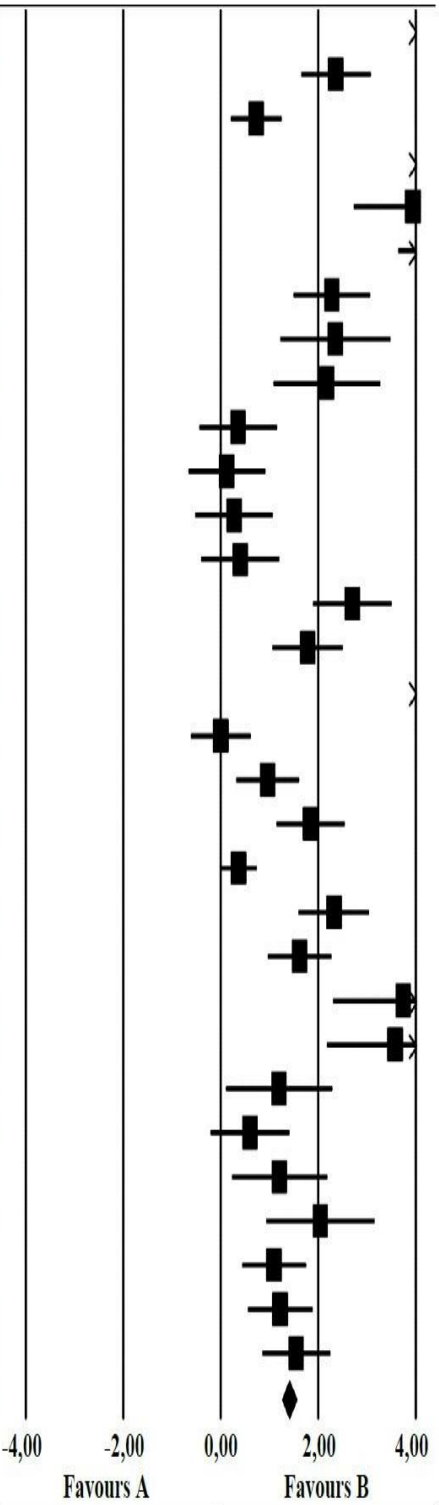


Figure 4. Forest Plot of Studies Examining the Effectiveness of The Montessori Education Program at 95% Confidence Interval.

table better. When the graph is examined, it is seen that only 5 of the 62 data are negative, and 57 are positive. It is seen that the rhombus in the bottom row, which symbolizes the general effect size value of the graph, is greater than zero and close to 2. This indicates that the teaching method in which the Montessori education program is applied in the pre-school period is more effective compared to other methods.

Discussion

This meta-analysis study, which aims to determine the level of the effect of MEP in the pre-school period, was conducted with 40 studies and 22 sub-studies that were determined to meet the inclusion criteria and with a total of 2492 participants consisting of 1261 experimental and 1231 control groups. In the research, it was determined that there was a fluctuating spread when the years in which the studies were conducted were examined. Starting in 2005, the number of studies decreased in some years and increased in others. It was noted that the fewest studies were conducted in 2005, while the highest number of studies were conducted in 2015 and 2016.The increase in the number of studies, especially after 2015 (Acay, 2018; Ahmadpour & Mujembari, 2015; Dedeoğlu, 2018; Katrina, 2019; Yavaş, 2020; Yıldırım, 2021; Zengin, 2019) reveals the finding that education programs have started to be compared more recently.

In order to determine the effectiveness of MEP in the pre-school period, 40 studies, including 18 master's theses, 18 articles, and four Ph.D. theses, conducted between 2002 and 2022 were included. Of the studies accessed, 45% were master's theses, 45% were articles, and 10% were Ph.D. theses. The conclusion that can be drawn from these data is that master's theses and articles have a higher rate of inclusion in meta-analysis than Ph.D. theses. Considering this ratio, it is understood that MEP is not a very preferred topic for Ph.D. theses. In addition, although it is a striking finding that master's theses and article studies are higher than Ph.D. theses, it can be thought that this situation may be due to the difference between the number of master's programs and the number of doctoral programs in our country and abroad. In other words, the fact that there are more master's programs than doctoral programs may have led to this effect. The study conducted by Canbaz et al. (2022) supports this finding.

Of the studies accessed for the meta-analysis, 67.5% were domestic studies, and 32.5% were foreign studies. It is thought that this situation is due to the intensity of studies comparing education programs between 1960 and 2000 abroad and the effect of the MoNE Pre-school Education Program, which was prepared in 2006 and developed in 2013 in Turkey (Kayılı, 2016).

When the data on the development of the measurement tools used in the studies were examined, it was determined that 24 studies used a measurement tool developed by someone other than the researcher, nine studies used a measurement tool developed by the researcher, and seven studies did not include any information about the measurement tool used. The question of the lack of a certain standard for this categorization, which the researcher included in the research, and the question of why such a distinction was made remained unanswered.

The data obtained regarding the research samples showed that the highest number of participants was "1-39" and the lowest number was "80 and over". Of the studies, 52.5% were conducted with 1-39 participants, 30% with 40-79 participants, and 17.5% with 80 or more participants. It can be said that this situation is due to the small sample size of the studies with experimental design (Canbaz et al., 2022). In addition, it can be said that for the studies accessed for this study, the most preferred experimental processing time was 18 weeks or more, and 1-8 week experimental processing time was preferred, albeit slightly (6). 35% of the studies accessed consisted of studies of 18 weeks or more. For this reason, it is thought that the ideal study period for teaching based on MEP is 18 weeks or more.

When the data regarding the implementer of the experimental process in the studies included in the research are examined, it is not specified by whom 45% (18 studies) were implemented. It was determined that 13 studies (32.5%) were implemented by the researcher, six studies (15%) were implemented by the lecturer, and three studies (7.5%) were implemented by the researcher and the lecturer together. It appears that lecturers engaged in fewer Montessori education practices compared to researchers, potentially due to a lack of sufficient knowledge about such practices. The reason for the low number of studies in which the researcher and the lecturer practiced together is to prevent the effect on the subjects from diminishing and to avoid creating confusion in children's minds.

The studies reached within the scope of this research constitute a basis for the conclusion section. Of the 40 studies included in the research, 38 studies found MEP to be effective, while two studies found it to be partially ineffective. The findings of this study, indicating a 95% effectiveness rate for MEP, are consistent with the results reported in other studies. In the study, the effect size values of 40 studies examining the effect of MEP in pre-school period were calculated, and these calculations were combined with the meta-analysis method. The effect size values of the studies were calculated one by one according to both models, but since the significance level of the heterogeneity test result was greater than 0.05, the random

effects model data were preferred. When the included studies were analyzed one by one, it was determined that the largest effect size value belonged to Şimşek (2017), with 13.078, and the smallest effect size value belonged to Aral et al. (2015), with-0.241. Out of 62 data belonging to 40 studies, 57 were positive, and five were negative. Wolf (1986) stated that a positive overall effect size value is in favor of the experimental group. Based on this result, the fact that the majority of the studies included in the meta-analysis (91.93%) were positive (Acay, 2018; Aghajani, 2021; Ahmadpour & Mujembari, 2015; Aslıyüksek, 2015; Aydoğan, 2016; Aygün, 2020; Azevedo et al., 2019; Bahatheg, 2010; Bayer, 2015; Beken, 2009; Dereli, 2017; Güven et al, 2020; Harris, 2005; Katrina, 2019; Kayılı, 2010; Kayılı, 2016; Kayılı and Arı, 2016; Kayılı and Koçyiğit, 2008; Kayılı and Kuşçu, 2012; Öngören, 2008; Öngören and Turcan, 2009; Ön Hallumoğlu and Karsak, 2020; Selçuk, 2016; Şahintürk, 2012; Şimşek, 2017; Tayfun and Aydoğan, 2021; Tepeli and Yılmaz, 2012; Tiryaki et al, 2021; Toran, 2011; Üstündağ, 2019; Yıldırım, 2021; Yıldırım Doğru, 2015; Yıldız, 2018; Yıldızbaş & Aslıyüksek, 2016; Yiğit, 2008; Zengin, 2019) in favor of the experimental group and a very small number (8.07%) were negative (Aral et al., 2015; Bezirci, 2017; Bülgür, 2018) in favor of the control group reveals that the results were obtained in favor of the control group.

Of the 62 studies and sub-studies included in this meta-analysis, nine had a moderate effect, nine had a small effect, eight had a weak effect, and 36 had a strong effect, which was the most common effect size category. The overall effect size value of the study (1,737) is in the strong effect size category. It is thought that the reason for this is that the Hedges's g values of the studies with a strong effect are high (Kayılı, 2010; Ön Hallumoğlu & Karsak, 2020; Şimşek, 2017) and dominant.

When the studies included in the study were analyzed in terms of type, it was determined that although the values of master's theses (EB=2.102) were higher than Ph.D. theses (EB=1.132) and articles (EB=1.388), they were not statistically more significant. In light of this result, the effect of MEP does not differ according to the type of publication. There is no comparable finding to this result. Therefore, more studies on MEP should be conducted.

According to the effect size values, the largest effect of MEP for the year of publication in the pre-school period was observed in 2009, while the smallest effect was observed in 2018. However, the test result was not statistically significant. Based on this result, it can be said that the year of publication has no effect on MEP. There are no studies with similar results that can be compared with this finding.

As a result of the analysis conducted to determine whether the effectiveness level of MEP in pre-school period varies according to the duration of implementation, it was determined that the studies conducted for 18 weeks or more (Acay, 2018; Kayılı, 2015; Toran, 2011) were more effective. However, according to the heterogeneity test data, the difference was not significant. In a different study in which the effect of MEP will be examined in the future, it can be said that the findings of more studies continuing for 18 weeks and over may be useful in terms of comparing and evaluating the findings obtained from this study.

Based on the evaluations conducted, it was determined that the effect size decreased as the sample size increased. This finding is also consistent with the findings of Canbaz et al (2022). It was determined that studies with 1-39 participants had the largest effect with an effect size of 2.166, while studies with 80 or more participants had the smallest effect with an effect size value of 0.479. It is thought that the studies included in the research are experimental, and it is expected that the effect size value of the sample ratio between 1-39 will be high in order to observe the effect of the training program better applied.

Based on the data determined as a result of the study, it can be said that there is no significant difference between the effect sizes when the data on the place where the studies were carried out, the way the measurement tools used in the studies were developed and the implementer of the experimental process are examined. However, this situation should be addressed and elaborated more comprehensively in future studies.

One of the negative aspects of the meta-analysis study selected as the research method is the need for more than one researcher to perform coding in order to ensure coding reliability (Şen & Yıldırım, 2020). For this study, coding was also performed by a different researcher, and this problem was tried to be solved. This problem was prevented by examining the two coding forms one by one and resolving the discrepancies with a joint decision. Another negative aspect is that the researchers published the studies in which they obtained positive results and did not publish the studies in which negative results were obtained, and the conclusion that MEP was effective in almost all of the included studies constitute a problem. However, this problem was tried to be prevented by measuring publication bias in the meta-analysis. The long-range publication years covered by the meta-analysis study caused the research process to be prolonged. In addition, the lack of sufficient studies is also a negative situation. However, care was taken to select keywords to prevent this situation. Searches were made by making all kinds of combinations with the determined keywords. While searching, "all content" was selected and scanned. In this way, it was ensured that no study with MEP applications was skipped by not depending only on the name of the thesis.

Result

In this meta-analysis study, which was conducted to determine the level of effectiveness of MEP in the pre-school period, 62 data from a total of 40 studies included in the research were utilized, and the average effect size of the research was determined. Based on the data obtained as a result of the research, it was determined that MEP had a positive and high-level effect (EB=1,737) in the pre-school period. In other words, it can be said that teaching with intensive MEP practices in the pre-school period is much more effective than teaching without MEP practices.

According to the subgroup analyses performed to assess whether effect size values vary based on certain criteria in the studies, it was found that there was no statistical difference in the subgroup analyses pertaining to the type of publication, the location of the study, the developer of the measurement tool, and the implementer of the experimental procedure. However, a statistically significant difference was observed when evaluations were conducted based on the subgroups of publication year, sample size, and duration of implementation. Among the studies published in Turkey, the study published in 2017, which was applied to 40 children (20 experimental, 20 control) for four weeks, was found to have the highest effect size value.

Recommendations

The recommendations developed based on the findings of the research are as follows:

- It is recommended that all studies conducted by researchers should be open to access or that researchers be encouraged to grant access.
- It is also recommended that researchers should pay attention to reporting in detail in studies where they do not obtain meaningful results as a result of the research.
- It is recommended that researchers should pay attention to including all data (sample size, arithmetic averages, standard deviation values, practitioner, implementation period, and scale developer) in their studies.
- In order to provide access to studies with access barriers or missing data in databases and to reach the author, it may be recommended to add author information (e-mail) to the imprint of the databases and to increase the accessibility of published studies.
- It can be said that coding by more than one researcher or coding at least twice by the researcher will make a significant contribution to reliability.
- In future studies, detailed examinations can be conducted on other education programs or other education levels that reach data saturation. For example, meta-analysis studies can be conducted on the effect of the Head Start Education Program in the pre-school period or the contribution of MEP to the social-emotional development of children at the primary school level.
- The studies with the highest effect size can be accessed, and the educational activities implemented in those studies can be implemented by parents and teachers. In addition, it is recommended that researchers who will work in this field should design their own studies by examining studies with large effect sizes and studies with small effect sizes in detail when planning a new study.
- It is thought that keeping the number of children in the classes to be implemented as low as possible and keeping the implementation periods of eight weeks or more will increase the effect of the educational programs implemented.
- It is recommended that in-service training programs should be organized for teachers working in pre-school education institutions within the scope of the Montessori education program and teachers should benefit from these trainings.
- In this study, the effectiveness of MEP in pre-school period was examined. In another study, it can be examined whether educational practices are permanent or not.
- The studies included in the research can be disseminated by applying them in different countries, provinces, and districts, and the studies can be repeated in terms of validity and permanence.

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