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Investigation of Technological Leadership of the School Administrators in Turkey: A Meta-Analysis Study

Özlem Akın Mart [a*], Öznur Tulunay Ateş [b]

a* Teacher, Ministry of National Education, (https://orcid.org/0000-0002-1597-1200) *, oakin2409@gmail.com

b* Assoc. Prof. Dr., Burdur Mehmet Akif Ersoy University, Faculty of Education, (https://orcid.org/0000-0003-1784-7227)

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Abstract

The purpose of this research is to analyze the findings related to the technological leadership of school administrators in Turkey associated with factors derived from research via the meta-analysis method. As a result of the literature review, it was determined that the variables examined in relation with the technological leadership of school administrators varied and the data on the technological leadership of school administrators were collected from two different groups as administrators or teachers. 24 studies were reached in the study, but it was seen in some studies that both the opinions of managers and teachers were taken together. Since these were taken into consideration separately, a total of 38 studies were analyzed in this study. As a result of the analysis, it is concluded that there is a positive, moderate and significant effect between technological leadership and factors such as gender and sample size related to teachers and administrators. In studies conducted on the technological leadership of school administrators, it has been determined that the impact coefficient of the studies conducted with teachers is higher than the impact coefficient of the research conducted with administrators. Moreover, the effect size of the factors related to the research group (teacher-manager) affecting the technological leadership of school administrators did not differ statistically according to the publication year and publication mode; it has also been observed that it differs statistically significantly according to the region variable.

Keywords: Technological leadership, meta-analysis, school administrator

Türkiye'de Okul Yöneticilerinin Teknolojik Liderliklerinin İncelenmesi: Bir Meta Analiz Çalışması

Öz

Bu araştırmanın amacı, Türkiye'de okul yöneticilerinin teknolojik liderlikleri ile ilişkili etkenler konusunda yapılan araştırmalardan elde edilen bulguların meta-analiz yöntemiyle analiz edilmesidir. Alan yazın taraması sonucunda, okul yöneticilerinin teknolojik liderlikleri ile ilişkisi incelenen değişkenlerin çeşitlilik gösterdiği ve okul yöneticilerinin teknolojik liderliklerine ilişkin verilerin yönetici ya da öğretmen olarak iki ayrı gruptan toplandığı saptanmıştır. 24 çalışmaya ulaşılan araştırmada, yönetici ve öğretmenler görüşlerini alan çalışmaların yer alması nedeniyle toplamda 38 çalışma meta-analize dâhil edilmiştir. Araştırmanın sonucunda, teknolojik liderlik ile öğretmen ve yöneticilerle ilgili faktörler arasında, pozitif yönlü, orta ve anlamlı düzeyde bir etki olduğu sonucuna ulaşılmıştır. Okul yöneticilerinin teknolojik liderlikleri konusunda yapılan araştırmalarda öğretmenlerle yapılan çalışmaların etki katsayısının, yöneticilerle yapılan araştırmaların etki katsayısından yüksek olduğu tespit edilmiştir. Ayrıca araştırma grubu (öğretmen-yönetici) ile ilgili faktörlerin okul yöneticilerinin teknolojik liderliğini etkileme düzeyleri ile ilgili hesaplanan etki büyüklüğünün yayın yılı ve yayın türü moderatör değişkenlerine göre istatistiksel olarak farklılaşmadığı; bölge değişkenine göre ise istatistiksel olarak anlamlı düzeyde farklılaştığı görülmüştür.

Anahtar kelimeler: Teknolojik liderlik, meta-analiz, okul yöneticisi

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1 | INTRODUCTION

Technology, which affects many fields such as education, culture, health, science and art, is an integral part of today's world. It is a known fact that education, one of the areas affected by technology, affects the society. Therefore, technology is widely used today, technology is also included in education. Alkan (2005) explained the relationship between education and technology as follows:

> Education and technology are two basic elements in making human life more effective. Both are the two basic tools that people use to dominate their natural and social environment. Education has served to uncover the innate latent powers and abilities brought by man, his development and growth as a stronger, more mature, creative and constructive entity. Technology, on the other hand, helped people to benefit from the knowledge and skills gained through education more efficiently and to apply them more systematically and consciously. Thus, education and technology have been influential in the cultivation and development of human beings, dominating nature and its environment (p. 11).

Today, technology is frequently used in educational institutions because there is a generation that is considered as Z generation in schools and this generation grows with technology. Therefore, it is important to combine educational institutions with technology (Arslan, 2016). The integration of technology and the training personnel should be trained in this direction in order to enter and use technology to educational institutions that prepare individuals for society (Küplü, 2012). Teachers are at the top of these staff. School administrators are the ones who will ensure the technological development and training of teachers. Two important roles of school administrators in the education and training system are the “leadership” and “management” roles. While their roles should be fulfilled because of their position in the school; leadership roles are important for successful management to meet the requirements of the age. Due to the requirements of the age; technology leadership in addition to the managerial roles of school administrators (Anderson & Dexter, 2005, 2003a; Chang, 2003b; Ford, 2000; Hsieh, 2004; Irmak, 2015; Matthews, 2002; Ölez & Kılıçoğlu, 2018; Scott, 2005; Seay, 2004; Yeh, 2003) should be adopted by the school administrators.

The technology leadership role that adopts the widespread use of technology in schools has been an important step in the information and technology age (Teke, 2019). Because school administrators who are far from technological developments will cause their schools to be insensitive to keeping up with the changes (Baş, 2012). Technology leader is “the person who establishes, manages, prepares the necessary environment and prepares all kinds of educational infrastructure suitable for the innovations and developments brought by the age by educating and motivating those who will benefit” (Ulukaya, 2015, p. 10). Technological leaders are the indispensable necessity of the age, making the necessary guidance in using technology effectively and at the highest level of efficiency, influencing, and directing the organization in this regard (Tanzer, 2004); development-oriented and able to create systematic development activities in the organization with new ways, methods, plans and programs (Can, 2008); it is expressed as individuals who possess technology skills, pioneer in following and implementing developments, affect teachers, students and other people, enable the use of technology and combine technology with other fields (Gökoğlu & Çakıroğlu, 2014). Chang (2012) defines technology leader as the person who applies, manages, guides and develops technology in the organization's business and operations (field of activity) to improve organizational performance. As a result, technological leadership can be defined as the person who co-directs the necessary and effective use of technology influences, directs and manages the organization (Akbaba-Altun, 2008).

With the frequent use of technological leadership in recent years, various studies have been carried out to identify and standardize school administrators' competencies in technology leadership. One of the most comprehensive standardization studies among these is “National Educational Technology Standards for Administrators (NETS-A, National Educational Technology Standards for Administrators) prepared by ISTE. In NETS-A (ISTE, 2002), it handled the technological leadership standards in 6 dimensions, but in

2009 these standards were handled in 5 sub-dimensions by ISTE (Hacıfazlıoğlu et al., 2010, p.543-544). These dimensions can be listed as follows (Görgülü et al., 2013, p, 58):

1. Visionary Leadership: Education managers create a common vision for the combination of perfection and transformation for the integration of technology in the whole institution and support and implement the vision.

2. Digital Age Learning Culture: Education managers create and maintain a digital age learning culture that provides detailed, appropriate and interesting education to all students.

3. Perfection in Professional Practice: Training managers strengthen educators and support environments focused on professional learning and innovation to enable students to learn by combining modern technology and digital resources.

4. Systematic Development: Education managers provide digital age leadership and management for the development of the organization by using information and technology effectively.

5. Digital Citizenship: Education managers design and develop an understanding of social, ethical, legal issues and responsibilities that support the development of digital culture (Akbaba-Altun, 2008).

In the literature, the relationship between technological leadership of school administrators conducted in Turkey investigated the following issues; perceived ease of use and perceived benefit between technology leadership self-efficacy perceptions and their acceptance towards technology (Bülbül & Çuhadar, 2012), use of information technologies in management processes (Cantürk, 2016), internet and computer usage time and learning organizational culture (Banoğlu et al., 2016), positive attitudes of teachers towards the use of educational technologies (Celep-Tülübaş, 2014), school culture, support services and technology integration (Gürfidan & Koç, 2016), open leadership and digital citizenship (Akcil et al., 2016), year of service in management (Aktaş, 2016), personality traits (Çalık et al., 2018), information technologies self-efficacy perceptions (Doğan, 2018), seniority and teaching seniority (Bostancı, 2010), technological pedagogical knowledge levels (Demirsoy, 2016), lifelong learning competences (Gürkan, 2017), levels of performing knowledge management (Durnalı, 2018), computer anxiety levels (Uysal-Balaban, 2012), school climate (Baş, 2012; Erdoğdu & Umurkan, 2014), teacher-student interaction in social media (Karabağ-Köse et al., 2017), technology integration in primary education classes (Samancıoğlu et al., 2015), positive and negative attitudes of teachers (Hayytov, 2013), professional seniority of teachers (Irmak, 2015), executive effectiveness (Gerçek, 2016), the level of performing education and training works (Ulukaya, 2015). Although several studies have been conducted, the number of studies examining similar variables was not sufficient for analysis. Although there are various studies on this subject, no meta-analysis study has been found. For this reason, it can be said that there is a need for a new study in which a general evaluation of the researches is made. In addition, it was determined that data on the technological leadership of school administrators were collected from two separate groups, either administrators or teachers. For this reason, it was aimed to reveal the differences between the research conducted with teachers and administrators regarding the technological leadership of school administrators. Thus, it was aimed to reveal the situation more objectively with comparative analysis and to shed light on new research examining the technological leadership of school administrators.

2 | Method

In this study, meta-analysis method was used to determine the factors that affect the technological leadership of school administrators. Meta-analysis is the analysis of analyzes; quantitatively analyzing different studies and identifying deficiencies in existing research, suggesting new emphases for future studies in this way (Cohen et al., 2005). In another definition, meta-analysis is defined as “one of the most obvious ways to quantitatively synthesize research findings” (Chamber, 2004, p.35). Cook et al. (1992, p.

7-12) mentioned 5 steps of meta-analysis; formulating the problems, gathering the data, evaluating, analyzing and interpreting the collected data, and finally presentation. The first two steps followed are explained in detail in the data collection, the third and the fourth steps are explained in the data analysis section and the fifth step is explained in the discussion and conclusion section. In the first step, it was decided that the subject of technological leadership of school administrators should be composed of two parts as studies with teachers and administrators. Secondly, the studies examining factors related to technological leadership are investigated. Thirdly, analysis was made using percentage and frequency values according to the type of study, year of study, school type variables. Then meta-analysis was carried out with 24 studies reached. 24 studies were reached in the form of 12 master's theses, 2 doctoral theses, 10 articles. However, 14 studies were also used since opinions of both teachers and administrators were taken, totally 38 studies were analyzed with the help of meta-analysis method. Then the descriptive features and the evaluation of the studies are given in this study.

Data collection

In the research, studies examining the relationship between school administrators and technological leadership and various variables were included. In determining the data to be included in this research; YÖK thesis database, Google academic, Scopus, ULAKBİM and EBSCOhost, ERIC databases have been used. These databases have been selected in order to reach more publications, and are limited to the databases offered by the university. Scanning through these databases was performed on October 2, 2019 and then scanned twice, on October 25, 2019. In the scans, the keywords "technological leadership", "technology leadership" and "technological leaders" were used in Turkish and English. While choosing the keywords, expressions in accordance with the research purpose and the prevalence of use in publications were taken into consideration.

In the research, the studies that will be included in the meta-analysis during the screening process are written on the coding form created. Some choosing criteria should be used in determining the studies to be written on the coding form. In this study, selection criteria were determined as follows: 1) Articles published in refereed journals at national and international level between 2008 and 2019. 2) Master's theses and doctoral dissertations published at the national level between 2008 and 2019. 3) The studies on the technological leadership of school administrators and / or teachers in Turkey who works in official or private pre-school, elementary, middle and high school level were investigated. 4) Studies examining factors related to technological leadership. 5) Giving the sample number (n) and correlation values (r) of the variables examined in the study. Articles produced from the thesis that meet the selection criteria and contain the same information as the thesis are excluded from the evaluation. In addition, the papers presented at the symposiums and congresses were also excluded. Because it is thought that some of these publications have been translated into articles and the papers that are difficult to reach. As a result of the investigations, it was determined that in 24 of the studies, the relationship between technological leadership and various variables was examined and the total sample size was 9867.

Validity and Reliability

The internal validity of the meta-analysis varies greatly depending on the internal validity of the studies included in the analysis, and the external validity of the studies reached (DeCoster, 2004, as cited in Sarıer, 2016). Therefore, the validity and reliability of the studies included in the analysis to ensure internal validity were also examined and it was seen that all these studies were conducted. In order to ensure external validity, all of the determined researches were tried to be reached, and e-mails were sent to the authors to reach the 4 theses, but no feedback was received from any of them. In order to ensure the reliability of coding in meta-analysis, at least two encoders of the studies to be analyzed must be performed separately (Cooper, 2015). The only way to get better results is to increase the number of studies. For these reasons, more than 30 studies have been reached in the research, all research stages have been carried out, and the scanning and coding of the publications have been tried to contribute to reliability by two researchers

conducting this research separately. For the reliability of the data, the formula [Consensus / (Consensus + Disagreement)] x 100, which was proposed by Miles and Huberman (1994), was used. In conclusion, 92% agreement was determined among the researchers in the studies reached.

Data Analysis

Before the analysis is conducted, descriptive analysis of the studies that met the selection criteria was made. In this context, analysis was pursued using percentage and frequency values according to the type of study, year of study, school type variables. Secondly, meta-analysis was carried out with 24 studies reached.

In meta-analysis studies, there are two main approaches with various arguments. These approaches are fixed-effect and random-effect that make inferences about the average effect size obtained from a group of studies (Borenstein et al., 2009; Hedges & Vevea, 1998). There are aspects that distinguish the fixed effects model and the random effects model. In the fixed effects model, the studies included in the meta-analysis are assumed to share the true effect size (Borenstein et al., 2009). In other words, the assumption in the fixed effect model is "there is only one real effect size for all studies in meta-analysis"; the assumption in the random effects model is that the effect size can vary with various variables (Üstün & Eryılmaz, 2014, p. 13). In Q statistics, which is another method used in the selection of fixed or random effects model, the hypothesis is tested in terms of whether all studies share the general effect or not. (Ulubey & Toraman, 2015). If the significance value of the analysis result (p) is below the critical value, all studies share the overall effect and, in this case, it can be said that there is heterogeneity between the studies (Borenstein et al., 2009; Hedges & Olkin, 1985). I2 (= 97.958) statistics was found as provide information about the heterogeneity ratio. Publication bias in the study is examined with funnel plot, and in the absence of publication bias, a symmetry is expected. According to Cooper et al. (2009), if there is a publication bias, it is stated that there is an asymmetrical image on the graph and one corner of the graph remains empty compared to the other. Moderator analysis, on the other hand, is an analysis method used to determine the direction of differences of subgroups and the average effect sizes of variables (moderators) (Littel et al., 2008). The difference between the moderator variables is tested with the help of Q statistics method (Hedges & Olkin, 1985). The moderators cause interactions with the variables examined (Shadish & Sweeney, 1991, p. 883).

Rosenthal's Fail-Safe N, Orwin's Fail Safe N, Begg and Mazumdar rank correlation, Egger regression cutting, Duval and Tweedie's clipping and filling analyzes were performed and funnel scatter plots were examined in determining publication bias in the research. Moderator analyzes were made with the publication year of the research, the region where the research was conducted, and the type of publication.

In this study, the analyzes were carried out with the Comprehensive Meta-Analysis program (CMA). During the analysis, graphs and statistics related to general effect, heterogeneity, publication bias, and moderator variables were examined. While evaluating the research, p, Q, I2 values were examined. In evaluating the results, Q value and 0.05 p significance level were chosen. In interpretations in the study, I2 value was evaluated as low when 25%, moderate when 50%, and high level of heterogeneity when 75% (Cooper, Hedges, & Valentine, 2009).

In this research, the correlations between technological leadership and independent variables were calculated by converting the effect sizes calculated using "r" and sample numbers (N) to Fisher's Z value. While evaluating the findings of the analysis, they were interpreted by converting them into a correlation coefficient. No additional transformations are required in software (Dinçer, 2014, p. 118). Therefore, the following information was used in the evaluation of the analysis findings.

The interpretation of the correlation levels is as follows (Cohen et al. (2007, p. 521):

Correlation between ± 0.00 - ± 0.10: Very low correlation (week)

Correlation between ± 0.10 - ± 0.30: low level correlation (modest)

Correlation between ± 0.30 and ± 0.50: Moderate correlation

Correlation between ± 0.50 - ± 0.80: Strong correlation (strong)

Correlation Above ± 0.80: Very strong correlation (very strong)

Research ethics

Since the study is a meta-analysis study, it is not necessary to obtain the permissions from the ethics committee.

3 | Findings

Descriptive features of the studies on the effect of gender on technological leadership on school administrators are presented in Table 1.

Table 1. Descriptive Statistics of Studies on Technological Leadership

		Frequency (f)	Percentage (%)
Type of the study	Article	10	17%
	Master thesis	12	50%
	Doctoral dissertation	2	8%
Year of the study	2010	1	4%
	2012	3	13%
	2013	1	4%
	2014	3	13%
	2015	3	13%
	2016	6	25%
	2017	3	13%
	2018	2	8%
	2019	2	8%
School level	Primary	1	4%
	Secondary	3	13%
	Primary + Secondary	4	17%
	High School	4	17%
	All	12	50%
Type of the school	Public	22	92%
	Private	1	4%
	Public + Private	1	4%

In Table 1, it is seen that between 2008 and 2019, 24 studies in the form of 12 master's theses, 2 doctoral dissertation and 10 articles are reached on the technological leadership of school administrators related factors. Since the opinions of both administrators and teachers were received in 14 studies, the data set included in the analysis consisted of 38 studies. When the publication type of the studies is examined, it is seen that the number of master thesis and article types is applied more but the number of master thesis studies is high, and these studies are mostly performed in 2016. When the types of schools in which the studies are carried out are examined, it is seen that studies in both public and private schools are mostly conducted in public schools.

Meta-analysis findings regarding the factors related to teachers and administrators affecting the technological leadership of school administrators

The first aim of the research is to determine the effect of variables originating from teachers and administrators on the technological leadership of school administrators. For this purpose, first of all, the publication bias of the studies included in the meta-analysis through graphs and statistics were examined. The funnel scatter graphic obtained is given in Figure 1.

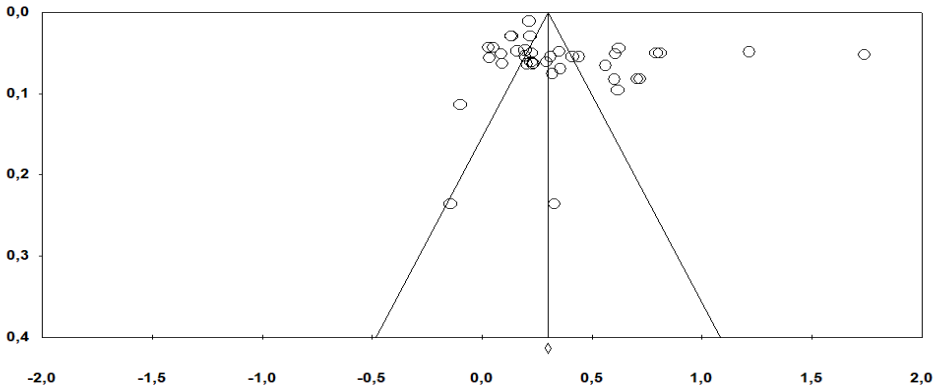

Figure 1. *Publication Bias Funnel Plot*

When the funnel graph in Figure 1 is analyzed, it is seen that the overall funnel graph shows a symmetrical distribution on both sides of the line, and some of the studies are outside the funnel graph. For these reasons, it can be said that the sample numbers of the studies are generally high. Due to the studies outside the funnel graph, the bias of the publication has continued to be examined to ensure the reliability of the study. The data obtained as a result of the analyzes are given in Table 2.

Table 2. Reliability Tests Showing the Bias of the Studies Included in the Meta-Analysis

Confidence Tests	Name of Data	Confidence Test Data
Rosenthal's Fail-Safe N	Z value for Reviewed Studies	43.855
	P value for Reviewed Studies	0.000
	Alpha	0.050
	Direction	2.000
	Z value for alpha	1.960
	Number of the studies reviewed	38
	Safe N (FSN)	8988
Begg and Mazmundar Rank Correlations	Tau	0.206
	Z value for Tau	1.823
	P value (1 tailed)	0.034
	P value (2 tailed)	0.078
Linear Regression of Egger Standard	Standard Error	1.959
	95% lower limit (2 tailed)	-0.364
	95% upper limit (2 tailed)	7.581
	t value	1.842
	df	36
	p value (1 tailed)	0.037
	p value (2 tailed)	0.074

Based on the findings in Table 2, the following comments can be made. Rosenthal's Safe N Test results show that the meta-analysis performed is statistically significant (p = 0.000). In order for the meta-analysis

to lose its significance, that is to be p> 0.05, 8988 studies with an effect size of zero are required. This finding was supported by another calculation. Mullen et al. (2001, 1454) the results obtained in the meta-analysis continue to be permanent even though new researches are done in the future. He stated that the value to be obtained with the formula N / (5k + 10) can be determined by being greater than 1. In the calculation made in this direction, [16614 / (38 * 5 + 10) = 83.07] has been found to be greater than 1. Continuing to examine the data in the table, it is seen that Kendall's Tau coefficient in the Begg and Mazumdar Rank Correlations analysis is not statistically significant (0.206 and p = 0.078). This is another sign that there is no publication bias. In addition, by looking at the results of Egger's Linear Regression method (p = 0.074> 0.05), it can be expressed with 95% confidence that there is no publication bias.

After determining that there was no publication bias in the study, heterogeneity examination was started. The funnel graph obtained for this purpose is given in Figure 2.

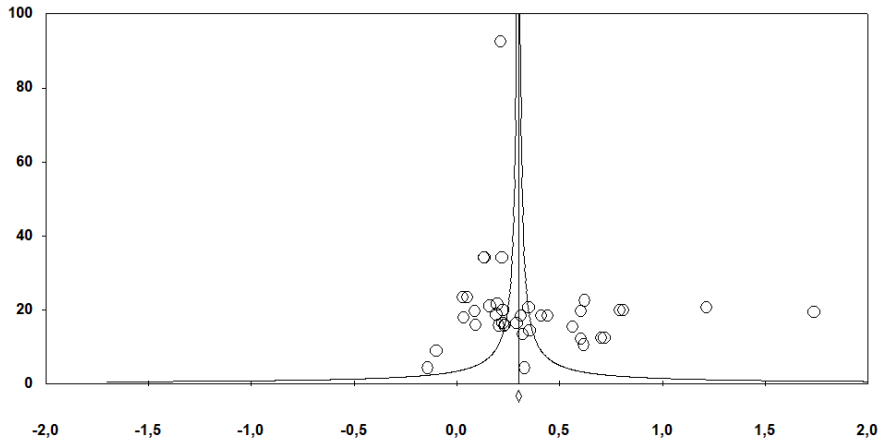

Figure 2. *Heterogeneity Funnel Plot*

When the graphic in Figure 2 is examined, it is seen that some studies are not included in the slope lines. This situation can be interpreted as the research may be heterogeneous. For this reason, heterogeneity analysis was made and the result of the analysis supported this finding. All the values obtained as a result of the heterogeneity test (Q = 1811,605, p <0.05, I^2 = 97.958) showed that the distribution of the effect sizes of the studies within the scope of the study is heterogeneous. Therefore, it was decided that the use of random effects model is more appropriate in the interpretation of the effect sizes. In the analysis, the studies included in the meta-analysis are given according to the first author surname and the year of publication. Findings regarding variables related to teachers and administrators affecting the technological leadership of school administrators are given in Figure 3, Table 2 and Table 3. While making the groups in Table 3, studies with administrators were coded as “Y”, those with teachers as “O”, and research with both groups as “OY”.

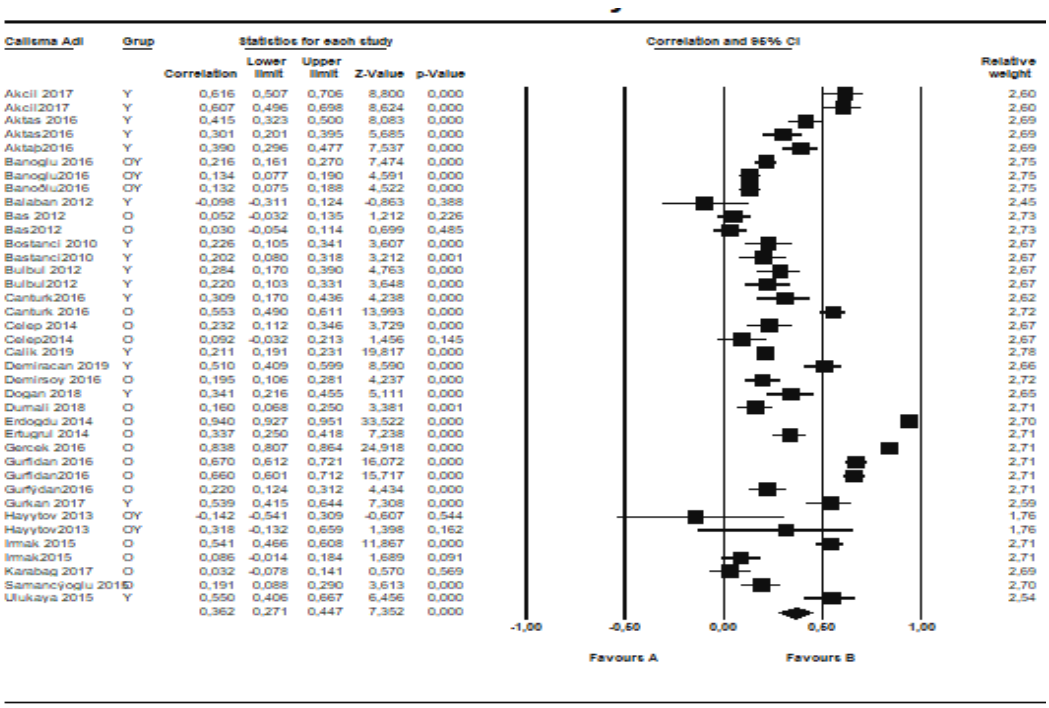

Figure 3. *Correlation Based Forest Graph of the Variables Regarding Teachers and Administrators Affecting the Technological Leadership of School Administrators*

Figure 3 shows the correlation distribution of 38 studies based on the relationship between the school administrators' technological leadership and the research group (teacher-administrators) related variables. When the distribution is examined, it is seen that the weights of the studies (between 1.76-2.78) are close to each other. In addition, it is understood that 2 studies are very strong, 9 studies show strong correlation, only two studies show negative correlation, others show positive correlation, and correlation values vary between -0,142 and 0,940. For these studies, the correlation value calculated according to the random effects model was 0.362, and the Fisher's Z effect size was 0.379. These data indicate that there is a positive, moderate and significant (p <.05) effect between the technological leadership and the variables related to the research group (teacher-manager).

Table 3. Meta-Analysis of Technological Leadership of School Administrators

				95% Confidence Interval		Heterogeneity Test		
Basic Factor	f	df	Average Effect Size	Lower limit	Upper limit	QB	X2	P
Teachers	17	16	0.438	0.213	0.662	1427.569	26.296	0.00
Managers	16	15	0.381	0.293	0.468	165.285	24.996	0.00
General	38	37	0.379	0.278	0.480	1811.605	55.758	0.00

When the data in Table 3 are examined, it is seen that the average effect size of the variables examined in the technological leadership of school administrators with 37 degrees of freedom in 38 studies is 0.3379 (confidence interval lower limit: 0.278, upper limit: 0.480). In addition, it was calculated that the impact of the factors perceived by teachers (ES: 0.438) on the technological leadership of school administrators was higher than the factors perceived by administrators (ES: 0.381). It was understood that the analyzed studies were heterogeneous (p <0.05) since it was seen that the heterogeneity value between the groups calculated as 1811,605 according to the random effects model was higher than the chi-square table value (55.578).

Secondly, the data collected from teachers and administrators were analyzed according to the level of influence of school administrators on the technological leadership, the publication year determined as the moderator variable, the type of publication, and the region variables. In the analyzes pursued, the studies that do not specify the region and cover all of them and the studies with single data in each class were excluded due to the need for at least two studies (Dinçer, 2014; Kalkan, 2020).

Table 4. Moderator Analysis Results of Factors Affecting Technological Leadership of School Administrators

				95% Confidence Interval		Heterogeneity Test		
Main Factor	f	df	Average Effect Size	Lower Limit	Upper Limit	QB	X2	P
2010	2	1	0.214	0.128	0.297			
2012	5	4	0.111	-0.005	0.223			
2013	2	1	0.093	-0.354	0.505			
2014	4	3	0.540	-0.170	0,881	15.347	15.507	0.053
2015	4	3	0.355	0.097	0.568			
2016	13	12	0.420	0.267	0.553			
2017	4	3	0.471	0.139	0.708			
2018	2	1	0.247	0.062	0.415			
2019	2	1	0.365	0.041	0.619			
Doctoral	3	2	0.353	0,061	0,590			
Master	18	17	0.330	0.184	0.462	0.423	5.991	0.809
Article	17	16	0.394	0.253	0.519			
Mediterranean	6	5	0.582	0.363	0.740			
Aegean	5	4	0.288	0.113	0.446			
Central Anatolia	4	3	0.099	-0.015	0.211	18.021	9.488	0.001 *
Marmara	17	16	0.318	0.151	0.466			
Unspecified	3	2	0.489	0.157	0,722			

When Table 4 is analyzed, it was found that the effect size calculated by the various factors perceived by teachers and administrators regarding the level of influencing the technological leadership of school administrators did not differ statistically (p> .05) according to the publication year and type of moderator variables (p> .05), but statistically differentiated according to the region variable (p <.05). For this reason, it can be said that the region where the studies are carried out has changed the effect size of the school administrators regarding the technological leadership, and the publication year and publication type of the studies did not change the effect size of the school administrators regarding their technological leadership. In 2013, the lowest effect size value (0.093) for the year in which the studies were conducted; the highest (0.540) is seen to be calculated in 2014. The lowest impact size value (0.330) for study types is master's degree; the highest (0.394) was calculated in the article publication type. The lowest effect size value for the region where the studies are carried out (0.099) Central Anatolia; the highest (0.582) was obtained in the Mediterranean region.

4 | Discussion & Conclusion

In this study, it was aimed to study the findings obtained from the research conducted on factors associated technological leadership of school administrators in Turkey by using meta-analysis method. As

a result of the literature review, it was seen that the variables examined with the technological leadership of school administrators were in a wide range (technology use in education, school climate, information communication technology, executive effectiveness, lifelong learning, etc.), and the number of researches examining similar variables was not sufficient for analysis. However, it was determined that the data about the technological leadership of school administrators were collected from two different groups, namely the administrator or the teacher. Accordingly, it was aimed to reveal the differences between the research conducted with teachers and administrators regarding the technological leadership of school administrators. In the research, 24 studies were reached in the form of 12 master's theses, 2 doctoral theses, 10 articles. However, 14 studies were also used since opinions of both teachers and administrators were taken, they were taken into consideration separately. So, totally 38 studies were analyzed with the help of meta-analysis method. The sample numbers of the analyzed studies differed significantly from each other. It was determined that the sample consisted of a total of 9867 people; 4021 women and 5846 men. It was observed that the researches were mostly in the type of master thesis, and were carried out intensively in 2016, mostly in public schools and all types of schools.

It was found that some studies were carried out from the point of view the school administrators. The school administrators' self-efficacy perceptions of technology leadership, their acceptance towards information and communication technologies (Bülbül & Çuhadar, 2012), their level of education and training (Ulukaya, 2017), their attitudes towards the use of technology in education (Aktaş, 2016), their use in management processes (Cantürk, 2016), their technology leadership strategies and innovation management competence beliefs (Demiraçan, 2019), information technologies self-efficacy perception (Doğan, 2018), lifelong learning competence with their technological leadership (Gürkan, 2017), technology leadership competence perceptions, teachers' positive and negative attitudes towards technology (Hayytov, 2013), the place of open and technology leadership in management practices in the education system (Akçil et al., 2017), the technology leadership profiles of the principals (Banoğlu et al. 20 16), the relationship between school administrators' technology leadership roles and computer anxiety levels (Uysal-Balaban, 2012) were analyzed. In addition to these studies, Bostancı (2010) examined the technological leadership of school administrators. In these studies, it is seen that there is a positive and moderate relationship with a positive effect level (Aktaş, 2016; Demiraçan, 2019; Gürkan, 2017; Ulukaya, 2017). As a result of the studies, it was reached that the school administrators' acceptance level for information and communication technologies is used in the academic process and administrative structure of technology. Moreover, it was found that integration will be provided in educational institutions with the increase in acceptance levels of technology leadership self-efficacy perceptions and technology use (Bülbül & Çuhadar, 2012; Cantürk, 2016); The development of these competencies of school administrators as a requirement of the rapid changes brought by the digital age (Gürkan, 2017) and the necessity for education managers and leaders to have digital citizenship and open leadership in order to be effective (Akçil et al., 2017). In the context of Fatih Project Schools and other schools, it was emphasized that technological leadership meetings, workshops, sharing experiences, giving importance to “digital citizenship” practices for principals, teachers to adopt “team learning” school culture more (Banoğlu et al., 2016).

When all the studies analyzed in the research were evaluated together, it was determined that the average effect size value of the variables examined in the technological leadership of school administrators was medium. In addition, in the studies conducted on the technological leadership of school administrators, it has been determined that the impact coefficient of the studies conducted with teachers is higher than the impact coefficient of the research conducted with administrators. In most studies, teachers' views about administrator's technological leaderships were taken, because it would be more objective for teachers to evaluate managers rather than school administratos' own perspectives. Similarly, Hayytov (2013) stated that it may be an exaggeration to assume that managers' perceptions of their "technology leadership competence levels" are realistic. In his own study, he attributed the reason for the perception of competence of private school administrators to be lower than that of official school administrators. Even

if the managers see themselves as sufficient about their leadership, it can be said that the teachers whose leader is the audience are not affected by the leadership behavior of their managers.

The level of data collected from teachers and administrators to affect the technological leadership of school administrators were analyzed according to the publication year, publication type and region variables, which were determined as moderator variables. While the effect size calculated by the various factors perceived by teachers and administrators on the level of school administrators to influence their technological leadership does not differ according to the publication year and publication type variables, it is concluded that it differs according to the region variable. Consequently, it can be said that the region where the studies are conducted, the various factors perceived by teachers and administrators change the effect size of the school administrators regarding their technological leadership. It is concluded that the value of the lowest effect size for the year in which the studies were carried out is 2013, the highest one was in 2014, lowest degree of impact size is in master's study types, the highest one is in article publication, Central Anatolia has the lowest effect size for the region where the studies are conducted, highest effect size is in Mediterranean region.

As a result of the research findings, it can be suggested that the studies to be carried out regarding technological leadership should be carried out by applying different methods and techniques, and the causes of regional differences should be investigated in different studies. In addition, it can be suggested that studies on the development of technological leadership be carried out in other regions and schools, and in addition to the variables in these studies, it is recommended to enrich the literature with the studies dealing with the variables related to technological leadership, and the level of relationship between these variables and technological leadership.

Statements of publication ethics

Since this research was carried out with the method of meta-analysis, no ethics committee approval was required.

Researchers' contribution rate

First author collected data and contributed to manuscript revisions. Second author contributed with data analysis and reported the results. All authors read and approved the final manuscript.

Conflict of interest

The authors of this article declare that there is not conflict of interest.

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