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Trends in 'Technology Leadership' Research in Education: Scoping Review

Özgen Korkmaz

Amasya University, Faculty of Technology, Department of Computer Engineering Amasya, Turkey
ozgenkorkmaz@gmail.com

Asena Özge Kutlu

Amasya University, Faculty of Technology, Department of Computer Engineering Amasya, Turkey
ozgekutlu07@gmail.com

Şifanur Yavuz

Amasya University, Faculty of Technology, Department of Computer Engineering Amasya, Turkey
yavuzsifanur@gmail.com

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ABSTRACT

The rapid development of technology and the effective use of technology in education systems have revealed the concept of technology leadership. In this study, a total of 32 master's and doctoral dissertations on 'technology leadership' published in the National Thesis Center of Turkey (YÖKTEZ) between 2009-2020 were examined. PRISMA (2009) model was preferred in the selection of published thesis studies. This review was carried out using the Scopping Review method of Arksey and O'Malley (2005). In this direction, the scope of the research consisted of 28 master's and 1 doctoral thesis 'in the field of education and training', 'the language of publication is Turkish', which 'has the conditions of publication and permission'. Of the examined studies, 26 were conducted using quantitative, 2 qualitative and 1 mixed research method. In the sample distributions in the studies, it is seen that there are 52% teacher participants and 24% administrator participants. When the findings of the studies were examined, it was determined that school administrators' self-efficacy regarding technology leadership, role perceptions and teacher views on technology leadership were the most researched dependent variables. In studies on ISTE (International Society for Technology in Education) and NETS-A (National Educational Technology Standards for Administrators) standards, it has been concluded that school administrators are seen as technology leaders. When the literature is examined, it is seen that the studies on technology leadership in education have increased in recent years, but doctoral studies are not sufficient in the general distribution.

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INTRODUCTION

In 2005, Turkey's National Education policy adopted the student-centered constructivist approach system to adapt to the developing age. In our country, the constructivist approach has been applied in educational institutions since 2005 (Bostan & Yapıcı, 2019). According to this approach, knowledge is actively and continuously reconstructed by the learner (Noddings, 2017). The answer is given in a constructivist approach to learning by doing and experiencing and how learning environments can be made more effective (Aykaç & Ulubey, 2008). It is stated in the literature that the important contribution of technology in the development of academic success and high-level cognitive skills with the education system in which the constructivist approach is adopted has a very important role in teaching and learning (Borel et al., 2019; Çakır, 2012; Gonzales, 2020). All kinds of materials used in education are technological tools in providing learning. It is important to follow new developments in teaching methods that change and develop over time, as in everything else. The primary reason for the use of technology in education is the widespread use of technology in every field and environment in our age, and as a result, the necessity of integrating education and technology. Many factors can be listed among the benefits of using technology in education, such as supporting critical thinking, helping permanent, effective, and fast learning, interdisciplinary use, and the importance of adapting to living conditions after the formal education process. With the development of technology on these conditions, the integration of technology into the school environment brings the need for technology leadership (Ahmadi, 2018; Baybara, 2018; Güven, 2015).

The need for school administrators to use technology in order to perform work and operations quickly and practically while performing their duties, and to be a role model for the other stakeholders of the school in the use of technology has given birth to the concept of technology leadership (Köybaşı, 2020). While making decisions regarding the integration of technology into education and training in the institution, it is necessary to adopt and implement technology leadership roles in initiating a change in the school climate and facilitating the operation in the use of technology (Gonzales, 2020). In his study, Yeni (2020) reveals that 21st century skills in technology leadership in education support the leadership role of school administrators and that the leadership role is the qualifications expected from school administrators by evaluating the opinions of the participants. In this direction, the effective use of technology was included in the job descriptions of school administrators with the circular numbered 53 published by the General Directorate of Education Technologies in 2001 (MEB, 2018). This job definition, which has been renewed in education administrators, emphasizes the necessity of administrators who have sufficient skills and a vision suitable for the technological age at the point of ensuring the integration of technology into education (Güven, 2015).

It will be easier for teacher candidates trained in this direction to adapt to the integration processes of technology (Borel et al., 2019; Gökoğlu, 2014). In addition to the field and professional knowledge and skills expected from teachers, they are expected to have the ability to use and design appropriate technology in learning environments (Şimşek et al., 2013). It is thought that these trainings for the use of technology will determine the attitudes and perceptions of teacher candidates regarding technology for the schools where they perform their teaching duties (Can & Namlı, 2019).

In the use of technology in education, it is necessary to give importance to the pedagogical level of the students. It is important for school principals and teachers to be able to choose the technological designs and applications to be used during teaching in accordance with the profiles and developmental levels of the students and to guide them throughout the process. Teachers need to receive supportive training in the use of technology in education, develop their technopedagogical competencies and keep them constantly updated (Tondeur et al., 2017). It should be realized that technology integration in education is a phenomenon that should include all the stakeholders of the school together with school administrators (Ahmadi, 2018; Baybara, 2018; Güven, 2015).

When the distribution of the theses written under the leadership of technology in education is analyzed by years, it is seen that the most intense research on technology leadership were published in 2019. When the

literature is examined, the concept of "technology leadership" is seen as a field of study that has been given great importance in recent years (Turan, 2020; Tan, 2010). ISTE (International Society for Technology in Education) creates standards for technology in international education by working for teachers, students and school administrators and renews these standards according to the conditions of the day (Turan, 2020). This organization has determined the international education technology standards for school administrators working in all educational institutions as 'NETS-A' (National Educational Technology Standards for Administrators) (Eren and Kurt, 2011). NETS-A is accepted as one of the most comprehensive studies on an international scale that determines guiding criteria in the field of technology leadership of school administrators. This study, which was determined as 6 subtitles in November 2001, was reviewed in 2009 and ISTE-2009 standards were created (Gürsel, 2020), and the latest changes were added in 2018, bringing together technology leadership standards in education under five subtitles (ISTE, 2018).

1. *Equality Advocate:* Educational administrators create a school climate that provides learning environments where teachers and students can actively use instructional technologies. Educational administrators contribute to positive social change by evaluating online resources and become a digital citizen role model by improving ethical and safe use of technology behaviors.

2. *Visionary Planner:* Educational administrators develop a vision and create a strategic plan in order to ensure that the school's stakeholders dominate the instructional technologies. They manage the process, evaluate, and make corrections on this plan and give a qualified direction to the use of technology. They make the strategic plan created by active interaction with the education stakeholders operative.

3. *Empowering Leader:* Education managers encourage teachers to develop their digital citizenship skills by encouraging them to in-service training in the field of technology. They raise the digital competencies of teachers and students by taking steps to implement ISTE standards. They support education stakeholders in using technology by giving importance to innovation and cooperation.

4. *System Designer:* Education managers create robust infrastructure systems for their technology strategic plans. They make predictive decisions for the instructional technology systems to be established by ensuring the effective use of resources. They create privacy policies in line with the protection of personal information of teachers and students and take protective measures in this regard.

5. *Commitment to Learning:* Educational administrators follow innovations by blending advances in instructional technologies with pedagogical developments. They use technology to create learning environments that support the development of education stakeholders by collaborating with professional teams. They develop its capabilities in order to direct change, save the system from stagnation and encourage more qualified use of technology (ISTE, 2018).

When the national and international studies on the technology leadership of education administrators are examined in the literature, it is seen that especially in recent years, ISTE and NETS-A standards have been emphasized (Hacıfazlıoğlu et al., 2011; Esplin, Stewart & Thurston, 2018; Aksoy & Çobanoğlu, 2018; Çalık et al., 2019). These standards provide guidance to school administrators by creating specific indicators that determine technical skills, knowledge, and tendency in terms of technology integration (Gonzales, 2020). When the study titles on technology leadership are examined; technology leadership roles of school administrators (Sezer, 2011; Baş, 2012; Balaban, 2012; Şahin, 2015; Baybara, 2018; Smart, 2019), school administrators' attitudes towards technology leadership (Efeoğlu, 2019; Hayytov, 2013), school administrators' technology leadership roles leadership self-efficacy perceptions (Gültekin, 2013; Güven, 2015; Ulukaya, 2015; Gençay, 2018; Baybara, 2018; Dinç, 2019; Kurt, 2019; Teke, 2019), technology integration (Gürkan, 2017), technopedagogical leadership competencies of managers (Çakır, 2020), teachers' views on technology leadership of school administrators (Tezel, 2020; Baş, 2012; Sincar, 2009) focused on studies on technology leadership in many sub-branches. When the studies on the technology leadership of school

administrators are examined, it is seen that mostly quantitative research methods are preferred.

Since the concept of technology leadership in education is a new field in the literature, examining its relationship with different variables using different research techniques will be effective in completing the deficiency in the literature. In this research, all master's theses published between 2009 and 2020 were examined by using the search term 'Technology Leadership' in the National Thesis Center of the Council of Higher Education (YÖKTEZ), and it was aimed to bring together the trends in the field of technology leadership and the results of the studies. It is thought that this research will contribute to the literature on the subject of technology leadership by compiling the studies in the literature and presenting them systematically in terms of the sub-problems determined.

The aim of the research is to compile the published studies on technology leadership in the field of education and training and present them in a systematic way in terms of determined sub-problems. For this purpose, answers to the following sub-problems were sought:

1. What is the distribution of master's and doctoral theses on technology leadership in education by years?
2. Which scientific research methods were used in master's and doctoral theses on technology leadership in education?
3. What is the distribution and quantity of participants used in master's and doctoral theses on technology leadership in education?
4. What are the dependent and independent variables used in master's and doctoral theses on technology leadership in education?
5. What are the contributions of master's and doctoral theses on technology leadership in education to technology leadership?

METHOD

In line with the purpose of the study, the master's theses published in the national thesis center on "Technology Leadership in Education" were examined. Scoping review method, which was determined by Arksey & O'Malley (2005), was preferred during the examination. Scope reviews have a broader scope than traditional literature reviews and differ in their primary purpose.

Research Design

A clear definition of keywords and purposes in a scoping review is a useful alternative when an explanation is needed around a concept (Munn, Peters, & Stern, 2018). In line with the chosen method, a five-stage syllabus is carried out;

1) Defining the research question
2) Identification of all studies related to the research subject
3) Selection of studies covering the purpose of the research
4) Visual graphing of data
5) Compilation and reporting of results (Arksey & O'Malley, 2005). The study was implemented by following these steps.

Inclusion and Exclusion Criteria

In this research on the research problem, the search term 'Technology Leadership' was preferred in the field of education and training. Among the published articles, master's thesis and doctorate studies on technology leadership, the studies published in the Turkish National Thesis Center were examined. The National Thesis Center affiliated to the Council of Higher Education includes master's and doctoral theses published in Turkey. As a result of the research, 32 master's/doctorate theses published between 2009-2020

were found. According to the coverage criteria of the research, the research was limited to master's and doctoral theses published in Turkish. Master's and doctoral theses published in a foreign language are excluded from the scope of the research. Accordingly, the coverage criteria are presented in Table 1 in detail.

Table 1. *Scope Criteria of the Study*

Criteria's	Included Studies	Excluded Studies
Time interval	2009-2020	Before 2009 and After 2020
Language	Turkish	Other Languages
Discipline	Studies in the field of education and training	Studies in other fields
Research Method	Quantitative, qualitative, and mixed methods research	Studies without a research method and design
Publishment Type	Master's and Doctoral Theses with Permission to Publish	Books, articles published in academic journals
Sample	Teachers and administrators working at preschool, primary school, secondary school, high school, and undergraduate level.	External stakeholders of education (parents, pressure groups, unions, etc.)

Data Collection Instrument and Procedure

In accordance with the research carried out by using the search term "Technology Leadership" dated 18.03.2021 in the national thesis center, 29 master's theses and 3 doctoral studies were listed. The studies included in the scope of the research were determined in line with the criteria specified in Table 1. In accordance with the criteria in Table 1, a thesis that is not in the field of education and training, a thesis that does not have permission to be published, and a thesis whose publication language is not Turkish were excluded from the research area. The PRISMA method developed by Moher et al., (2009) was used in the study selection process. This method is useful for reporting and developing systematic reviews and meta-analyses, and critically evaluating published studies (Moher et al., 2009). The selection of studies is shown in Figure 1.

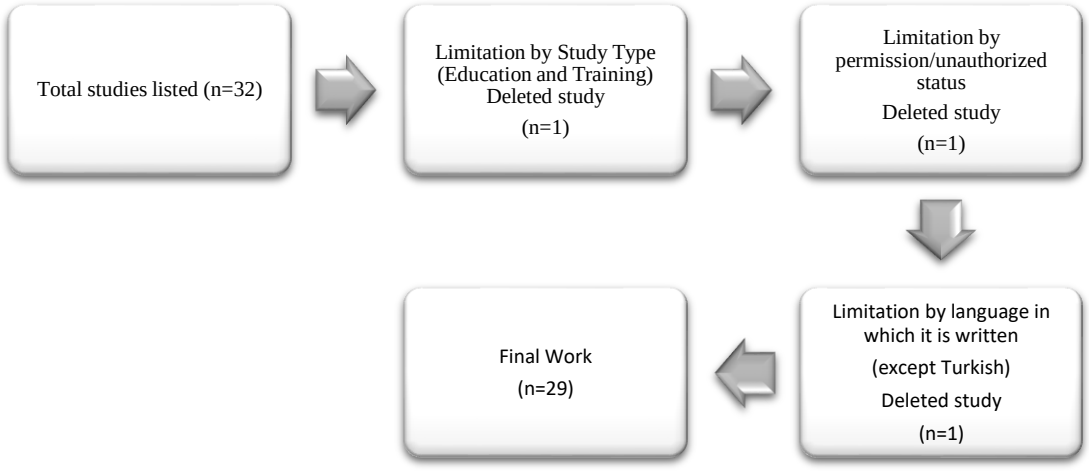

Figure 1. *PRISMA flowchart/ study selection, (Source: Moher et al., 2009)*

The studies included in the scope of the research at the end of the selection period stated above are summarized in Table 2 (Appendix-1).

Data Analysis

The studies, which were included in the scope of the research (Appendix -1) and summarized in Table 2, were examined in the findings section in accordance with the research problems.

Ethic

Since this study was a meta-analysis study, ethics committee approval was not required.

FINDINGS

1. Distribution of theses written on technology leadership in education by years

The distribution of the examined master's and doctoral theses by years is given in Figure 1.

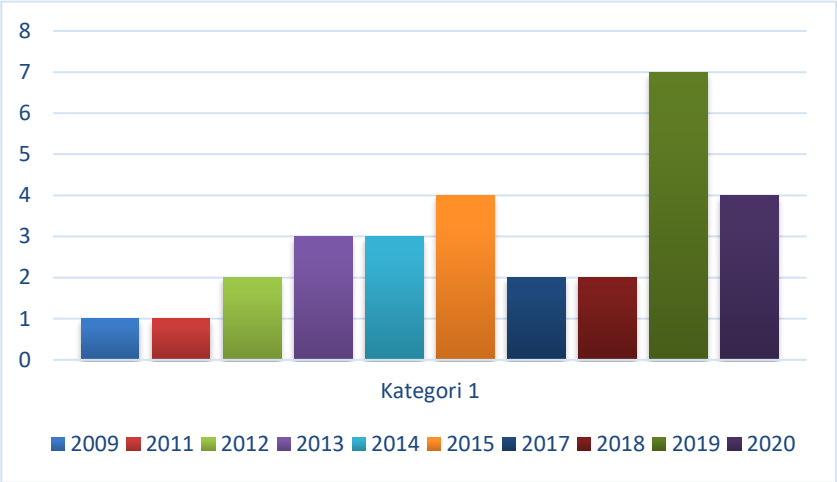

Figure 2. *Distribution of master's and doctorate theses on technology leadership in education by years*

When Figure 1 is examined, there was no thesis study on technology leadership in 2010 and 2016. It is seen that the thesis studies on technology leadership in the literature have increased in recent years, and the most studies were done in 2019. Accordingly, it is possible to say that the subject of technology leadership has become more popular in recent years.

2. Research approaches used in studies on technology leadership in education

The scientific methods used in the studies examined and the thesis numbers in which these methods are used are listed in Figure 2.

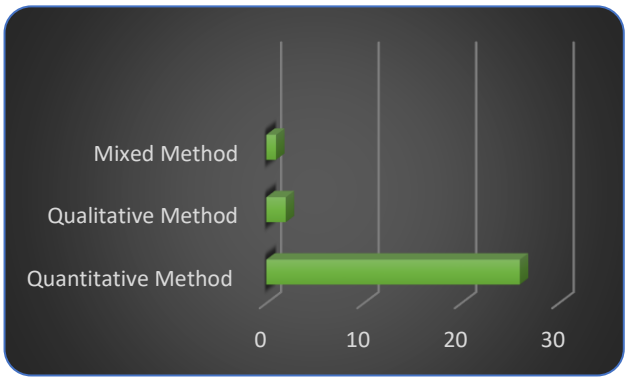

Figure 3: *Distribution of examined master's and doctoral thesis studies by research approaches*

Of the 29 master's and doctoral theses examined, 26 were carried out using quantitative research, 2 qualitative research and 1 using mixed research methods. It is seen that the quantitative method is used more in the studies. In addition, it is seen that the second place in the ranking of qualitative studies and the third in the ranking of mixed studies are quite low compared to the quantitative studies. It is concluded that the scales used in the literature on Technology Leadership are preferred to collect data from large samples.

3. Sample size and quantities in studies on technology leadership in education

The quantity of the sample determined during the data collection phase in academic studies varies according to the subject studied and the research method. It is stated that in studies where the qualitative method

is preferred, it is important that the ideal sample consists of the population that contains the characteristics of the subject studied, and it is sufficient to keep the sample number reasonable if the participant qualifications are provided (Büyüköztürk, 2015). In studies where quantitative methods are preferred, the number of samples varies according to the preferred design. If the universe of the research subject determined for the descriptive survey model consists of a large universe, at least 10% of the universe should be taken as participants, and if the universe consists of a small universe, at least 20% of the universe should be taken as participants. However, in the descriptive survey model, it is appropriate for the ideal sample size to be '218 participants'. In the regression technique, on the other hand, it is expected that the number of variables will be 10 times or more. In quantitative studies where the correlational and causal model is preferred, at least 30 participants and 30 participants in each group for experimental models are the desired sample numbers in terms of increasing the reliability of solving research problems (Büyüköztürk, 2015). In Table 2, the sample sizes and qualifications of the theses included in the study are summarized.

Table 2*: Methods applied by sample size range*

Sample Size	Sample type	Qualitative Method(f)	Quantitative Method(f)	Mixed Method(f)
100 and below	Teacher	1	1	
	Administrator	1		
	Teacher and Administrator			
Between 100-200	Teacher			
	Administrator		3	
	Teacher and Administrator			
Between 201-300	Teacher		1	
	Administrator		1	
	Teacher and Administrator			
Between 301-400	Teacher		6	1
	Administrator		1	
	Teacher and Administrator			
401 and above	Teacher		6	
	Administrator			
	Teacher and Administrator		7	

In Table 2, the sample size is given at certain intervals and the number of theses according to the applied methods is given. In line with this information, if there are participants suitable for the purpose of the research in the thesis studies using the qualitative method, there is no specific criterion in terms of the number of participants in the sample number. Accordingly, the sample size of both of two qualitative studies included in the study was found appropriate. It has been observed that the ideal sample size is considered as 217 in studies adopting the descriptive research paradigm, and there are 25 descriptive survey models in the study, and it was observed that three theses were below the desired number of participants in terms of the research method applied. It is seen that one regression method was used within the scope of the research. In studies in which the regression method is used, variables are used in determining the sample. The independent variables in the study are gender, branch, seniority, duration of management, school level, age and graduation. The dependent variable is technology leadership and learning competencies. As a result of the determination of the sample number as 10 times the number of variables, it was concluded that the study, which used the regression method, worked with enough participants. In the mixed model, qualitative and quantitative methods are used together. It is seen in the study that the number of theses in which the mixed model is applied is one. Quantitative and qualitative sample numbers included in the mixed study were found to be appropriate. As a result, it is understood that three thesis studies, in which quantitative methods are used and the sample type consists of administrators, do not have the appropriate sample number.

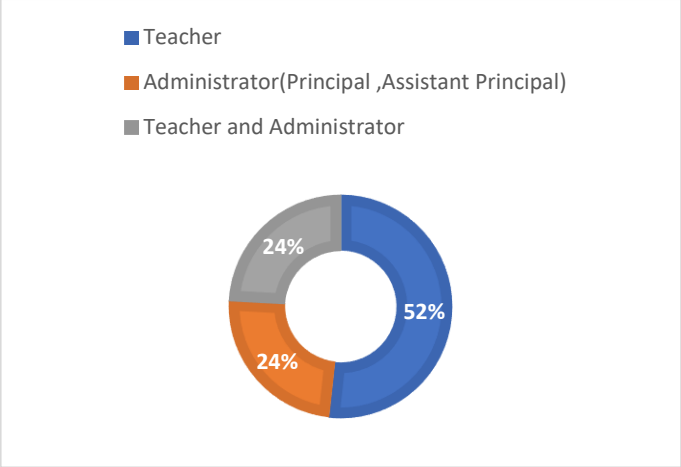

Figure 4: *Participant Distribution Chart*

In the variety of participants selected to collect data in the master's and doctoral thesis studies examined within the scope of the research, "teacher participant" in 15 (52%) studies, "administrator (principal / assistant principal) participant" in 7 (24%) studies, and "teacher and administrator participant" in 7 (24%) studies was preferred and the distribution of participants is given in Figure 3.

4. Distribution of dependent and independent variables used in theses written on technology leadership in education

Table 3 and Table 4 show the dependent and independent variables and frequency of use of the studies examined.

Table 3. *Dependent variables*

Dependent Variables	Thesis Frequency
The Most Used Dependent Variables	
Self-Efficacy of School Administrators on Technology Leadership	11
Role Perceptions of School Administrators on Technology Leadership	8
Teachers' Views on Technology Leadership of School Administrators	6
The Least Used Dependent Variables	
Media and Technology Use Attitudes	1
Technopedagogical Competencies of School Administrators	1
Lifelong Learning Competencies	1

When we examine the studies on technology leadership, it is observed that the elements that make up the school are focused on the managers. Although technology leadership is a broad-spectrum concept, it is seen that there is not an adequate and balanced distribution in the literature regarding the evaluation of the studies made in terms of teachers, students and parents. Considering the dependent variable distribution of studies on school administrators, it is seen that they are shaped by 'Self-Efficacy on Technology Leadership' (24%), 'Role Perceptions on Technology Leadership' (17%) and 'Teacher Views on Technology Leadership of School Administrators' (13%). More than half of these master's and doctoral thesis studies on technology leadership are based on these three dependent variables. The remaining dependent variables constitute 46% of all dependent variables. The dependent variables, whose differences were examined only once in the theses examined in the field of technology leadership in education, are "The Effect of Technology Leadership Behaviours of Administrators, School Climate, Level of Realization of Educational Jobs, Levels of Computer Anxiety, Technology Leadership Level Perceptions of School Administrators and Technology Leadership Roles in Educational Studies of Teachers". Level, Lifelong Learning Competencies, Technology Leadership Strategies and Innovation Management Competencies of Administrators, Meaning of Technology Leadership, Level of Fulfilment of Technology Leadership by School Administrators, Technology Leadership and Teacher Academic Optimism of Administrators, Technopedagogical and Leadership Competencies of Administrators. The Integration of Technology into Learning Environments, one of the dependent variables, is discussed in two separate theses using a qualitative and a quantitative method and Making Sense of Technology Leadership

is discussed in a thesis using a qualitative method. The study, which deals with the Opinions of Classroom and Branch Teachers' Managers on the Roles of Technology Leadership, was included in the mixed method. It is seen that other dependent variables are considered as quantitative method studies.

Teachers' views against technology leadership perceptions of school administrators stand out as another important variable and constitute approximately 20% of all studies. Teachers' opinions are important in terms of looking at technology leadership from a different perspective and contributing to the literature. Studies on variables such as 'school climate, school success and teachers' attitudes towards technology constitute 10%. It is important to conduct more research on dependent variables such as the effect of technology roles on the level of computer anxiety, technology leadership strategies, technopedagogical competencies of school administrators, and lifelong learning competencies to contribute to the literature.

Table 4. *Independent Variables*

Independent Variables	Thesis Frequency
The Most Used Independent Variables	
Gender	25
Professional Seniority	25
Educational Status (Associate/Undergraduate/Graduate)	19
Branch (Class/ Other)	18
The Least Used Independent Variables	
District of Schools	1
Marital Status of Participants	1
City/District where Managers Serve	1
Type of Faculty from which Participants Graduated (Education/Other)	1

When we examine the distribution of demographic information in the master's and doctoral thesis studies examined, it is seen that the variables of *'gender'* and *'professional seniority'* are mainly questioned. It is seen that variables such as *'education status (associate degree/undergraduate/graduate)'*, *'branch (class/other)'*, *'participant age' and 'school type (primary/secondary school/high school)'*, *'managerial seniority'*, and *'in-service training in IT'* were collected as data in most of the thesis studies. In the distribution of this data collected in these master's and doctoral theses written on technology leadership, it is noteworthy that the 'computer literacy experience' independent variable remained at 10%.

5. The findings of the thesis studies on technology leadership in education on technology leadership

The contributions and effects of the research findings on technology leadership are presented in Table 5.

Table 5: *Contributions of technology leadership*

Examined Features	Contributions/Effects	Thesis Frequency
Self-efficacy Perceptions	It was concluded that technology leadership competencies are high, and perception is positive.	10
Technology Leadership Roles	It has been stated that the positive effects and roles are at a high level in the studies.	8
Teachers' views on technology leadership of school administrators	It has been stated that technological leadership perceptions are high and have a high effect on educational performances.	8
The Relationship Between Technology Leadership Roles of School Administrators and School Management	It has been determined that the level of fulfilling technology leadership roles is high and there is a positive relationship between managerial roles.	2
Attitudes Towards Technology	In general, it has been explained that technology leadership perceptions and attitudes are highly correlated.	2
The Effect of Technology Leaders on the Integration of Technology into Lessons	It has been concluded that it has an indirect positive effect.	2
Technology Leadership Behaviours of Managers	It has been stated that technology leadership behaviours are at a moderate level.	1
School Climate	It was concluded that they showed the relationship between school climate and leadership roles to a large extent.	1

Levels of Realization of Educational Jobs	It has been shown to be highly positive.	1
Computer Anxiety Levels	It was stated that anxiety levels decreased with the increase in support from technology leadership roles.	1
Technology Leadership Level Perceptions of School Administrators and The Level of Effect of Technology Leadership Roles on Teachers' Performance in Educational Studies	It has been concluded that it is highly and positively effective.	1
Lifelong Learning Competencies	A positive correlation was found between technology leadership and lifelong learning.	1
Technology Leadership Strategies and Innovation Management Competencies of Managers	A positive relationship was found.	1
Making sense of Technology Leadership	It is revealed that administrators are role models in the use of technology and that teachers need motivation about technology.	1
Levels of School Administrators' Fulfilment of Technology Leadership	In general, their self-efficacy is high and varies according to seniority and school types.	1
Technology Leadership of Administrators and Teacher Academic Optimism	A positive and moderate relationship was determined.	1
Technopedagogical and Leadership Competencies of Managers	It has been revealed that technopedagogical and leadership competencies are highly positive.	1
The Relationship Between Technology Leadership and Technology Use	It was found to be highly correlated in the positive direction.	1

In the variables of 'technology leadership competencies' and 'role perceptions of technology leadership', which were emphasized in the master's and doctoral thesis studies, it was seen that school administrators' self-efficacy and perceptions of technology leadership were high and positive. According to the attitudes of the teachers, a positive and high relationship was found in the direction of the increase in the academic success and the quality of education in the school in terms of the technology leadership of the administrators. It has been revealed that the integration and management of technology into the school positively affects the school climate and dynamics and reduces the level of computer anxiety. It is seen that the role model behaviours of administrators on technology leadership have a positive and moderate effect on teachers' motivation and academic optimism. In addition, significant differences were determined that the professional seniority of school administrators and school types (primary school / middle school / high school) vary in terms of fulfilling technology leadership. A positive correlation is observed in the perceptions of technology leadership regarding lifelong learning and innovation management competencies. Finally, it has been revealed that there is a positive and high-level relationship between the perceptions of technology leadership and school administrator roles and the level of realization of educational work.

DISCUSSION, CONCLUSION, RECOMMENDATIONS

The results and comments obtained in line with the findings of the study, which classifies the studies on technology leadership of education administrators between the years 2010-2016, are discussed according to each variable in this section.

1) Within the scope of the research, master's and doctoral theses published between 2009-2020 in the field of "Technology Leadership in Education" were examined and the data obtained were discussed in line with each sub-problem in this section. When the distribution of studies by years is examined, it is seen that research on technology leadership has increased in recent years. When the distribution of these studies by years is analyzed in Figure 1, it is stated that the most intensive studies were published in 2019 with a slice of 24%. From these data, it can be interpreted that the concept of *'technology leadership'* is seen as a field of study that has been given more importance in recent years. There is evidence in the literature to support this conclusion. Due to the renewal of NETS-A standards in 2009, an increase is observed in the studies in the field of technology leadership in the literature (Anderson & Dexter, 2005). Öznacar et al. (2020) stated that 2011 was

the year with the highest number of publications in studies on technology leadership, the number of which increased over the years, while, according to Uzunboylu and Beheshti (2017), the studies published in the literature differ from year to year. As a result of the research, Köybaşı (2020) emphasizes that the fact that the studies that increased over the years in technology leadership were at the lowest level in 2016 may be coincidental and may be due to the differences in the acceptance and publication processes of the publications. As a result, it can be said that the studies published on technology leadership have become more important in recent years.

2) The distribution of scientific research methods used in master's and doctoral theses examined within the scope of this research on Technology Leadership in Education is given in Figure 2. In the studies examined, 26 quantitative research methods, 2 qualitative research methods and 1 mixed research method were used. It is seen that 89.6% of these studies preferred the quantitative research method. In the distribution of Büyüktaş & Özçelik's study (2021), it is revealed that the quantitative research method is preferred at a rate of 66% and a qualitative research method at a rate of 29%. They mention that quantitative research methods are frequently preferred in studies in the field of organizational leadership behaviour in Turkey. It can be concluded that the renewed NETS-A standards data form on technology leadership and the availability of data collection scales on the subject encourage researchers to prefer quantitative research methods. Öznacar et al. (2020), on the other hand, reveals that 39% of quantitative research, 35% of mixed research and 26% of qualitative research method are preferred. When the research methods used in the articles that include the opinions of school administrators on technology are analyzed, it is seen that quantitative research methods are preferred at a rate of 39% (Bicen &Demir,2020). The fact that Rovshenov (2020) stated that quantitative research methods were preferred more intensely in his study, in which he examined the articles of school administrators about technology, supports these findings. According to the results of the content analysis conducted by Köybaşı (2020) on technology leadership in education, it is stated that the quantitative research method is preferred more intensely because the research focuses on problems such as technology leadership self-efficacy, perception, and attitude. He also states that qualitative and mixed studies on technology leadership in the literature are quite few compared to quantitative studies. As a result, it can be said that quantitative research methods are preferred more frequently in these studies in the field of technology leadership in the literature. From the findings, it is seen that there are very few studies on technology leadership using qualitative and mixed methods. It is thought that the preference of these methods in future studies will contribute more to the field.

3) When the distribution of the participants of these master's and doctoral theses on technology leadership in education is analyzed as indicated in Figure 3, 52% of the distribution consists of teachers, 24% school administrators (principal/assistant principal) and 24% teachers and administrators. From this distribution, we can conclude that teachers' and school administrators' perceptions of technology leadership is a generally used research problem and that teachers' views on this issue are given importance. In the technology leadership content analysis study conducted by Akın-Mart & Tulunay-Ateş (2021) between the years 2010-2019, it is seen that this distribution is 51.5% for teachers and 48.5% for school administrators. When the distribution of participants in the studies is examined, it can be concluded that the teachers are partially involved more. Looking at the participant ratios in Chang (2002)'s study, it was stated that more studies on teachers were included, which supports these findings.

4) Considering the distribution of dependent variables in master's and doctoral thesis studies on school administrators, *'technology leadership self-efficacy'* (24%), *'role perceptions of technology leadership'* (17%) and *'teachers' views on technology leadership of school administrators'* (% 13) is seen to be shaped in the framework. It is concluded that more than half of the master's and doctoral thesis studies on technology leadership are based on these three dependent variables. When the literature is analyzed Göl & Bülbül (2012), Yalınkılıç (2012), Derbedek (2008), Şimşek et al., (2013), Demirsoy (2016) 's studies, it is concluded that the dependent variables included in the theses are highly dependent variables (Göl & Bülbül, 2012; Yalınkılıç, 2012; Derbedek, 2008; Şimşek et al., 2013; Demirsoy, 2016).

The remaining dependent variables constitute 46% of all dependent variables. *The Integration of Technology into Learning Environments*, one of the dependent variables, is discussed in two theses and *Making Meaning of Technology Leadership* in one thesis. In addition, the variables of *Integration of Technology into Learning Environments and Making Sense of Technology Leadership* are included in qualitative method studies. The study, which deals with the *Opinions of Classroom and Branch Teachers' Managers on the Roles of Technology Leadership,* was included in the mixed method. It is seen that other dependent variables are concentrated in quantitative studies. In the study of Dexter & Richardson (2020), which is a similar study, which they consider as technology integration literature, it is stated that every staff in the school is a fundamental part of a school technology leadership team with the potential to integrate technology into the course content areas, albeit indirectly, especially teachers in this area. has made important contributions.

When we examine the distribution of the data in which demographic information is collected in the master's and doctoral thesis studies examined, we can see in Table 4 that the independent variables of 'gender' and 'professional seniority' are equally questioned. Gender and professional seniority variables constitute 32% of the study. Immediately after, 'Educational status (associate/undergraduate/graduate)', 'branch (class/other)', 'participant age' and 'type of school (primary/secondary/high school)', 'management seniority', 'IT in-service training' The variables 'receive state' follow the order.

Considering the ratio of independent variables, it is thought that the effect of gender on technology leadership arouses curiosity. On the other hand, it makes us think that what kind of effects the managers have on technology leadership according to their seniority according to the years they perform their duties can change the course of the research. When the "self-efficacy perceptions" of school administrators are examined according to independent variables such as *"age, gender, professional seniority, educational status"* within the dependent variable, Gürsel (2020), Dinç (2019), Gençay (2018), Ulukaya (2015), Güven (2015) as in the literature, in which no significant differences are observed according to 2018; Ulukaya, 2015; Güven, 2015; Cantürk & Aksu ,2017).

5) One of the 29 theses included in the study, which includes technology leadership in education, is a doctoral study and the others are graduate studies. It is clearly understood that the subject of technology leadership in education is not adequately addressed in doctoral studies. It is seen that more than half of the thesis studies on technology leadership are shaped around the dependent variables of *'Self-Efficacy on Technology Leadership', 'Role Perceptions on Technology Leadership'* and *'Teacher Views on Technology Leadership of School Administrators'*. When considered in terms of independent variables, 'gender' and 'professional seniority' variables predominate, followed immediately by 'Educational status (associate/undergraduate/graduate)', 'branch (class/other)', 'participant age' and 'school type (primary school/secondary school/high school)', 'management seniority', 'in-service training in IT', and it is seen that data is collected in most of the thesis studies. It can be thought that the dependent variables, which are examined only once, contribute to the literature by explaining what kind of differences they cause in these variables about Technology Leadership. It is thought that the mentioned dependent and independent variables will contribute to the literature in more thesis studies and the increase in the number of doctoral studies (Brunson, 2015). It is predicted that especially the studies in the fields of technology integration will guide the educators who want to take a position in this field in the future (Dexter & Richardson, 2020).

This study consists of the examination and analysis of the thesis studies on technology leadership in YOKTEZ between the years 2009-2020 with the scopping review method. "Technology leadership" is a relatively new area of expertise in the field of technology integration in educational sciences and requires different studies. The gap in the literature should be filled with new studies to be done with qualitative and mixed research methods and especially the theses to be written in the doctoral field. We think that this study will contribute significantly to the literature in terms of new studies on technology leadership.

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APPENDIX-1:

Table 2: *Studies Examined*

Study Number	Author/Year	Study Model	Sample	The Dependent Variable	Thesis Results
1	Sincar, M./2009	Mixed Method	386 Primary School and Branch Teachers	Views of Primary School and Branch Teachers' Managers on the Roles of Technology Leadership	The results of examining the opinions of the stakeholders in the school together with the variables in order for the educational technologies to benefit the school and the students make a positive sense.
2	Sezer,B./2011	Quantitative/Descriptive Survey Model	950 Teachers – 879 School Administrators	Technology Leadership Roles	Technology leadership role levels were higher than the opinions of administrators and teachers. A significant difference was found only with the professional seniority variable.
3	Baş, E. D./2012	Quantitative/Relational Survey Model	545 Teachers	Teachers' Views on the Relationship Between Technology Leadership Roles of Administrators and School Climate	A significant difference was found when the teachers' views were examined over the variables in the technology leadership roles of primary school administrators. It has been stated that they show their technology leadership roles to a large extent.
4	Balaban, N. /2012	Quantitative/Relational Survey Model	80 School Administrators – 620 Teachers	The Relationship between School Administrators' Technology Leadership Roles and Computer Anxiety Levels	It has been stated that there is no relationship between the technology leadership roles of the managers, but the increase in the support roles reduces the level of computer anxiety.
5	Öztaş, A. /2013	Quantitative / Comparative Screening Model	940 Teachers	Determining the Technology Leadership Role Level of Secondary Education Administrators in the Line of Teachers' Opinions	It has been emphasized that the teachers' views and the average technology leadership competencies of school administrators are close to each other, that teachers' opinions should be taken in the effective use of technology in education and that school administrators have technology leadership roles.
6	Hayytov, D. /2013	Quantitative Research/ Descriptive Model	58 Administrators – 408 Teachers	Technology Leadership Efficiency Perceptions of Primary School Administrators and Teachers' Attitudes Towards Technology	It has been stated that school administrators have high technology leadership efficacy perceptions, and there is no significant relationship between teachers' positive and negative attitudes towards technology.

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Table 2: *Studies Examined*

Study Number	Author/Year	Study Model	Sample	The Dependent Variable	Thesis Results
7	Gültekin, F. /2013	Quantitative/General Survey Model	81 Secondary school administrators	Technology Leadership Self-Efficacy Perceptions	It has been stated that the administrators believe in the importance of technology leadership, they do what is necessary to include technology in teaching and learning at school, and there is no difference in technology leadership with independent variables.
8	Ölçek, G. /2014	Quantitative Research/ General Survey Model	431 Teachers - 119 School Principles	Technology Leadership Levels of School Principals	It has been concluded that the leadership level of technology leadership levels is higher than the opinions of the administrators and the opinions of the teachers, and there is no difference when it is considered with independent variables.
9	Beyaz, G. /2014	Quantitative Research/ General Survey Model	360 Teachers	Technology Leadership Behaviours of Managers	According to the teachers' opinions, it was explained that the technology leadership behaviours of the administrators were at a moderate level and there was no difference between the independent variables and the teachers' opinions.
10	Gökoğlu, S. /2014	Qualitative Research	10 Teachers	Evaluation of the Impact of Technology Leaders in the Integration of Technology into Lessons	It has been understood that technology contributes to learning by integrating technology into learning with the help of technology leaders and the importance of technology leaders.
11	Güven, A. /2015	Quantitative/Sectional Survey Model	115 School Administrators	Technology Leadership Competence Perceptions	It was explained that school administrators' perceptions of efficacy were high and there was no significant difference according to independent variables.

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Table 2: *Studies Examined*

Study Number	Author/Year	Study Model	Sample	The Dependent Variable	Thesis Results
12	Ulukaya, F. /2015	Quantitative Research/ Descriptive Model	112 School Administrators	The Relationship Between Technology Leadership Self-Efficacy and Levels of Realization of Educational Jobs	It has been explained that Technology Leadership Self-Efficacy, Technology Leadership Self-Efficacy perceptions of Educational Affairs, and levels of realization of educational work are significantly higher in school types, vocational high school administrators are significantly higher than primary school administrators, and there is no significant difference according to independent variables.
13	Şahin, H. /2015	Quantitative Research/ General Survey Model	545 Teachers	The Relationship Between Technology Leadership Roles of School Administrators and School Management	It was found that the level of fulfilling the roles of Technology Leaders was high, and there were significant differences in the variables of professional seniority and educational status.
14	Irmak, M. /2015	Quantitative Research/ General Survey Model	350 Teachers	School Administrators' Perceptions Regarding Technology Leadership Levels and The Level of Effect of Technology Leadership Roles on Teachers' Performance in Educational Studies	It has been stated that the principals' behaviours in technology leadership are at a medium level, primary school teachers' technology leadership behaviours are at a higher level compared to secondary school teachers, and that administrators' technology leadership behaviours at a high level are highly effective on their educational performance.
15	Gürfidan, H. / 2017	Structural Equation Modeling Quantitative/ Structural Equation Modeling	396 Teachers	Technology Integration	It has been concluded that support services and school culture indirectly affect technology integration.

APPENDIX-1:

Table 2: *Studies Examined*

Study Number	Author/Year	Study Model	Sample	The Dependent Variable	Thesis Results
16	Gürkan, H. / 2017	Quantitative / Correlation and Regression Techniques	150 School Principles	Lifelong Learning Competencies	A positive correlation was found between technology leadership and lifelong learning. It was concluded that raising the lifelong learning competencies of managers is important in terms of their integration into technology.
17	Gençay, A. / 2018	Quantitative Research/ General Survey Model	445 Teachers	Technology Leadership Competencies of Managers	As a result of the quantitative data collected, it was concluded that the managers were able to partially show their technology leadership competency levels. The importance of the improvable features of managers in technology leadership was emphasized.
18	Baybara, M. / 2018	Quantitative Research/ General Survey Model	507 Teachers/ 81 School Administrators	Competences of State and Private School Administrators for Technology Leadership Roles	It has been determined that public school administrators see themselves at a higher level in terms of performing their duties in terms of support, development and evaluation, ethical and safety criteria compared to private school administrators, and there is no significant difference in terms of educational status and seniority variables.
19	Demiraçan, A. / 2019	Quantitative / Relational Survey Model	236 School Administrators working at different levels	Technology Leadership Strategies and Innovation Management Competencies of Managers	A positive relationship was found between school administrators' innovation management beliefs and technology leadership strategies. In this relationship, it was determined that there was a significant difference according to their educational status, professional seniority, and in-service training they received.
20	Efeoğlu, C. / 2019	Quantitative / Relational Survey Model	283 Primary School and Branch Teachers		A positive correlation emerged between school administrators' perceptions of

APPENDIX-1:

Table 2: *Studies Examined*

Study Number	Author/Year	Study Model	Sample	The Dependent Variable	Thesis Results
				Technology Leadership Roles and Attitudes Towards Educational Technologies	technology leadership and teachers' attitudes towards educational technologies.
21	Akıllı, E. / 2019	Quantitative / Relational Survey Model	381 Teachers	Effectiveness of School Administrators and Roles of Technology Leadership	It has been determined that there is a positive relationship between the technology leadership levels of school administrators and effective management.
22	Gölçek, E. / 2019	Qualitative / Phenomenological Research Model	9 CEIT Graduate School Principals	Making sense of Technology Leadership	It has been revealed that administrators are role models in the use of technology, but teachers show resistance to new technologies and lack motivation in this regard.
23	Dinç, H. / 2019	Quantitative/Descriptive Survey Model	149 School Principles 373 Teachers	Technology Leadership Competencies	It has been determined that the visionary leadership perception of male managers, whom managers consider themselves competent in the field of digital citizenship, is higher than female managers.
24	Kurt, İ. / 2019	Quantitative Research/ General Survey Model	360 Teachers	Technology Leadership Competencies of School Administrators	According to the teachers, school administrators' technology leadership competencies views are at a sufficient level. In addition, it has been revealed that school administrators do not differ according to variables such as the type of school they work, gender, age, branch.
25	Teke, S. / 2019	Quantitative Research/ General Survey Model	452 Teachers	Technology Leadership Competencies of School Administrators	According to the teachers, it has been determined that the technology leadership competencies of the administrators are at a medium level and the leadership roles of the administrators differ according to the school type and the graduation degrees of the administrators.

APPENDIX-1:

Table 2: *Studies Examined*

Study Number	Author/Year	Study Model	Sample	The Dependent Variable	Thesis Results
26	Öztaban, A. / 2020	Quantitative/Descriptive Survey Model	392 Teachers	Levels of School Administrators' Fulfilment of Technology Leadership	According to the teachers, the technology leadership self-efficacy of the administrators is generally high, and these perceptions vary according to the seniority and school types of the administrators.
27	Tezel, B. / 2020	Quantitative / Relational Survey Model	544 Teachers	Technology Leadership of Administrators, Teacher Academic Optimism	A moderate and moderate relationship was determined between administrators' perceptions of technological leadership and teachers' academic optimism levels.
28	Çakır, Ö. / 2020	Quantitative Research/ General Survey Model	188 School Administrator – 558 Teachers	Technopedagogical and Leadership Competencies of Managers	According to the teachers, it has been revealed that the technopedagogical competencies of the administrators vary in direct proportion to their seniority and computer usage time.
29	Gürsel, R.S. / 2020	Quantitative / Relational Survey Model	326 School Administrators	The Relationship Between Technology Leadership and Technology Use	It has been determined that the technology leadership perceptions of the managers are at a high level and their attitudes towards media technologies are positively related to media sharing.