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Effectiveness of School Readiness Programs for Preschool Children: A Meta-Analysis Study

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Abstract

The current study adopted meta-analysis method to determine the effect of school readiness programs on preschool children. The researchers scanned national (i.e., Turkish) and international databases for studies conducted using experimental and quasi-experimental methods which were published between 2008 and 2022 that met this study's inclusion criterion. The search yielded 3254 studies on school readiness, of which 258 adopted experimental or quasi-experimental designs. However, 16 studies (N = 3254) meeting the inclusion criteria were evaluated within the scope of this study. The school readiness intervention programs were found to be positive and significant, and using the standard set forth by Cohen (1992), the results yielded a large effect size (g = .932). The results highlighted significant differences in groups in terms of age and duration of the intervention variables. The overall results will shed a light in designing effective school readiness intervention programs.

Keywords: Meta-analysis, Preschool, Early childhood, Primary education, School readiness, Children

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Introduction

The early childhood period covers the critical years when the child's developmental speed and learning capacity are at their highest. A good early childhood education increases all developmental areas of the child in a balanced way with an important infrastructure, and it helps the child receive a level that includes all the prerequisites required for academic learning (Lipscomb et al., 2013). Previous research has suggested that children who have received preschool education are at least one academic year ahead of their peers, and receiving preschool education makes significant contributions to their further education lives and developments (Herreras, 2017). The education given in these early years provides long-term and permanent effects in both the personal and educational lives of individuals (Kurniah et al., 2019; Tremblay et al., 2017).

A body of literature on the subject in the international context (e.g., Kokkalia et al., 2019; The Organisation for Economic Co-operation and Development [OECD], 2015) has revealed that readiness is among the most important priorities of many countries, and in order to increase the welfare of the society in the 21st century, countries aim to raise more qualified citizens by making the education in childhood and youth more successful in their early childhood education policies.

There are many definitions of school readiness. Hanniffy (2017) defines it as a multifaceted concept that has been modified to suit the views of different stakeholders and different purposes. Therefore, it has caused many discussions, and has confused parents and teachers (Kagan, 1990). School readiness is a more limited construct that embraces certain cognitive and linguistic skills, such as identifying colors and distinguishing a triangle from a square. Regardless of the academic field, school readiness can typically be defined as a child being developed enough in several skills, including physical, intellectual, and social skills, that helps him/her to meet school requirements (Okon & Wilgocka-Okon, 1973). This point of view, which was very popular for a long time and basically based on Piaget's theory, has undergone various developments and changes, especially under the influence of Vygotsky's theories (Hanniffy, 2017).

Piaget (1978) argues that the individual is in interaction with the culture, but the knowledge that emerges is based on the individual's judgment of this interaction. In line with this thought, school readiness is based on chronological age and the order of achievements, as children must reach the required level of development at the age of starting school. In Piagetian terms, readiness is based on the actual abilities each child has when entering the school environment. The theory has been used by many educators and researchers as a theoretical background to the idea that children must be in a certain biologically based developmental stage to benefit from school or education (Kagan, 1990), and the Gesell school readiness test has formed a theoretical basis for standardized tests which evaluate the school readiness in the perspective of maturation.

Unlike Piaget, Vygotsky argues that a child does not need to reach a certain developmental stage to learn (Feldman & Fowler, 1997, p. 197). Vygotsky argues that learning comes before developmental stages, especially in terms of language development (Vygotsky, 1934/1962). The transition between learning and development occurs in the so-called "zone of proximal development" (Vygotsky, 1978). In other words, as Ilg et al. (1978) argue, since children cannot participate in all processes at the same rate, they cannot reach the school readiness standard at the same time; therefore, school readiness should be determined by developmental capacity, not chronological age. Consequently, an important concept for this theory is the social state of development. What children see and hear affects their development. With the help provided by more experienced people in the social environment, children gradually learn to function intellectually on their own (Hanniffy, 2017).

On the other hand, in explaining the concept of school readiness, UNICEF (2012) emphasizes that Bronfenbrenner's theory should be considered in the conceptualization of school readiness due to its strong impact on children, schools and families. Children starting school experience an ecological transition where they enter a new and different ecological context in which they develop gradually. Every such transition has developmental consequences that involve the person in new activities and new types of social structures (Bronfenbrenner, 1977). This perspective argues that when evaluating the understanding of school readiness, one should go further than assessing children's skills and abilities, and include relationships children establish (Hanniffy, 2017).

Children's school readiness levels are affected by a number of factors including age, intelligence, personality, mental health and family characteristics. Although each child has different conditions and characteristics, they are expected to have acquired some skills in assessing their school readiness. The education process that children go through before primary school is of vital importance in developing their early academic and social skills. In this period, the progress of cognitive development affects the development of academic skills. The development of early academic skills, which are directly related to further education life, such as literacy and mathematics skills in children, is too critical to occur by accident (Pan et al., 2019). Social cognitive processes support both social and academic aspects of school readiness (Ziv, 2013). In this context, the concept of school readiness in early childhood includes children's skills in areas such as early mathematics, early literacy, self-regulation, social emotional regulation, and motor skills (Lonigan et al., 2015; McClelland et al., 2019; Marti et al., 2018; Walker & MacPhee, 2011). As children's participation in early childhood education increases, their development increases, and their readiness for primary school increases as well (Bala et al., 2010).

In the literature, there are many studies examining the effects of preschool education and the intervention programs on primary school readiness using experimental methods (i.e., Atteberry et al., 2019; Bierman et al., 2018; Carson et al., 2019; Distefano et al., 2020; Duncan et al., 2018; Hong &

Henly, 2020; McCoy et al., 2017; McLeod et al., 2019; Tunçeli & Akman, 2014; Welsh et al., 2020; Wolf et al., 2019; Wong et al., 2013) and a review study (i.e., Kokkalia et al., 2019). In addition, that two meta-analysis studies (Duncan et al., 2007; Paro & Pianta, 2000) have been carried out, which have evaluated the results of experimental research on primary school readiness together. Meta-analysis studies have been criticized for combining data obtained by using unrelated intervention programs, variables, samples and measurement tools (Maksimovic, 2011). However, the purpose of combining different studies is to give a clearer picture of the effect of an intervention rather than focusing on the effects of individual studies (Borenstein & Higgins, 2013). Glass (1982) emphasizes that the importance of comparing different studies rather than comparing similar studies in all aspects because a vast amount of literature on the subject, as the nature of it, has tended to employ different participants with different characteristics, who are as different as apples and oranges.

It is of vital importance to make a generalizable assessment of the intervention programs prepared for primary school readiness. In line with this, the aim of this paper is to help determine how long and intense the school readiness intervention program should be in order to achieve effectiveness in planning the intervention programs for researches in this field. In addition, the current study will guide the improvement of studies which are conducted using long-term and high-cost programs, or programs that do not support readiness in a meaningful way. In this vein, in order to determine the effect of primary school readiness programs on preschool children, the researchers scanned studies using experimental/quasi-experimental designs conducted between 2008 and 2022 from international and national (i.e., Turkish) databases considering the study's inclusion criteria of the study. The reasons for including studies conducted starting from 2008 is that the last meta-analysis in the field was conducted in 2007 (Duncan et al., 2007). This research provides evidence of which experimental study is more effective by taking the total effects of the effect sizes found in the experimental studies on primary school readiness.

Method

The aim of this study is to determine whether primary school readiness programs affect children's scores expressing their primary school readiness levels. In line with this, the current study uses the meta-analysis method to re-analyze the results of the studies conducted in this context. Meta-analysis is a method of obtaining more general results by re-examining and analyzing the results of a body of research carried out by different researchers in different environments on a specific subject (Glass, 1976). While conducting a meta-analysis study, initially, a theoretical analysis of the results of the literature on the given subject is conducted. Then, studies supporting these results are reviewed. Finally, these studies are systematically coded and their effect size values are checked. The researcher(s) reaches a conclusion by investigating these values and their effects on the variables of

the study investigated. These results are interpreted by the researcher(s) and turned into a report (De Coster, 2004).

The current study examined national and international literature on the studies on readiness for primary school which included practices as well. After the review process, the studies carried out between 2008 and 2022 were scanned both in Turkish and in English in the databases of ProQuest Dissertations and Theses (EKUAL), Web of Science, Ebscohost-Eric, Google Scholar and Higher Education Institution (YÖK) National Thesis Center using the following keywords, "ilköğretime hazırbulunuşluk", "okul olgunluğu", "school readiness", "preschool and school readiness". As a result, 258 studies with experimental/quasi-experimental designs were found among 3254 studies on primary school readiness. In selecting the studies to be included in the meta-analysis, studies not including standard deviation values, mean values, posttest scores, and overall scale scores were excluded. The reason for not including studies not giving overall scale scores was that the concept of school readiness is considered as a whole including various concepts such as early mathematics, early literacy, self-regulation, social emotional regulation (Lonigan et al., 2015; McClelland et al., 2019). In addition, studies using nonparametric tests were excluded as well. As a result of these criteria set forth by the researchers, 16 studies (12 articles, three master's theses, one doctoral dissertations) that met the inclusion criteria were included in the meta-analysis. Studies included in the analysis are indicated with * in the references section.

Coding Process

The studies selected after the literature review were included in the current study in line with certain criteria. These studies were coded within a system framework to be used in the processes of analyzing and interpreting the results. Initially, the researchers developed a detailed coding form describing the general characteristics of the studies. The first part of this form, which consisted of three parts, included the ID, the title, the author information and the year information of a study. The second part consisted of the type of the study, the ages of the children and the duration of the application. The last part consisted of mean, sample size and standard deviation values (Table 6, Appendix 1). The dependent variable of this study was the effect size (Effect size: ES), which was calculated with the primary school readiness scores in the studies selected and expressed with the values determined for the measurement tool used (Bernard et al., 2004). The coding of the studies included in the meta-analysis was done by two field experts (Cooper, 2017), and the inter-coder reliability was calculated. By using Miles and Huberman's (1994) formula, the reliability between coders was calculated as 86%. Miles and Huberman (1994) state that the reliability value should be above 70%. However, as the nature of the meta-analysis studies requires, the coders were brought together to reach 100% inter-coder reliability (Cooper & Hedges, 2009), and the conflicts between

coders were resolved through discussions and 100% inter-coder reliability was obtained. The coders were competent in the field of meta-analysis.

Data Analysis

The process effectiveness method was used to analyze the data. In order to reveal the differences between the control and experimental groups in the process effectiveness method, various scales are used when determining the mean of the dependent variables in the studies included in the research (Camnalbur & Erdoğan, 2008). The main thing in the meta-analysis method is to examine the effect sizes that show the frequency of occurrence of a phenomenon in a particular situation. The difference index between the control and experimental groups shows the effect size (Yıldız, 2002). Effect size expresses the quantitative data of other studies included in the meta-analysis studies through a common unit. The current study used Cohen's (1992) standard to report the effect sizes. Cohen (1992) states that values between 0.20 and 0.50 indicate small effect size, values between 0.50 and 0.80 indicate moderate effect size, and values above 0.80 indicate large effect size.

In the study, Comprehensive Meta-Analysis Software (CMA) 3.0, MetaWin and Microsoft Excel 2016 programs were used in coding and analyzing the data. CMA software was used to analyze tests (heterogeneity and random and fixed effects models) and calculate the descriptive statics such as standard deviation, p- values, effect size, variance and Hedges'g (Bax et al., 2007; Hedges & Olkin, 1985). The random-effects model (REM) (Hedges & Vevea, 1998) was used to interpret the meta-analytical procedures. In estimating the mean effect size using the REM assumption, the actual effect varies from study to study (Raudenbush, 2009).

Inclusion Criteria

The inclusion criteria of research conducted to determine the effectiveness of primary school readiness practices are as follows:

1. Studies using experimental and quasi-experimental designs,
2. Studies stating the number of samples, mean and standard deviation values,
3. Studies with full text,
4. Studies written in English or Turkish,
5. Studies published between 2008 and 2022,
6. Articles published in peer-reviewed journals,
7. Unpublished theses
8. Studies which do not include standard deviation values, mean values, posttest scores, and overall scale scores and use nonparametric tests were excluded. (Figure. 1)

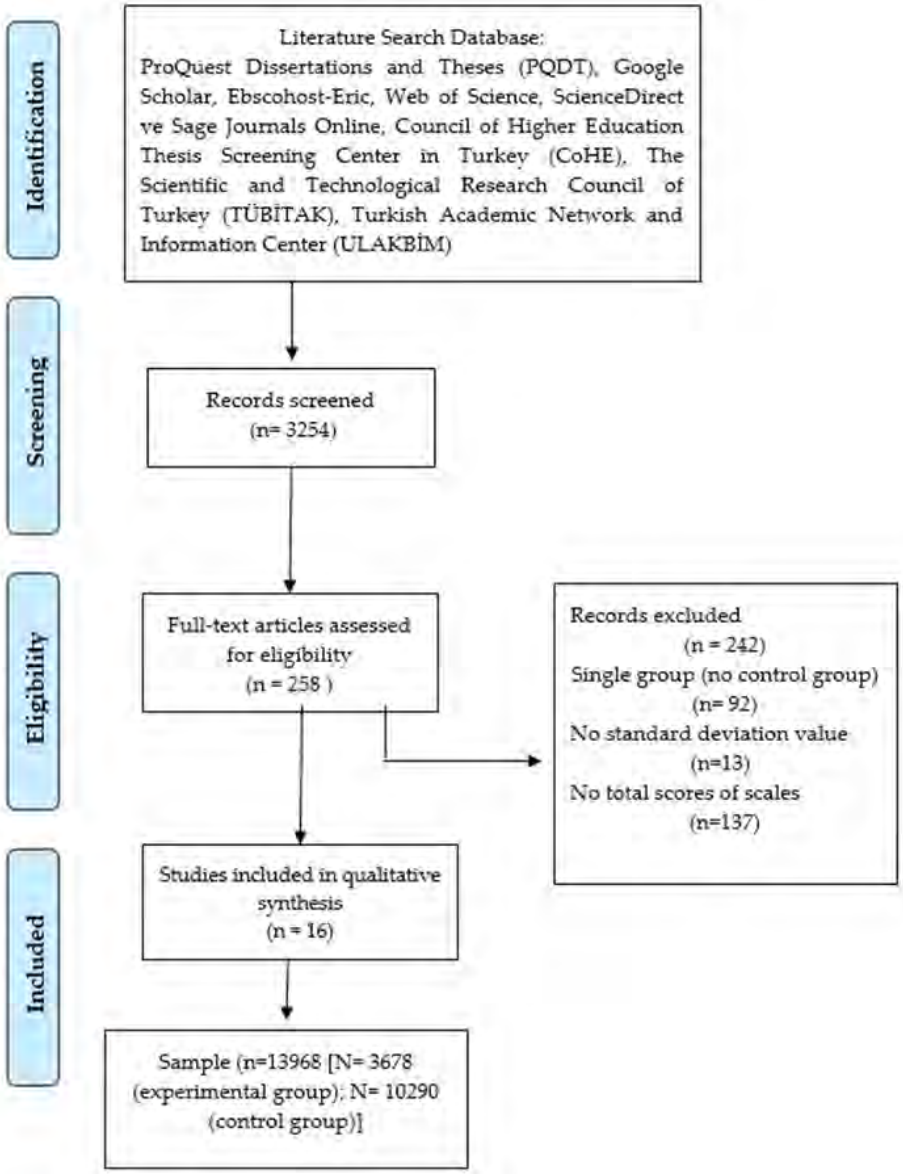

Figure 1. Literature flowchart (PRISMA)

Table 1. Descriptive values of the studies included in the meta-analysis

Variables of the Study		**f**	**%**
Publication year (k=16)	2008-2014	6	37.50
	2014-2022	10	62.50
Country of the study (k= 16)	Türkiye	6	37.50
	Other Countries	10	62.50
Publication type (k=16)	Master's thesis	3	18.75
	Doctoral dissertation	1	6.25
	Article	12	75
The duration of the experimental procedure (k= 16)	4 weeks	2	12.25
	6 weeks	2	12.25
	8 weeks	4	25
	1-2 semesters	6	37.75
	1-3 years	2	12.25

Age groups (k=16)	36-60 months	4	25
	51-58 months	2	12.25
	59-73 months	2	12.25
	60-72 months	4	25
	72 months	4	25

Results

Effectiveness of Practices to Increase the Level of Readiness for Primary School

The REM calculation results calculated the standard error as .116, the upper limit of the 95% confidence interval as 1.159, the lower limit as .704 and the Hedges'g value as .932. The effect size of the Hedges'g was large (Cohen, 1992). Z test results indicated a significant value below .01 (z = 8.025; p = .000). In addition, the I2 value increased to 92.958%. This result shows a high level of heterogeneity according to Higgins and Thompson's (2002) classification. After examining the 95% significance level according to the chi-square (X^2) table, the results indicated that the critical value with 15 degrees of freedom was 24.996 and the chi-square distribution was above the critical value ($X^2(.95)= 24.996$), meaning that the effect sizes were heterogeneously distributed.

Table 2. Distribution of mean effect sizes and confidence intervals of the studies included in the meta-analysis

Model	N	*Z*	*Q*	df	Hedges*'g*	SH	95% Confidence Interval		*p*	I^2
							Lower Limit	Upper Limit		
FEM	16	19.524	212.691	15	.483	.025	0.435	0.532	.00	92.948
REM	16	8.025		15	.932	.116	0.704	1.159	.00	

FEM (Fixed Effect Model); REM (Random Effects Model)

The forest plot of the 16 studies included in the meta-analysis is shown in Figure 2. The black squares in this figure represent the effect sizes, and the lines represent the upper and lower limits of these effect sizes in the confidence interval (95%). In addition, the diamond in the figure indicates the overall effect size.

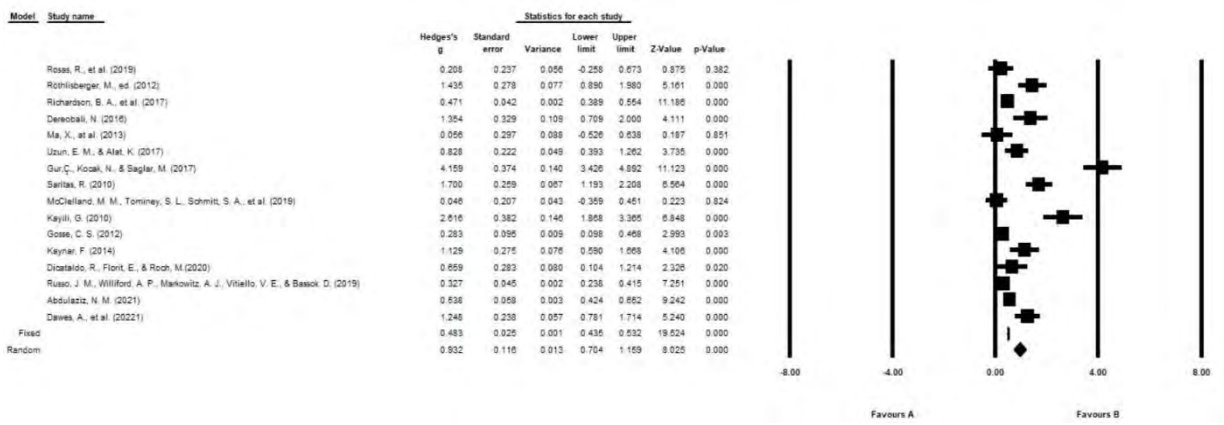

Figure 2. Graph of the studies included in the meta-analysis

Among the studies within the scope of the research, the results determined the study with the widest confidence interval as Kayılı (2010) while the study with the narrowest confidence interval was determined as Richardson et al. (2017). The results indicated that all of these 16 studies had a positive effect. Furthermore, the results of studies generally indicated an effect in favor of the experimental groups in the primary school readiness practices.

Effectiveness of Primary School Readiness Practices According to the Period in which the Studies Were Implemented

The studies were divided into 5 different groups as 4, 6, 8 weeks, 1-2 semesters and 1-3 years in order to examine the effectiveness of primary school readiness practices on the experimental groups according to the periods.

The results in the Table 3 indicated that studies implemented in 4 weeks (Hedges'g = 2.204), 1-2 semesters (Hedges'g = 1.115) and 6 weeks (Hedges'g = 1.108) had large effect sizes, studies implemented in 8 weeks (Hedges'g = .524) had medium effect sizes, and studies implemented in 1-3 years (Hedges'g = .367) had small effect sizes. The results further indicated the overall effect size of all studies according to the implementation period as .741, which is a medium effect size according to Cohen (1992).

Table 3. The effectiveness of primary school readiness according to the implementation period of the studies

Random Effects Model	*k*	Hedges'*g*	SH	95% Confidence Interval		Effect Size Level	Effect Size in Heterogeneity Test		
				Lower Limit	Upper Limit		*Q*	*sd*	*p*
1-2 semesters	6	1.115	.192	.739	1.491	Large			
1-3 years	2	.367	.180	.015	.720	Small			
4 weeks	2	2.204	.938	-1.594	6.003	Large			
6 weeks	2	1.108	.303	.515	1.702	Large			
8 weeks	4	.524	.268	-.000	1.049	Medium			
Overall	16	0.741	.110	.526	.955	Medium	10.802	4	.029

p<.05

Table 3 shows that the studies were grouped according to the periods of their implementation. The heterogeneity test between groups determined the Q value as 10.802. After considering the 95% significance level according to the chi-square (X^2) table, the critical value with 4 degrees of freedom was accepted as 9.448. The critical value of the Q value (Q=10.802) and the X^2 value calculated according to 4 degrees of freedom (X^2(.95)=9.448) were examined, and the results indicated that this value was not violated. The results further indicated that the effect size was homogeneously distributed, and there was a significant difference between groups (Z=6.755; p = .029). The forest graph showing the effect sizes of the periods in which the primary school readiness practices were implemented in the studies included in the meta-analysis is shown in Figure 3.

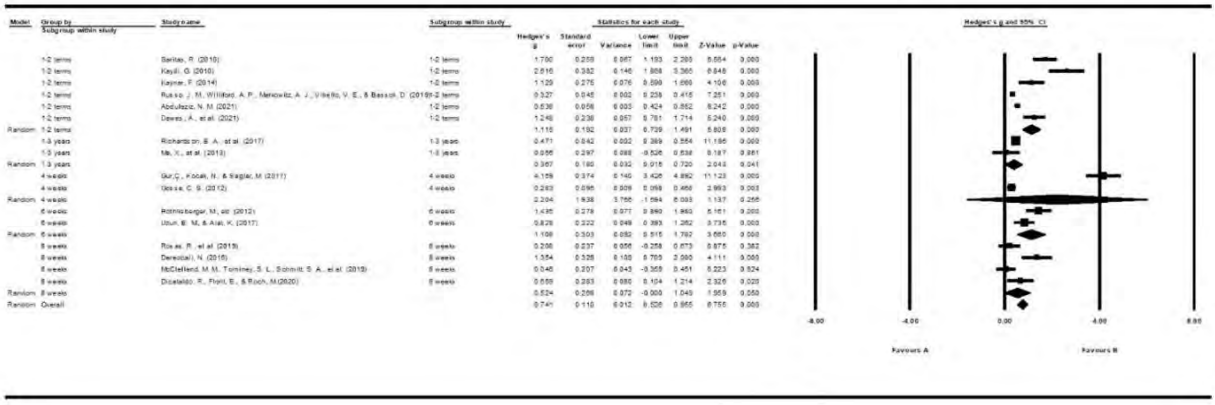

Figure 3. The forest graph of the effect size of the studies examined according to the period of implementation

Among the studies conducted between 1 and 2 semesters, the results of the forest graph in Figure 3 indicated that Kayılı (2010) had the widest confidence interval, and Russo et al. (2019) had the narrowest confidence interval. As per the studies conducted between 1 and 3 years, the results determined that the study with the widest confidence interval was Ma et al. (2013), and the study with the narrowest confidence interval was Richardson et al. (2017). For the studies with a 4-week implementation period, the results indicated that Gür et al. (2017) had the widest confidence interval and Gosse (2012) had the narrowest confidence interval. Among the studies conducted during 6 weeks, the widest confidence interval was determined as Röthlisberger et al.'s (2012) study, and the narrowest confidence interval was determined as Mercan Uzun and Alat's (2017) study. In 8-week studies, the study concluded that the widest confidence interval was Dereobalı's (2016) study, and the study with the narrowest confidence interval was McClelland et al. (2019).

The Efficiency of Primary Education Readiness Practices According to the Age Groups in which the Studies Are Applied

In order to investigate the effect of readiness for primary education practices on experimental groups according to the age group they are applied, the experimental groups have been divided into

three groups as 36-60 months, 51-58 months, 59-73 months, 60-72 months and 72 months (See Table 4). The analyzes included a small effect size of 1 group (51-58 months Hedges'g = .259), a medium effect size of the two groups (36-60 months Hedges'g =.523; 59-73 months Hedges'g = .407) and a backward showed that the remaining 2 groups had large effect sizes (60-72 months Hedges'g = 1.435; 72 months Hedges'g = 1.823). The total effect size of all groups was determined as .471. Therefore, when evaluated according to Cohen's (1992) classification, it can be said that it has a small effect size.

Table 4. The efficiency of primary education readiness practices according to the age groups

		k	Hedges'g	SH	%95 Confidence Interval		Level of Effect Size	Effect Size in Heterogeneity Test		
					Lower Limit	Upper Limit		Q	sd	p
R E M	36-60 months	4	.523	.090	.347	.699	Medium			
	51-58 months	2	.259	.120	.024	.494	Small			
	59-73 months	2	.407	.224	-.032	.846	Medium			
	60-72 months	4	1.435	.347	.754	2.116	Large			
	72 months	4	1.823	.740	.373	3.274	Large			
	Total	16	.475	.067	.344	.606	Small	14.558	4	.006

p<.05

Table 4 shows that the studies included in the investigation are grouped as per the age levels analysed. Considering the heterogeneity test between groups, the Q value has been determined as 14.558. Considering the 95% significance level according to the chi-square (X^2) table, the critical value with 4 degree of freedom has been accepted as 9.488. The critical value of the Q value (Q=14.558) and the X^2 value calculated according to 4 degree of freedom ($X^2(.95)$= 9.488) have been examined and it has been observed to exceed this value. As a result, it has been determined that the effect size is distributed heterogeneously. When the effect size between age categories is examined, statistical significance has been found (Z = 7.098; p = .000). In addition, I2 value of 92.948 % is another indicator of high heterogeneity. In this case, a statistically significant difference was observed between the effect sizes of primary school readiness practices in groups separated by age groups, in favor of children aged 60-72 months and 72 months.

The effect sizes of the studies examined according to the age levels of groups to which studies were conducted are given in the forest plot below.

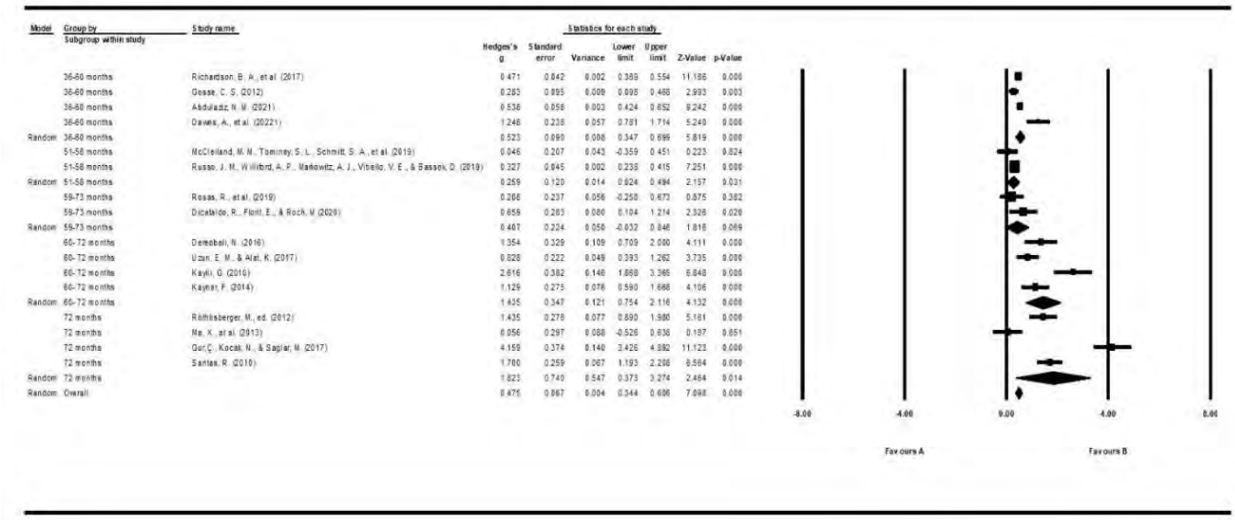

Figure 4. Forest plot of the effect size of the studies examined according to the age group in which the primary school readiness programs are applied

According to the forest plot in Figure 4, Daves et al. (2021), the narrowest one, Richardson et al. (2017), McClelland et al. (2019), the narrowest one, Russo et al. (2019), the study with the widest confidence interval in studies applied to children 69-73 months old. Rosas et al. (2019), the narrowest confidence interval in Dicataldo et al. (2020), the study with the widest confidence interval among studies applied to children aged 60-72 months. The narrowest one was Röthlisberger et al.'s (2012) study, and the study with the widest confidence interval was found Gur et al.'s (2017) study who worked with children aged 72 months.

Publication Bias

It can be said that publication bias occurs in different ways in meta-analysis studies. Firstly, it can be expressed as the probability of that the studies included in the analysis have been published more. Another is that studies with significant differences in the results cause a tendency to publish more (Greenhouse & Iyengar, 2009).

The study has used Begg and Mazumdar test (Begg and Mazumdar Rank Correlation), Funnel plot, Orwin's Safe N method (Orwin's fail-safe number), Rosenthal's Safe N method (Rosenthal's fail-safe number), Duval and Tweedie 's (1998) Trim and Fill, and Egger test (Egger's Regression Intercept) methods to detect publication bias. Funnel Plot is a scatter plot that reveals the possibility of publication bias in meta-analysis studies. It visually summarizes the research data (Cooper & Hedges, 2009). In this graph, the horizontal axis (x) shows the effect size. The vertical axis (y) shows the standard error, sample size and variance of the study (Sutton, 2009). The Funnel Plot showing the publication bias of the studies included in the research is given in Figure 5.

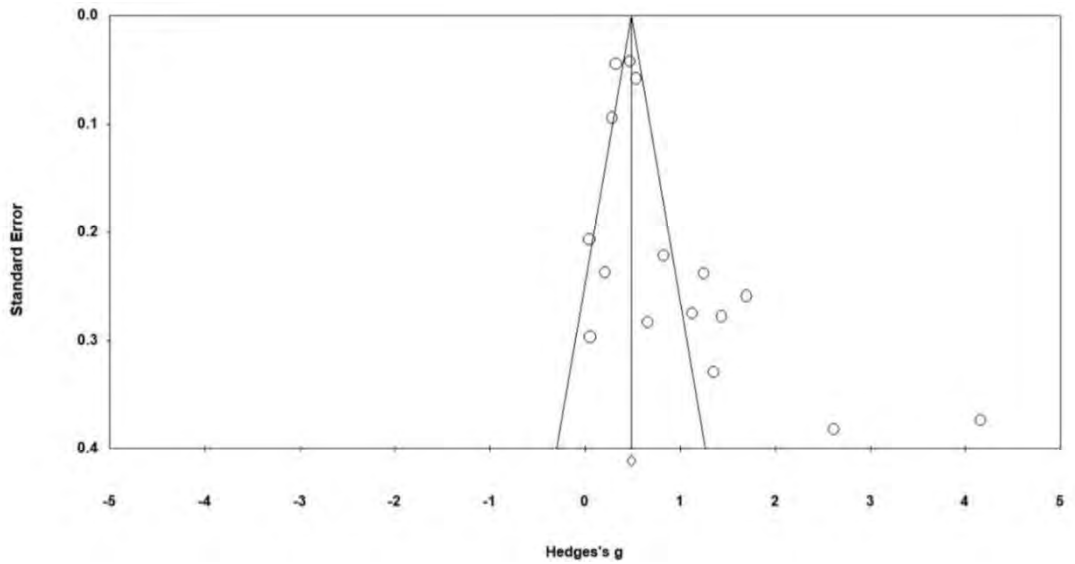

Figure 5. Funnel plot for publication bias

The Funnel Plot given in Figure 5 is clearly asymmetrical; and it is seen that most of the studies are clustered to the left of the mean. This asymmetry suggests the possibility of publication bias (Borenstein & Higgins, 2013). Publication bias can be evaluated visually, but statistical tests should also be applied, provided that the number of studies included in the research is not less than 10 (Sterne et al., 2000). In order to better determine the publication bias, statistical tests have also been conducted.

The results of the Egger test (Egger et al., 1997) indicated the cut-off point as 3.233, t= 2.857 and p = .012 < 0.5 between the lower limit of .806 and the upper limit of 5.660 within the 95% confidence interval. A p value of 0.5 or less in this test indicates that the asymmetry in the funnel plot is significant (Rothstein et al., 2005). The results of the Egger test results confirmed the asymmetry in the funnel plot (p = .012 < 0.5).

Using the Begg and Mazumdar (1994) test, Kendall's tau-b coefficient was calculated. The results of the tau-b test indicated that the funnel plot distribution was asymmetrical, (τb = .491, p = .003). Therefore, the results can be interpreted to mean that among the studies on the effectiveness of primary school readiness, those with a small sample yielded more positive results than larger studies. It can further be concluded that that the probability of publication of studies in which primary school readiness practices had a significant positive effect was higher than studies that did not have a significant effect (Hackshaw et al., 1997). In the interpretation of the results of the tests on publication bias, it is important that the sample sizes of the studies included in the research are varied, and that a study with a minimum of 1 medium effect size is included (Borenstein & Higgins, 2013).

Rosenthal's Safe N method has also been used to examine whether the study had publication bias. Mullen et al. (2001) stated that the N/ (5k+10) rule should be followed in Rosenthal's Safe N

calculation. They further state that if the value obtained as a result of this rule is above 1, this may be the evidence indicating that there is no publication bias. Within the scope of the research, Rosenthal's Safe N (Fail-safe Number [FSN]) value has been found to be 1700. Since N/(5k+10)=1700/(5.16+10)=1700/90=18.88>1, indicating that the results of the current study can be used as a guideline for future studies.

Another method used to determine publication bias is Orwin's Method. The results of the Orwin's Method yielded similar results to Rosenthal's Safe N method. When the publication bias is analyzed using Orwin's Safe N method, a value of 0.001 is determined as a criterion for the Hedges'g value to be "insignificant". In the case of the current study, the mean effect size was calculated as .483. For the current meta-analysis with a mean effect size value of .483, the number of studies to be included to achieve "insignificance" was found to be 62. In addition, the results further yielded that 139 studies were required to reduce the Hedges'g value to .500. However, since the number of both national and international studies conducted between 2008 and 2022 was 16, which met the inclusion criteria, it can be claimed that there is no publication bias as a result of the analysis.

As another method, the researchers used Duval and Tweedie's (1998) Trim and Fill Method. Adjusted effect sizes were added to the right of the mean (Table 5).

Table 5. Duval and Tweedie's trim and fill method

	Difference	Point Estimate	Confidence Interval		*Q*
			Lower limit	Upper limit	
Observed value		.931	.704	1.159	212.690
Adjusted value	2	1.077	.833	1.320	296.904

The results indicated that the funnel plot would be symmetrical when two more studies were included in the analysis. However, comparing the new (1.077) and previous results (.931) highlighted that there was no difference in impact classification since these results were in the same category in terms of size and direction and had a large effect. Figure 6 shows the funnel plot with the studies added to the right of the mean and the adjusted effect size according to Duval and Tweedie's trim and fill method.

The rearranged funnel plot by adding studies to the right of the mean according to the trim-and-fill method is shown in Figure 6. One study included later in the sampling was indicated by a black circle. The black diamond in the figure shows the corrected overall Hedges'g estimate. Card (2012) states that the increase in the difference between the two general effect size values can be interpreted as a publication bias. As indicated in Table 5, the adjusted effect size value (g = 1.077) and the overall effect size value (g = .931) are very close to each other, presenting a large effect size.

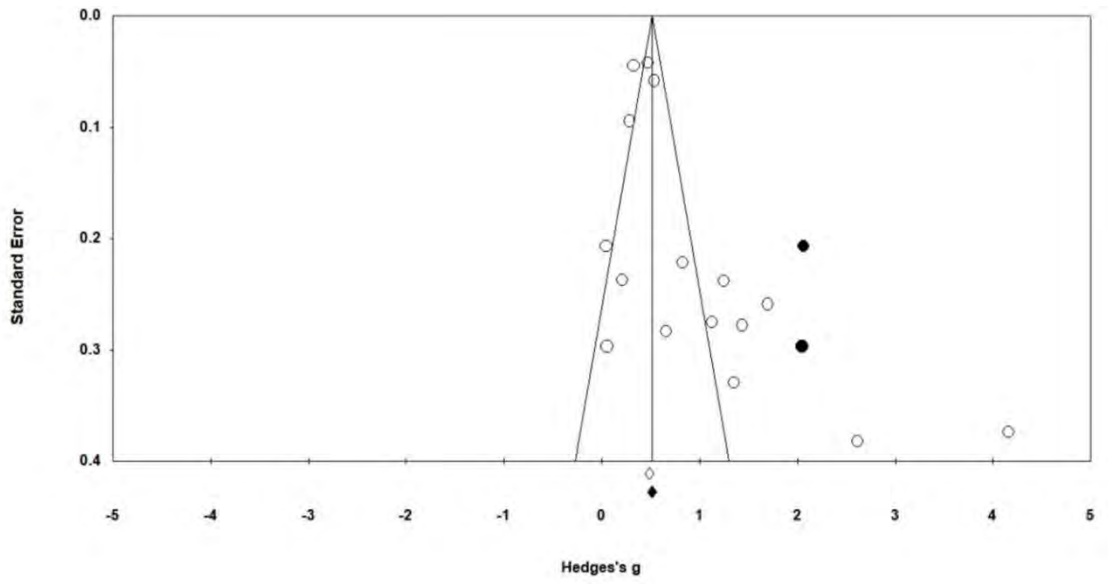

Figure 6. Adjusted effect size funnel plot according to Duval and Tweedie's trim-and-fill method

Therefore, the results indicate that the publication bias in this study is not at a level to affect the border under the graph. The results further highlighted no change in the closeness to zero effect in both values. Further, as Peters et al. (2007) argue, the assumption of Duval and Tweedie's method states that perfect symmetry is unrealistic.

Apart from these methods, the studies included in the research employed 3678 children in the experimental group and 10290 children in the control group. The large number of participants in the study sample can be considered as a factor that increases the reliability of the analyses.

Discussion, Conclusion and Recommendations

The current study, which aims to reveal the effect of the intervention programs applied for children's readiness for primary school in the pre-school period on the readiness of children for primary school, have analyzed studies carried out between 2008 and 2022, dealing with children's readiness for primary school, and 16 studies have been selected as per inclusion criteria. 16 studies identified through meta-analysis have been analyzed using CMA 3.0. The average effect size of the data on the effectiveness of intervention programs for primary school readiness, according to REM, has been found to be Hedges'g = .932 This value is at the large effect size level according to Cohen (1992) effect size classification. The results have concluded that the intervention programs for primary school readiness applied to children in the pre-school period have a positive, significant and high level effect on children's readiness.

The positive and significant result that emerged as a result of the analyses corresponds with the effect coefficient of the studies showing that the intervention programs for primary school readiness have a positive effect in favor of the experimental group (Dicataldo et al., 2020; Ma et al.,

2013; McClelland et al., 2019; Mercan Uzun & Alat, 2017; Richardson et al., 2017). Similar to the results of this study, research conducted, yet not included in the analysis since they violated the inclusion criteria, (Atteberry et al., 2019; Duncan et al., 2018; Lipscomb et al., 2013; Lonigan et al., 2015; Pears et al., 2013; Schmitt et al., 2015) has suggested that the programs implemented to support children's primary school readiness have positive effects.

Duncan et al. (2007) investigated six school readiness intervention programs. Their results highlighted that academic skills, especially early mathematics skills, improved the effectiveness of school readiness programs more than socio-emotional skills. Further, Paro and Pianta's (2000) study indicated that the school readiness assessment studies had a medium effect size in the academic/cognitive domain of the children and a small effect size in the social/behavioral skills. The overall effect size was moderate between preschool and kindergarten and/or first grade. The current study highlighted large effect size, meaning that the intervention programs significantly affect children's development.

When the effect sizes of the primary school readiness practices are examined according to the duration of the interventions in the studies included in the analysis, they are divided into 5 different groups: a) 4 weeks, b) 6 weeks, c) 8 weeks, d) 1-2 semesters, and e) 1-3 years. The results highlighted that the intervention periods of 4 weeks (Hedges'g = 2.204), 1-2 semesters (Hedges'g = 1.115), 6 weeks (Hedges'g = 1.108) had large effect sizes, the intervention period of 8 weeks (Hedges'g = .524) had a medium effect size, and the intervention period of 1-3 year group (Hedges'g = .367) had small effect size. The total effect size for the groups was medium (Hedges'g = .741). After carefully examining the content of the studies, the researchers assume that the intensity of the implemented intervention had an effect on this situation rather than the duration of the intervention.

According to the age variable, they were divided into five groups: a) 36-60 months, b) 51-58 months, c) 59-73 months, d) 60-72 months, and e) 72 months. The homogeneity test determined that the groups showed a heterogeneous distribution. Analysis indicated a small effect size for one group (51-58 months Hedges'g = .259), medium effect sizes for two groups (36-60 months Hedges'g = .523; 59-73 months Hedges'g = .407), and large effect sizes for the remaining two groups (60-72 months Hedges'g = 1.435; 72 months Hedges'g = 1.823). The total effect size of all groups was determined as .471, which was medium. Some studies (Gündüz & Özarslan, 2017; Küçüker, 2016; Teltsch & Breznitz, 1988; Uphoff & Gilmore, 1985), have concluded that the maturity required to start primary school, readiness in other words, increases as the age of children increases. These results can be interpreted that children's life experiences increase as they get older, and this increase results in the increase of school readiness levels (Gündüz & Özarslan, 2017). Gündüz and Özarslan (2017) further conclude that as the age of the children increases, their level of acquiring literacy skills also increases. Within this context, the high effect of school readiness programs on children in the older age group in

the pre-school period can be explained by the high level of maturation of these children, and accordingly, the increase in the level of acquisition of the gains in the program.

In the field of meta-analysis, Valentine et al. (2010) state that at least two studies should be included to conduct a meta-analysis study. However, Rosenberg et al. (2000) argue that meta-analysis studies should at least compare five studies in order to yield better results in terms of Hedges'g effect size. In this vein, in order to generalize the results obtained for age and duration variables of intervention programs, future research should include more studies conducted both in the national and international contexts.

As a result, this meta-analysis shows that interventions or education programs implemented to support children's readiness for primary school have a great impact on children's readiness for primary school. This effect is at the highest level in the programs planned as 4 weeks, 6 weeks and 1-2 semesters and applied to children in the 60-72 months and 72 months group. Based on these results, in order to have a greater positive impact on the development of children in the process of starting primary school, the researchers suggest paying attention to the duration and the intensity of the program, and the age group of the children when planning intervention or education programs for preschool children. Additionally, the literature in the field of primary school readiness falls short in terms of adopting experimental methods. For this reason, the current study suggests conducting studies employing experimental methods on primary school readiness.

Limitations

The first limitation of the study is that the results obtained could not be supported by another meta-analysis study. This is due to the absence of any other meta-analysis study on primary school readiness in the literature, and the existing ones fall short in giving an overall perspective. Another limitation is that since the databases accept English as the international language, all the studies included and scanned in the meta-analysis were conducted either in English or in Turkish. Studies conducted in Turkish were included since the language of the researchers is Turkish.

Policy Implications

In this study, the results showed that the intervention programs applied to support the school readiness of the children in the pre-school years had a significant effect on the school readiness of the children. A program can be effective on the sample, but meta-analysis studies are important in terms of obtaining more generalizable results by comparing the study group or the sample as a whole, which are not similar in terms of characteristics even though they are numerically the same. Therefore, increasing meta-analysis studies will ensure the development of educational research.

Based on the principle of equal opportunity in education, it is possible for all children to start their primary education processes under equal conditions, by providing them with pre-school

education opportunities. One of the main purposes of pre-school education is to prepare children for primary school, and children who received this education have a higher readiness for primary school than children who do not receive pre-school education. Pre-school education, which has a critical role in the development of children, should be compulsory for children to start primary school on equal terms. Ministries of education should include this in their policies in countries where pre-school education is not compulsory. In addition, children's school readiness is supported by early intervention programs. In this study, while the effectiveness of the intervention programs applied to children is revealed, the appropriate intervention period and appropriate age range are determined, and it guides the researchers in the development of early intervention programs. In countries that cannot provide adequate pre-school education opportunities to children, governments can cooperate with researchers and teachers to prepare and implement effective early intervention programs to increase the school readiness of young children.

Conflict of Interest

No potential competing interest was reported by the authors.

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Ethical Statement

The meta-analysis studies are exempt from ethics approval because data was retrieved and synthesized from already published studies.

Credit Author Statement

Conceptualization; Aysel Çoban, methodology; Ensar Yıldız, formal analysis and investigation; Hatice Selcen Aslan, Özge Koca, Ensar Yıldız, writing - original draft preparation; Ayşegül Öğütcen, Fatih Kaynar, Özge Koca, Hatice Selcen Aslan, Ensar Yıldız, writing - review and editing; Aysel Çoban, supervision; Aysel Çoban.

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Appendices

Appendix 1.

Table 6. The studies included in the meta-analysis

Studies (Author, Year)	Type of Study	Sample	Age Group	Duration	Effect Size Hedges's g
Rosas, Espinoza, Porflitt & Ceric (2019)	Article	EG: 37 CG: 33	68,42 months	8 weeks	.208
Röthlisberg, Neuenschwander, Cimeli, Michel & Roebers (2012)	Article	EG: 30 CG: 34	5-6 years	6 weeks	1.435
Richardson, Reynolds, Temple & Smerillo (2017)	Article	EG:1724 (G:890-B:834) CG:868 (G:435-B:433)	4 years	1 year	.471
Ma, Shen, Lu, Brandi, Goodman & Watson (2013)	Article	EG: 18 CG: 28	36-60 months	3 years	.056
Dereobalı (2016)	Article	EG: 22 CG: 22	60-72 months	8 weeks	1.354
Mercan Uzun ve Alat (2017)	Article	EG: 44 (G:26-B:18) CG: 43 (G:15-B:18)	Older than 60-70 months	6 weeks	.828
Gür, Koçak ve Sağlar (2017)	Article	EG: 46 (G:22-B:24) CG: 44 (G:24-B:20)	5-6 years	4 weeks	4.159
Sarıtaş (2010)	Master's Thesis	EG: 40 (G:18-B:22) CG: 40 (G:20-B:20)	72 months	12 weeks-5 hours	1.700

McClelland, Tominey, Schmitt, Hatfield Purpura, Gonzales & Tracy (2019)	Article	EG: 61 (G:26-B:35) CG: 37 (G:22-B:15)	51-58 months	8 weeks	.046
Kayılı (2010)	Master's Thesis	EG: 25 (G:12-B:13) CG: 25 (G:12-B:13)	60-72 months	27 weeks	2.616
Gosse (2012)	Dissertation	EG: 214 CG: 238	36-60 months /52months	4 weeks	.283
Abdulaziz(2021)	Article	EG: 308 CG: 300	36-60 months	1-2 semesters	0.538
Kaynar (2014)	Master's Thesis	EG: 30 (G:14-B:16) CG: 30 (G:15-B:15)	60-72 months	8 months	1.129
Dawes(2021)	Article	EG:41 CG:42	36-60 months	1-2 semesters	1.248
Dicataldo., Florit & Roch (2020)	Article	EG: 50 CG: 17	59-73 months	8 weeks	.659
Russo, Williford, Markowitz, Vitiello & Bassok (2019)	Article	EG: 988 CG: 1009	54 months	1 semester	.327