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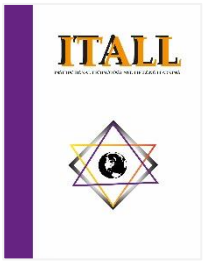

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Technology Leadership in Educational Organizations: A Systematic Review

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ABSTRACT

The use of technology in educational settings is recognized as indispensable if education is to provide 21st century skills. Since technology is an indispensable component of all schools, providing strong technology leadership, by either a school administrator or a teacher, has become a key requirement. This study aims to reveal the areas that studies in this field have focused on and analyze trends in the research. The study is based on three main points regarding studies of educational technology leadership: research methodologies, trends, and educational theories, approaches and standards. The systematic review method was used in this study in order to reveal the research trends in technology leadership. This study involved a systematic search of seven databases: ERIC, SCOPUS, OpenAIRE, SSCI, ScienceDirect, TR Dizin, Complementary Index. These search criteria identified 185 publications in the databases. According to the analysis, the studies focus on the goals of technology leadership for technology integration, technology leadership competencies, technology leadership self-efficacy and technology leadership perceptions. It shows that according to the theories and standards there are studies on ISTE/NETSA, ISTE and NETSA. The findings show that the researches began in 1992, reached their highest point in 2012 with the dramatic increase in 2010 and that the majority of the studies were conducted in the USA and Turkey. This systematic review will be beneficial for scholars and practitioners to gain understanding of the research.

Eğitim Örgütlerinde Teknoloji Liderliği: Sistematik Bir Analiz

MAKALE BİLGİSİ

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ÖZET

Eğitim ortamlarında 21. yüzyıl becerilerini kazandırma sürecinde teknolojinin kullanımı vazgeçilmez bir öğe olarak kabul edilmektedir. Teknoloji, tüm okulların vazgeçilmez bir bileşeni olarak görüldüğünden, okul yöneticileri ve/ veya öğretmenlerin teknoloji lideri olmaları temel bir gereklilik haline gelmiştir. Bu çalışma, teknoloji liderliği alanında yapılan çalışmaların odaklandığı temel alanları ortaya çıkarmayı ve araştırma alanındaki boşlukları analiz etmeyi amaçlamaktadır. Yapılan sistematik analiz çalışması, teknoloji liderliği araştırmaları ile ilgili araştırma yöntemleri, eğilimler ve eğitim teorileri, yaklaşımlar ve standartlar olmak üzere üç ana noktayı temel almaktadır. Analiz sonuçlarına göre, araştırmaların teknoloji liderliği ekseninde teknoloji entegrasyonu, teknoloji liderliği yetkinlikleri, teknoloji liderliği öz yeterliği ve teknoloji liderliği algıları üzerine odaklandığı ortaya çıkmıştır. Teori ve standartlar açısından bakıldığında ise ISTE / NETSA, ISTE ve NETSA standartları ile ilgili çalışmalar olduğu görülmüştür. Elde edilen bulgulara göre, araştırmaların 1992 yılında başladığı, 2010 yılında çarpıcı bir artışla 2012 yılında en yüksek noktasına ulaştığı ve çalışmaların büyük çoğunluğunun ABD ve Türkiye'de yapıldığı görülmüştür. Yapılan sistematik analiz çalışması, araştırmacılar ve uygulayıcılar için araştırmaları, eğilimleri ve boşlukları anlamada faydalı olacaktır.

1. Introduction

The use of technology in educational settings is recognized as indispensable if education is to provide 21st-century skills. The role of school principals has changed considerably through the twentieth century and they play a fundamental role in establishing successful schools. The concept of technology leadership helps integrate technology with leadership skills (Flanagan & Jacobsen,2003) and has become increasingly critical in the school setting. Since technology is an indispensable component of all schools, providing strong technology leadership is now one of the many requirements of an effective school leader. The technological leader maintains all the managerial activities required in the efficient use of technology (Tanzer, 2004). The role of the school principal has evolved from being a curriculum leader to that of a technology leader (Gulpan & Baja, 2020). Technological leadership is a growing phenomenon in the world of educational leadership as schools need leaders who are knowledgeable regarding the positives and negatives of school technology (Chang, 2012). However, technological leadership is a field of leadership not confined to principals. In this respect, technological leadership can be defined in terms of teachers as follows: It is a combination of methods and skills that guide teachers in developing teaching methods and strategies that are necessary for them to use technology effectively in lessons (Valdez, 2004).

Effective technology integration does not refer to the level of the technology itself but rather to effective instructional practices (Harris & Hofer, 2011). As Chang (2012) points out, if a principal has good technology leadership and integration skills and combines this with a strong technology learning environment, teacher effectiveness will increase and so too student achievement. According to Hoopey and McLeskey (2013), principals, who are the managers of their schools, must ensure the school meets accountability standards by supporting and encouraging teachers and students in their educational needs. The International Society for Education Technology (ISTE) set out the National Educational Technology Standard (NETS-A): (1) Leadership and Vision; (2) Learning and Teaching; (3) Productivity and Professional Practice; (4) Support, Management, and Operations; (5) Assessment and Evaluation; and (6) Social, Legal, and Ethical Issues. These standards are representative of the type of leadership behaviors and skills needed to effectively integrate technology. The increase in technology use in schools represents a substantive systematic change and depends greatly on the capability of building-level leadership (Brooks-Young, 2002; Fishman, Gomez, & Soloway, 1999; Haughey, 2006; Kearsley & Lynch, 1994). Educational administrators must be competent in technology leadership roles in order

to make education and training more functional and effective, to provide better outputs, and to meet the needs of society (Marulcu, 2010).

Flanagan and Jacobsen (2003) and Creighton (2003) suggest that technology leadership is much more than the acquisition and management of equipment or software. It also involves how leaders may influence and empower teachers to provide ongoing technical learning to their students. Irving (2010) points out that individuals in the 21st century live in a digital age where the advancement of electronic technologies in all areas of life continues at a surprising pace and states that leaders who value effective teaching and learning processes can benefit from the power of managing educational technologies. Given the presence of employees specialized in the use of technology in schools, the need for leadership understanding that can mobilize these employees and increase the quality of technology use makes itself felt more and more every day, and this situation requires educational institutions to integrate with the rapidly developing technology world (Banoğlu, 2011).

To fully understand the nature of the technological leadership role, it is useful to have a complete overview of the national and international literature in this field. There has been some research reviewing technological leadership research. Turan, Polatcan, and Cansoy (2020) systematically evaluated theses and articles published in Turkey relating to school technology leadership in terms of their topics, methods and recommendations. They reviewed 42 studies from 2000 to 2019. Their findings show that technology leadership studies mostly focus on technology leadership competencies, technology leadership behaviors, and technology leadership roles. They also found that according to teachers' and principals' perceptions, principals exhibited high levels of technology leadership competencies, behaviors, attitudes and roles. Gumus et. al (2018) conducted a systematic review on leadership models in educational research from 1980 to 2014 to determine the extent to which different leadership models in education are studied, including research trends that change over time for each model, the leading scientists working on each model, and the countries where the articles are published. Another study examined Turkish computer teachers' professional memories telling of their experiences with school administrators and supervisors (Deryakulu & Olkun, 2009). Uysal and Madenoğlu (2015) evaluated the scientific researches on technology leadership between the year of 2007- 2012.

Another study reviewed articles published from 1997 to 2010 housed in ERIC databases on school technology leadership (Richardson, Bathon, Flora & Lewis, 2012). In this study, 37 articles were analyzed based on the National Educational Technology Standards for Administrators (NETS-A). According to this review, although all indicators of the standards were covered to some degree, the current body of literature includes few studies

regarding Standard 4: Systemic Improvement and Standard 5: Digital Citizenship. This study differs from the above mentioned reviews as it examines technology leadership researches not only in Turkey but also in other countries.

The aim of the current study is to reveal the areas that the studies on technological leadership focus on and analyze the trends in the relevant field. This study is important in terms of providing information about the content of previous research on the subject of technology leadership, research methodologies and research trends. Our study is based on the following three research questions regarding studies of educational technology leadership:

RQ1: What are the research methodologies and methodological (data collection tool, sampling, data analysis method) purpose, in the existing literature?

RQ2: What are the trends in educational technology leadership studies? Sub-categories include distribution by year, distribution by country, research method, publication type, target audience, DB, number of authors.

RQ3: What are the educational theories, approaches and standards being reported?

2. Method

The systematic review method was used in this study in order to reveal the research trends in technology leadership. According to the Cochrane handbook (Higgins et al, 2019), the ever-increasing number of studies makes it difficult to keep track. In view of this, systematic reviews enable readers to keep up-to-date with full information on all available research evidence. Higgins et al (2019) also add that a systematic review presents the state of research, identifying gaps, limitations, deficiencies and lack of evidence in the literature to guide future research. This study aims to point out trends in technology leadership.

2.1. Data collection

Studies from 1990 to August 2020 are included in the review. This study involved a systematic search of seven databases: ERIC, SCOPUS, OpenAIRE, SSCI, ScienceDirect, TR Dizin, Complementary Index. In order to access a broad publication range, the search terms employed were "technology leadership" AND “school climate”, "technology leadership", and “technology acceptance”, "technology leadership" AND “technology integration”, "technology leadership" AND “"self-efficacy" OR "self-efficacy" OR "competency" OR "skill" OR "skills", "technology leadership" AND "Technological Pedagogical Content Knowledge" OR "TPACK", “school technology leadership”, “Technology Leadership in Schools”, “technology leadership” AND "education" OR

"instruction" OR "teaching" OR "learning", "technology leadership" AND "school administrators" OR "principals" OR "vice principals" OR "Education Administrators", "School Administrators' Technology Leadership". No publication date limitation was applied so the review includes all studies. These search criteria identified 185 publications in the databases.

2.2. Data analysis

In the first phase, a form page was created using Excel in line with the research questions. The categories in the form were determined by the researchers according to the research questions (Table 1). In order to determine the same properties in the same way, the properties of the publications on the form page were set to be selected from drop-down boxes. All the features of the selected publications, except those that are not suitable, were fully entered in this form. The form page was checked by another researcher by randomly selecting a few records. After the control, the data were transformed into graphics using Excel.

Table 1. Main research questions and subcategories

Main research questions	Subcategories
What are the research methodologies, methodological purpose, in the existing literature?	data collection tool, sampling, data analysis method
What are the trends in educational technology leadership studies?	distribution by year, distribution by country, research method, publication type, target audience, database , number of authors
What are the educational theories, approaches or standards being reported?	research purpose, educational theories/standards.

In the second phase, the full texts of 185 articles were examined and 61 duplicated articles were eliminated. During the screening phase, 23 articles were eliminated from the study since they were not related to the review. The criteria for elimination were as follow: a) not directly related to education (20 articles), and b) not directly related to educational administration / technological leadership (3 articles). After examination of the full texts, 42 articles were excluded for the following reasons: c) not including any administrators (23 articles), and d) not being a scientific research (19 articles). Finally, the remaining 59 publications were examined in detail (Figure 1).

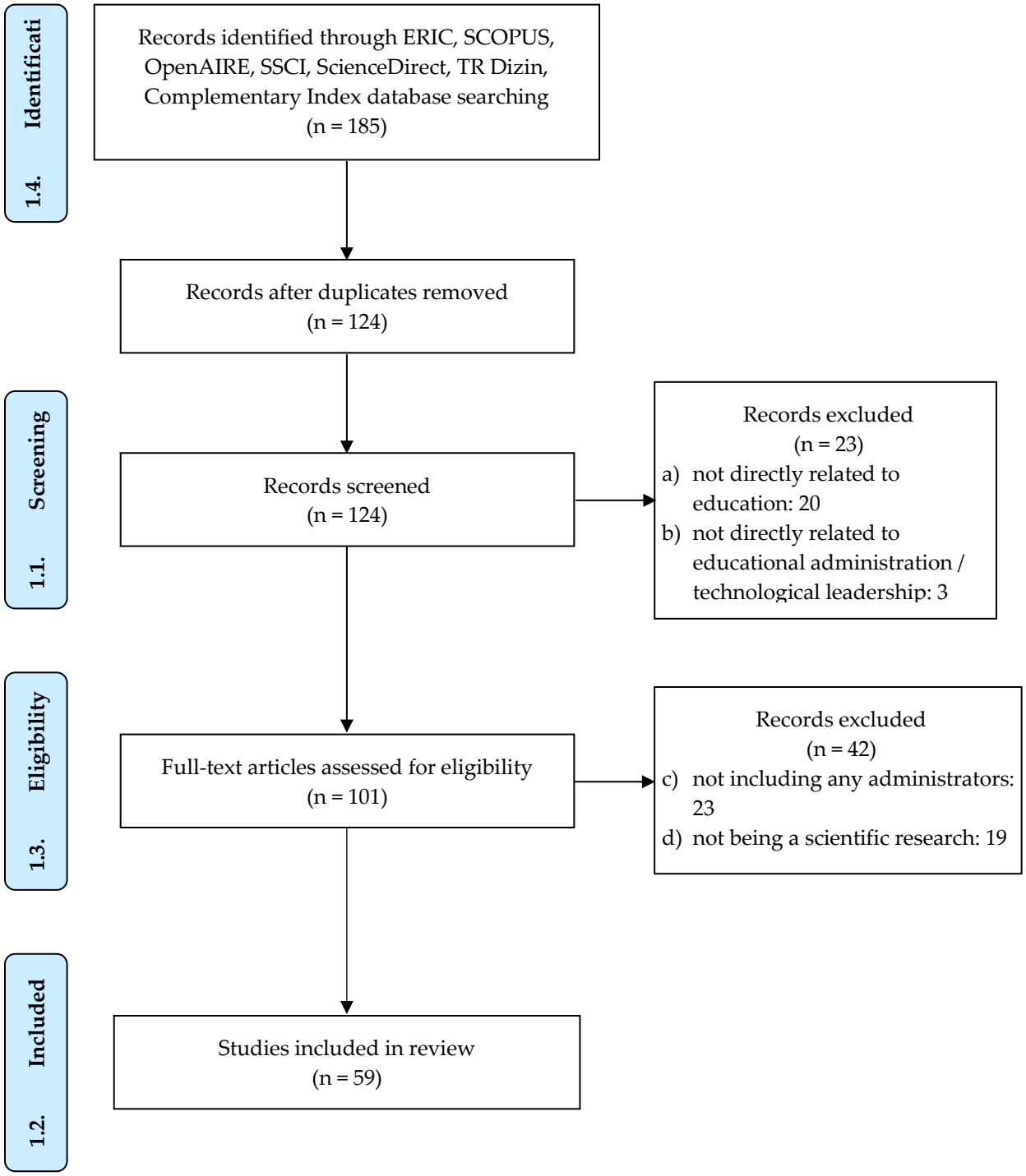

Figure 1. Flow chart for publication selection

3. Findings

The distribution of researches on technology leadership in education by year is shown in Figure 2. According to Figure 2, the researches, which began in 1992, reached their highest point (n=6) in 2012 with a dramatic increase in 2010. The following years show almost identical decreases and increases.

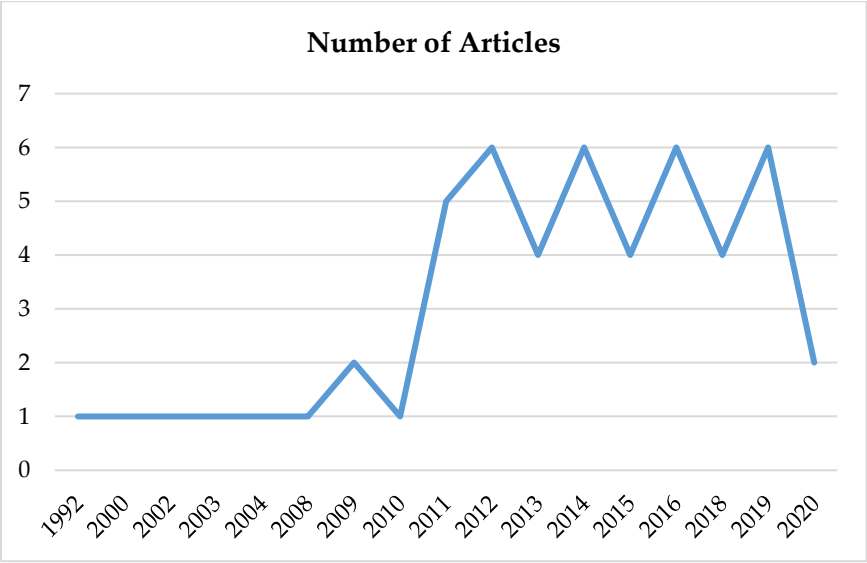

Figure 2. The number of studies by year

The countries where studies on technology leadership in education were conducted are shown in Figure 3. As shown in Figure 3, most studies on technology leadership in education took place in the USA (n=20) and Turkey (n=19). Following this, a series of studies were carried out in Taiwan (n=4) and Malaysia (n=4).

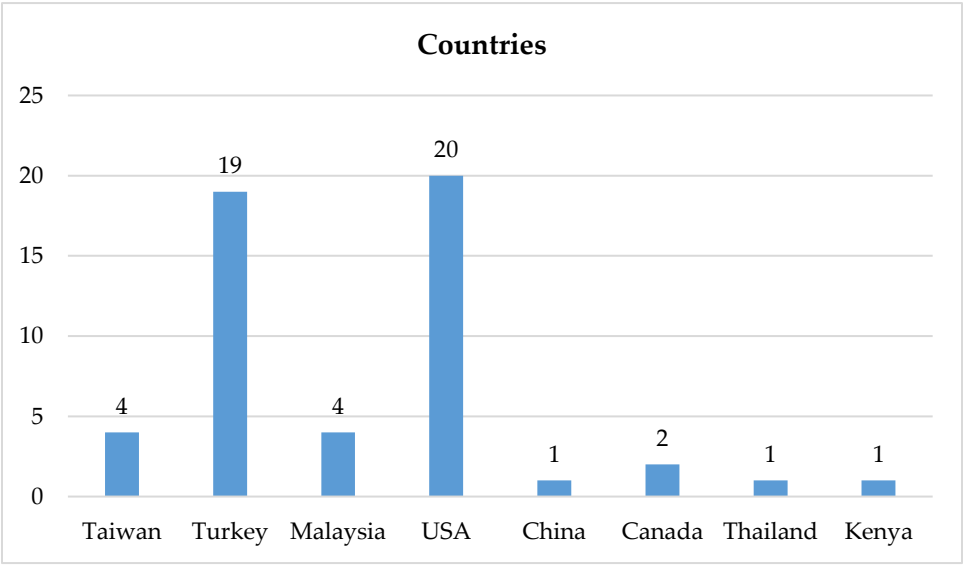

Figure 3. The number of studies by country

The data of the publication types are shown in Figure 4. Looking at the type of publications, almost all of them (n=43) are articles and a small number of them (n=9) are proceedings (Figure 4).

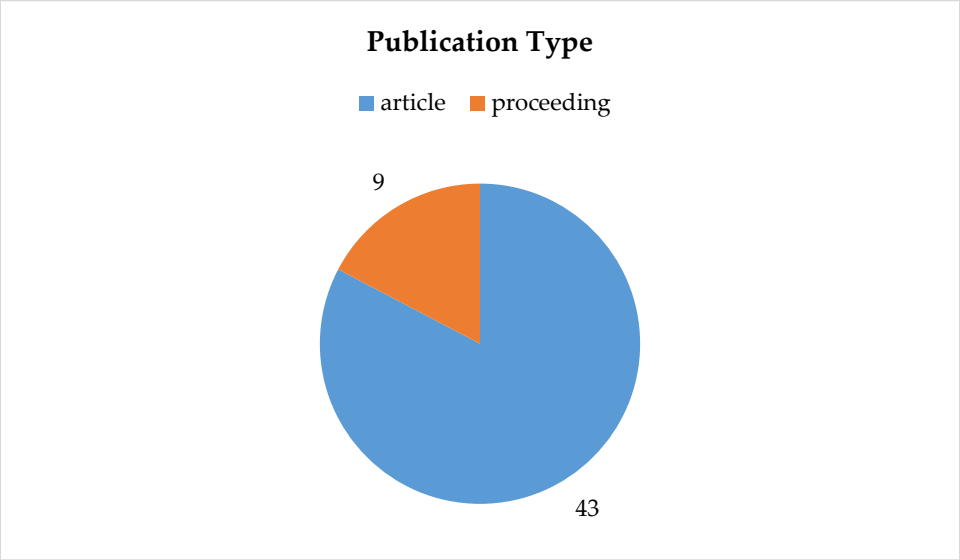

Figure 4. Publication type

The research methods used in the studies are shown in Figure 5. According to Figure 5, the most frequently used methods in technology leadership studies in education are descriptive (n=12) and survey (n=10). The total number of publications using qualitative methods is 11. It can therefore be said that the quantitative method is dominant in the studies.

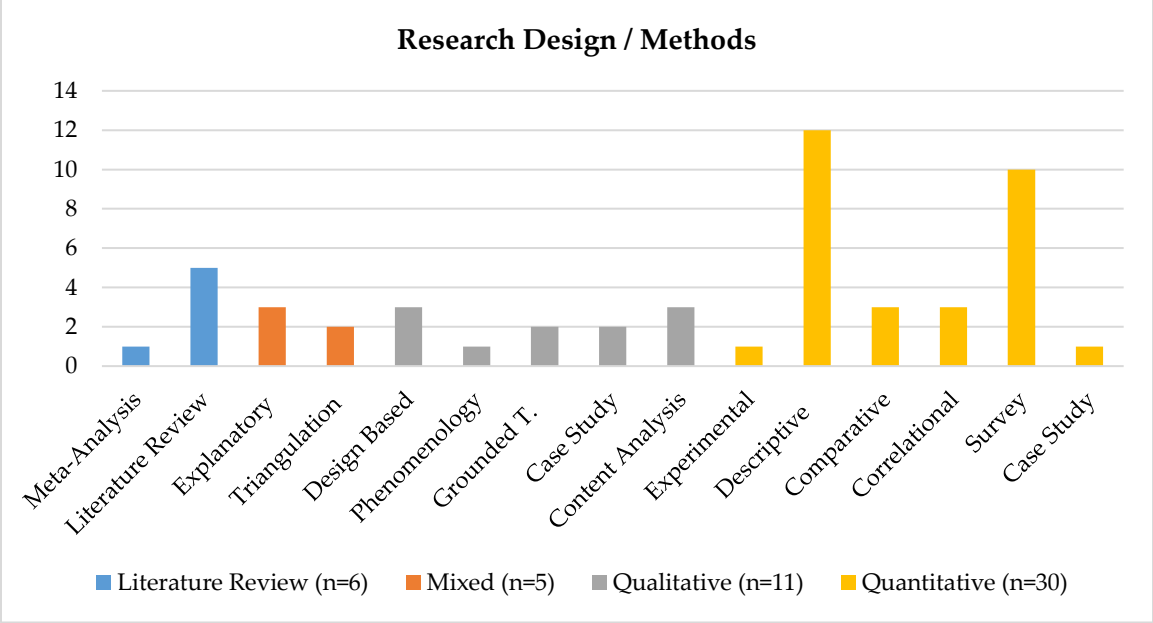

Figure 5. Research methods used in the articles

The data on the target audience of sampling in the studies is given in Figure 6. The target audience sampling (participants, working group, etc.) shows that the principals (n=34) are mainly included. At the same time, principals and teachers (n=5) and principals and vice principals (n=2) were included in the studies (Figure 6).

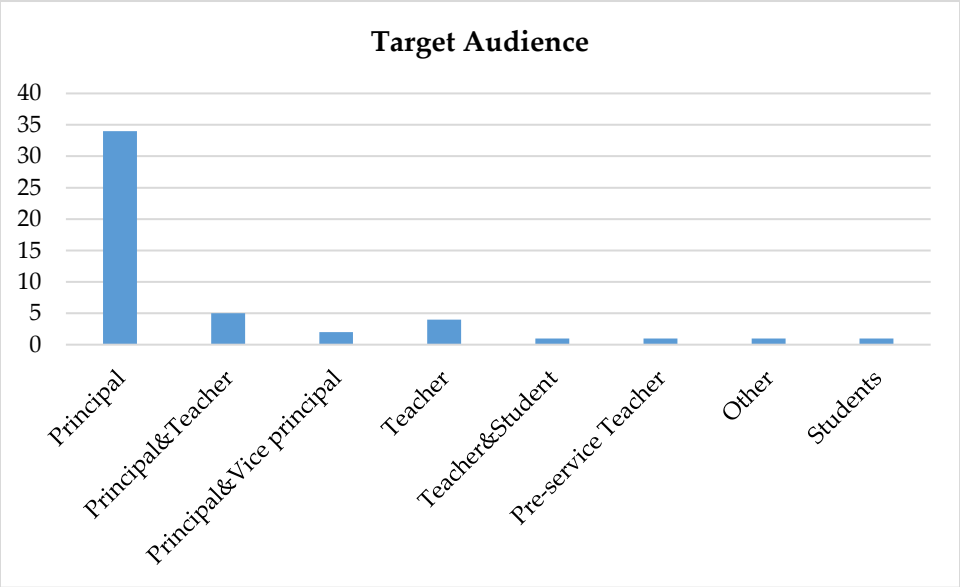

Figure 6. Target audience of sampling in the reviewed studies

The data collection tools used in the reviewed studies are shown in Figure 7. As seen in Figure 7, the most commonly used data collection tool is the questionnaire (n=30). This is followed by the interview or focus group (n=11).

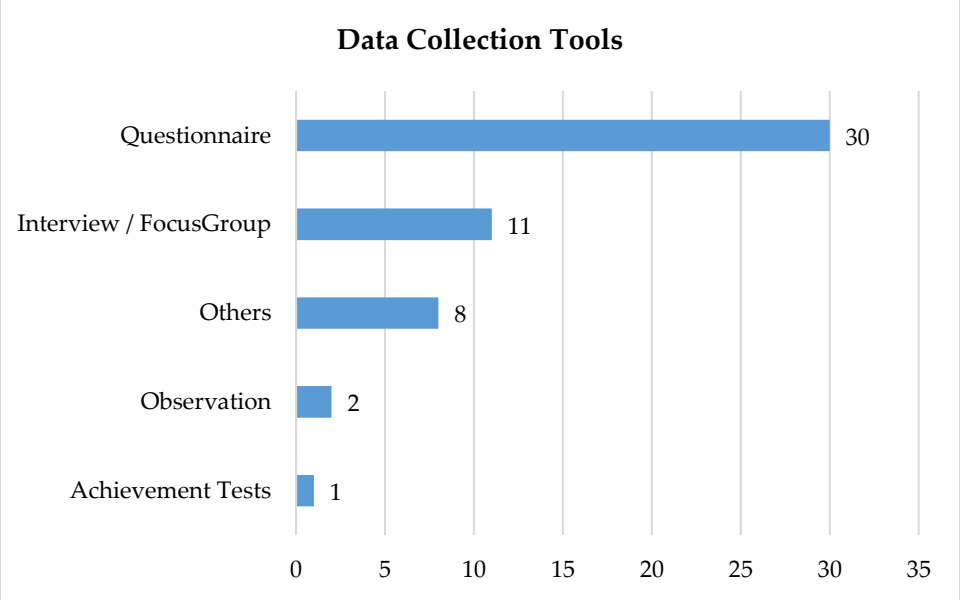

Figure 7. Data collection tools used in reviewed studies

The sample size and sample selection types and data analysis methods are shown in Figures 8, 9 and 10. Figure 8 shows that the sample size is below 100 in 23 of the publications and above 100 in 23 of the publications. This suggests that the sample size varies according to the research model. Figure 9 shows that sampling selection was mostly done in the form of convenience sampling (n=22) and purposive sampling (n=13). Figure 10 shows that the most used data analysis methods are descriptive (n=11) and content analysis (n=11). Considering that the studies are mostly quantitative descriptive and survey studies, these numbers can be seen as reasonable.

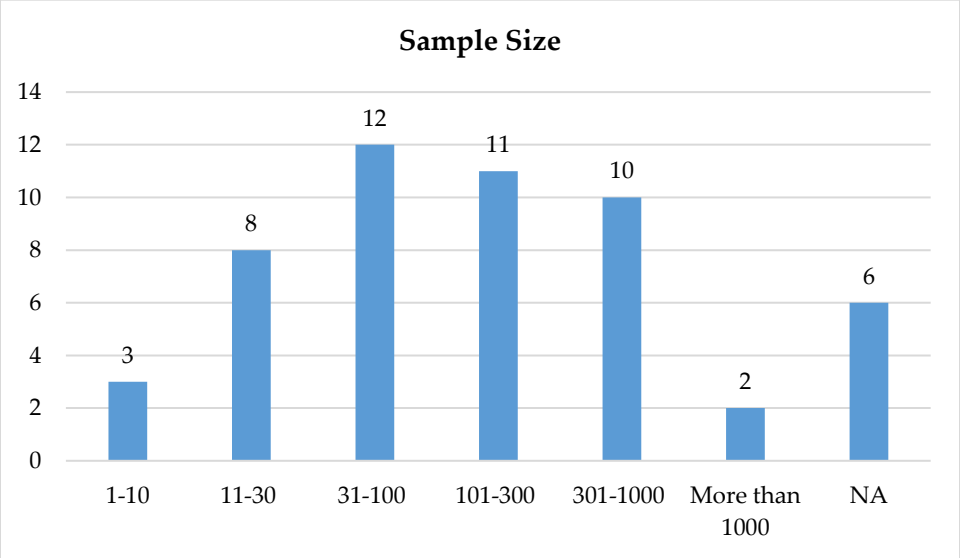

Figure 8. Sample size in reviewed studies

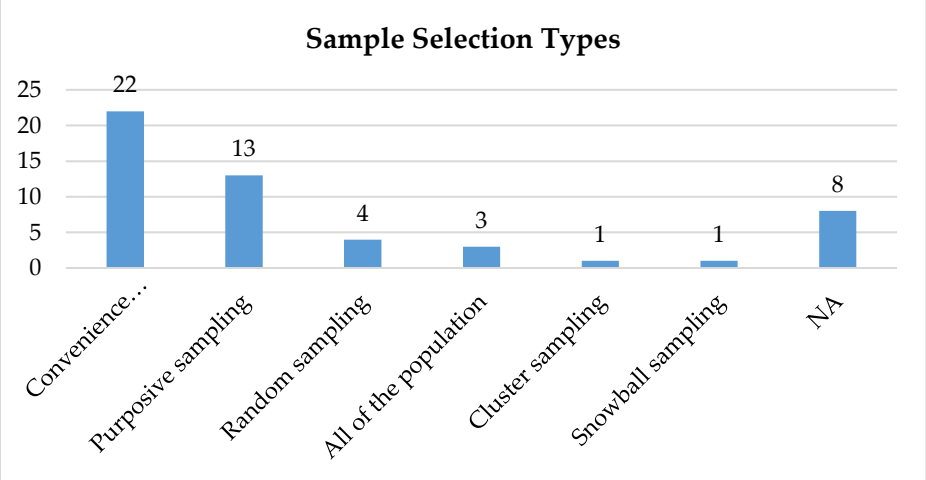

Figure 9. Sample selection types

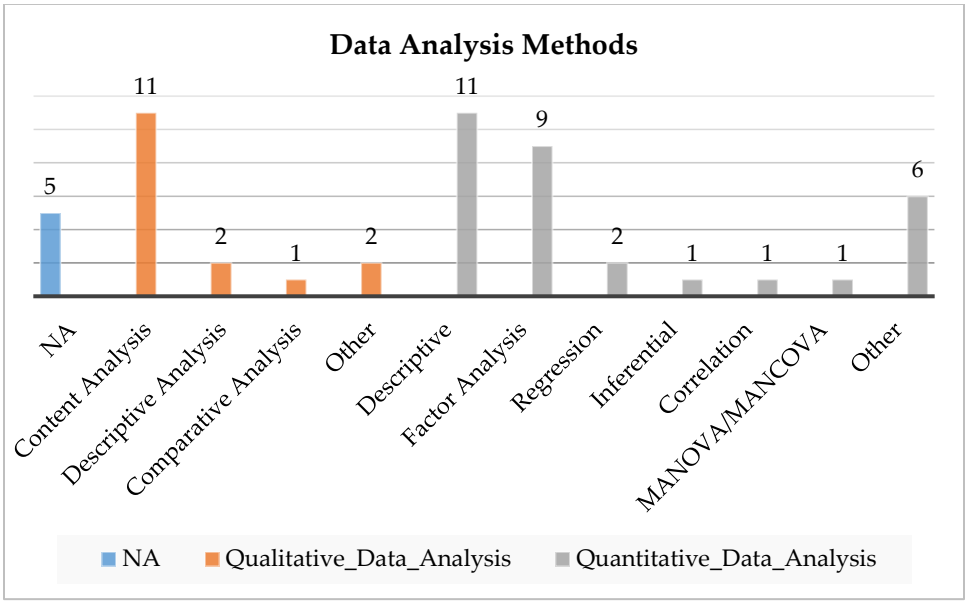

Figure 10. Data analysis methods

The distribution of the reviewed studies across the databases is shown in Figure 11. The databases where researches on technology leadership in education concentrated are ERIC (n=24) and Scopus (n=11).

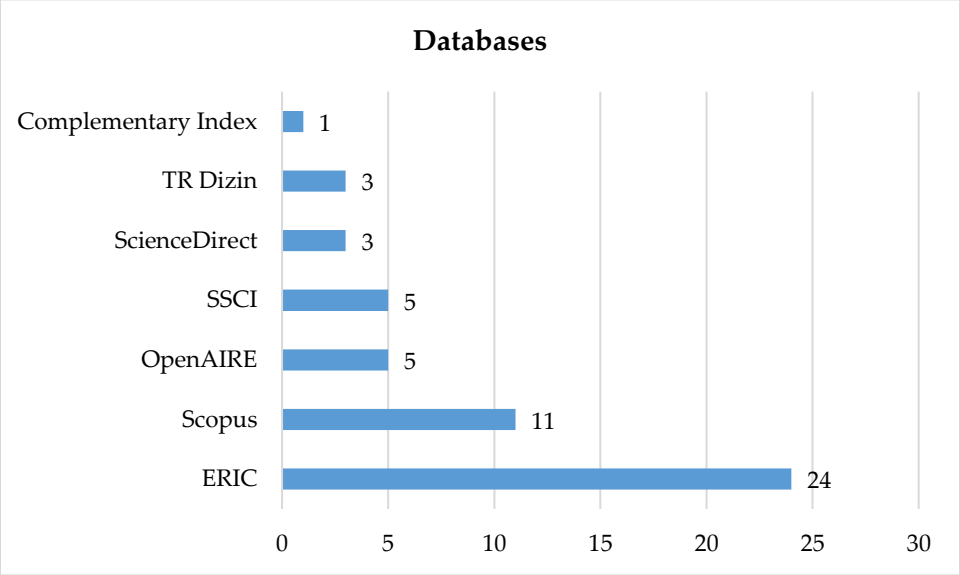

Figure 11. Distribution of studies across databases

Figure 12 shows the number of authors of articles on technology leadership in education. Most of the articles (n=21) have two or three authors (n=12). This is followed by studies with a single author (n=10).

Figure 12. Article distribution according to the number of authors

Figure 13 shows the distribution of studies on technology leadership in education. Although Figure 13 shows a wide distribution range, the articles focus on the goals of technology leadership for technology integration (n=7), TL competencies (n=5), TL self-efficacy (n=5), and technology leadership perceptions (n=4).

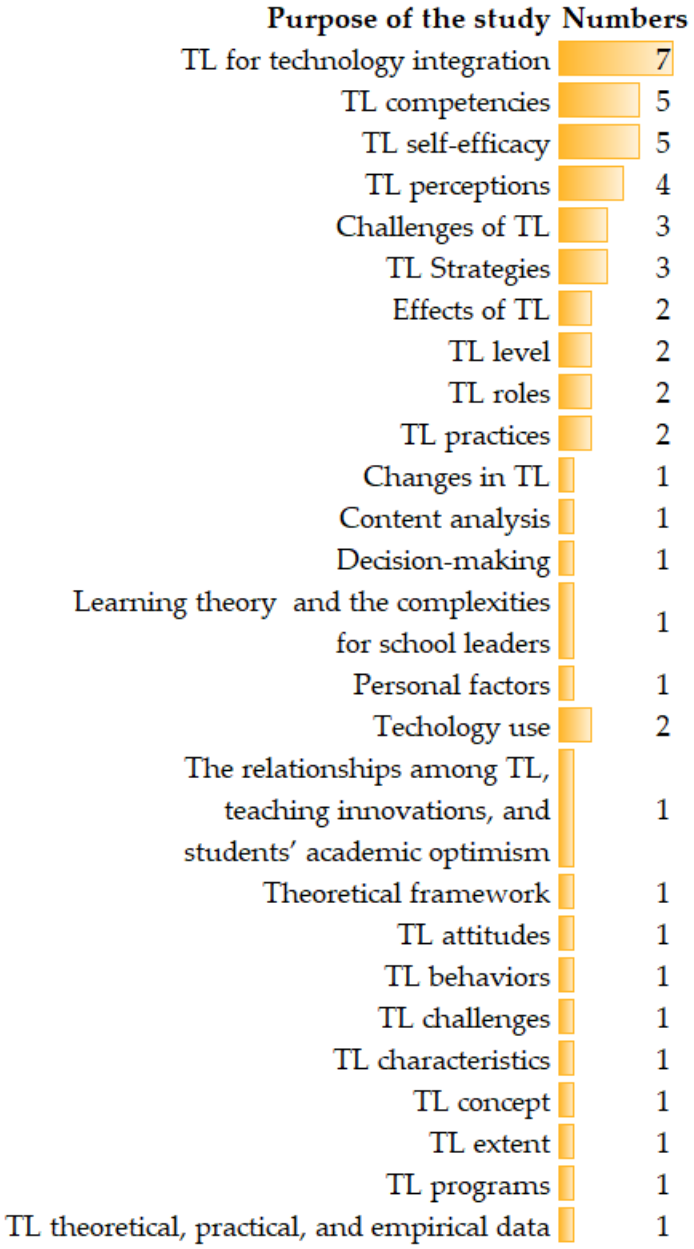

Figure 13. Distribution of studies based on research purpose

The distribution of the theories and standards used in the researches can be seen in Figure 14. Almost half of the studies did not provide information regarding theories and standards. In the other half, standards were implemented in 22 studies, ISTE/NETSA (n=12), ISTE (n=8) and NETSA (n=2).

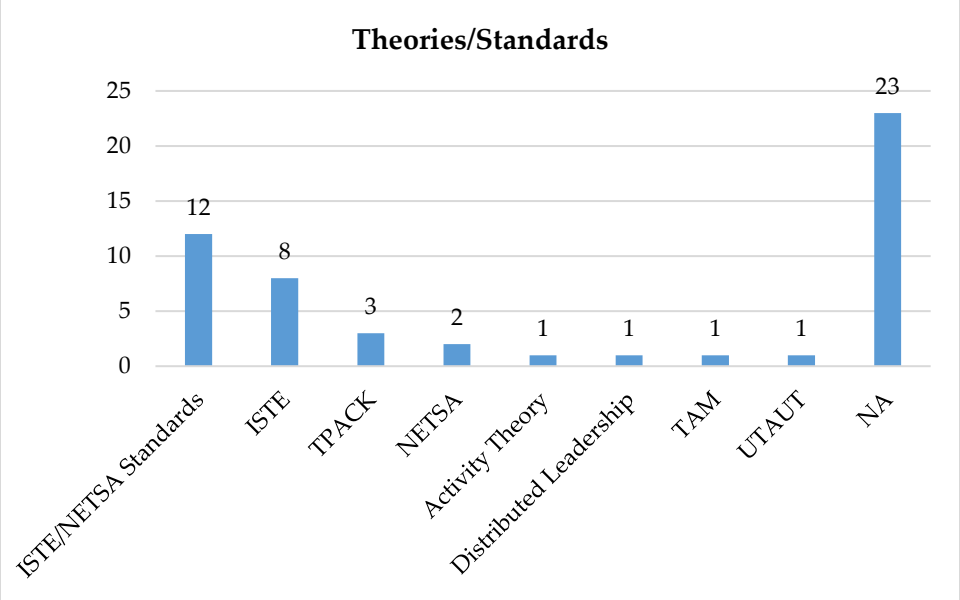

Figure 14. Theories/standards used in the studies

4. Discussion and Conclusion

In this study, the phenomenon of technology leadership was examined according to certain characteristics. The number of studies by year, the number of studies by country, publication type, research methods used in studies, target audience, data collection tools, sample size, data analysis methods, databases used in the studies, study distribution according to the number of authors, research purpose and theories/standards used in the studies were analyzed.

According to the findings of this review, the researches, that began in 1992, reached their highest number in 2012 with a dramatic increase in 2010, and most of the studies were carried out in the USA and Turkey. The widespread use of internet technology and technologies such as tablet, smart phone, smart board, which are becoming more affordable each year, may be the cutting edge. According to the methodologies and methodology purpose, the most frequently used method in technology leadership studies in education is descriptive and survey. It can also be said that the quantitative method is dominant in the studies. According to the results, there is a need for empirical researches to explore how to increase technology leadership skills. The most commonly used data collection tool in these studies is the questionnaire. In addition to traditional data collection techniques, alternative data collection tools could be used with different research designs, leading to the collection of more in-depth information. Longitudinal studies could be conducted, and ethnographic studies to understand corporate culture. The target audience sampling (participants, working group, etc.) in the studies is mainly

principals. As Tanzer (2004) argues, the technological leader is the person who maintains all the managerial activities required in the efficient use of technology. This person can be the school administrator or teacher. Further research is recommended on teachers taking on this role as well as school administrators. Every teacher has a role as a technology leader.

Based on the analysis provided, it is clear that the trend in these studies are mostly on goals of technology leadership for technology integration, technology leadership competencies, technology leadership self-efficacy, and technology leadership perceptions. As pointed out by Flanagan and Jacobsen (2003), principals play a fundamental role in establishing successful schools, therefore technology leadership that helps integrate technology with leadership skills has become increasingly critical in the school setting. In the reviewed studies it is the competencies and self-efficacy of technology leadership that is mostly questioned. Although it is important to investigate the competencies and self-efficacy of technology leaders, it is also necessary to carry out studies related to technology integration that ensure the cooperation of teachers and school administrators, the development of these competencies, measurement of their development in multiple ways, and the development of applications. According to another review study by Gumus et. al (2018) it was revealed that distributed leadership, instructional leadership, teacher leadership, and transformational leadership were the most preferred leadership models. In the same study, it was seen that most of the researches focused on the effects of leaders on organizational behaviors/ conditions and on student achievement (Gumus et. al, 2018).

The findings in this study differ to those of Turan, Polatcan and Cansoy's systematic review (2020), where the most preferred studies were the technology leadership role of principals and their technology qualifications and standards. Richardson, Bathon, Flora and Lewis's review study (2012) concluded that more scholarly effort is needed to focus on educational leaders' technology standards, specifically the NETS-A standards. According to the theories and standards analysis in our review, on the other hand, there are studies on ISTE/NETS-A (n=12), ISTE (n=8), and NETS-A (n=2). Many of the studies in the reviews focus on standards for educational leaders and to get a clearer picture of how to achieve these standards, further studies could focus on examples of how technology leaders implement such programs. In the review of Uysal and Madenoğlu (2015), mostly preferred topics were school administrators' technology leadership roles and technology qualifications and standards of school administrators.

This systematic review is beneficial for scholars and practitioners to gain understanding of the research regarding the technology leadership. As stated above, educational leaders have an impact on the field of education and this

review presents the trends. According to the results of the examined researches, it may be necessary to organize theoretical and practical training programs to improve the technology leadership competencies and individuals' self-efficacy. These training programs can be prepared in cooperation, in particular, with education administrators, educational technology experts and teachers. Empirical studies could be conducted on the effectiveness of the training programs. Mcleod and Richardson (2011) examined the extent to which technology leadership is discussed, framed, in the fields of educational leadership and educational administration by collecting data and conducting content analyses on conference programs of three leading professional organizations in the field and on a selection of professional journals spanning 1997 to 2009. According to their results the topics were on technology integration, staff development, and technology policy.

Future studies could be conducted to determine the opinions of teachers, students and parents' perceived technology leadership attitudes. As the findings show that the quantitative method is dominant in the studies, experimental methods could be applied in future studies. A comparison between schools where principals with a high level of technology leadership level and schools where principals display a low level of technology leadership looking at the schools' success and climate could be carried out, as well as intercultural comparison studies. Further studies could examine the effect of age, gender, years of seniority, professional qualifications on this process and how teachers in a role of technology leadership use educational technologies.

Ethical Declaration

We declare that this study is an original study; we act in accordance with scientific ethical principles and rules from all stages of the study, including preparation, data collection, analysis and presentation of information; that we cite and include these sources in the bibliography for all data and information not obtained within the scope of this study; we have not made any changes to the data used and that we have complied with all ethical duties and responsibilities by accepting all the terms and conditions of the Committee on Publication Ethics (COPE).

Conflict Interest and Author Contributions

The authors declare that they have no conflict of interest. First author Elif Polat managed the entire flow of the article, study design, organized the data collection tool and data analyzing process. Second author Ömer Yahşi managed the literature searches and the data collection process. Third author Sinan Hopcan managed data analysis and in the interpretation of the results and analysis. All authors managed in the interpretation of the results and in writing of the manuscript.

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