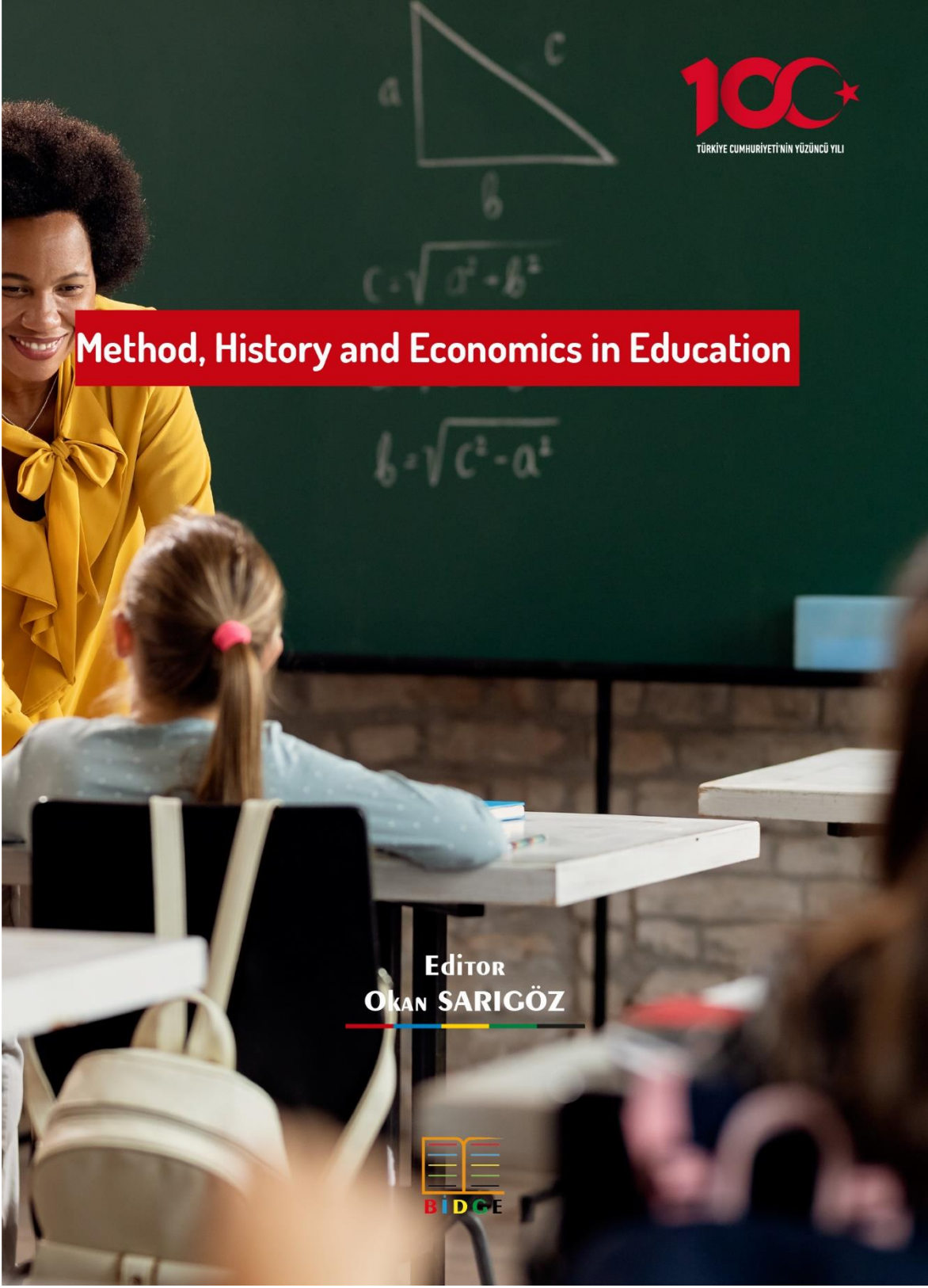

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Content

CHAPTER I

Classroom Teachers' Self-Efficacy Beliefs In Mathematics Teaching And The Impact Of Covid-19 Pandemic[1]

Ufuk UĞUZ[2]
Sibel YAZICI[3]

Introduction

Self-efficacy belief which is among the qualities of teachers is one of the significant factors affecting the teaching practices and activities (Şahin, Gökkurt &Soylu, 2014). Self-efficacy is confidence in the ability to control one's motivation, behavior, performance and social environment (Bandura, 1977). Teachers' self-efficacy belief refers to their belief in their ability to influence

[1] Bu araştırma ikinci yazar danışmanlığında, birinci yazar tarafından hazırlanan yüksek lisans tezinden üretilmiştir.

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the student achievement and to perform the necessary behaviors to fulfill their duties successfully (Yenilmez, 2016). It is reported that their self-efficacy belief has effects on their attempts to teach, the level of their professional goals and their future goals (Küçük et. al. 2013). Studies on the self-efficacy belief revealed a linear correlation between this belief and achievement (Louis & Mistelethe, 2011; Yıldırım, 2011). Chan (2003) found that teachers with higher levels of self-efficacy belief experience less stress during the process of teaching and provide much more efficient teaching in contrast to those with lower levels of self-efficacy belief. It is also reported that teachers with higher levels of self-efficacy belief spend more time for academic activities, provide more efficient learning settings and make more effort to teach (Gibson & Dembo, 1984). In addition, they are found to take into account the individual differences of students during the teaching process (Enochs et. al., 2000), to guide the students who experience difficulties in learning (Çetin, 2011), try much more divergent teaching methods and have much more confidence in their teaching of mathematical skills (Bates et. al., 2011). The other common characteristics of the teachers with higher levels of self-efficacy belief are as follows: making search for improving the teaching methods they employ, using student-centered learning strategies and more teaching tools (Pajares, 1996) and being patient in the face of problems and making attempts to avoid these problems (Aşkar & Umay, 2001). Therefore, a good classroom teacher should have higher levels of self-efficacy belief to teach mathematics in a desired manner (Dede, 2008).

There are many studies on the self-efficacy beliefs of the mathematics teachers (Arseven, Arseven & Tepehan 2015; Deniz &

Koç, 2020; Eren, 2018; Hacıömeroğlu, 2013; Julaihi, Voon & Tang, 2020; Mulu, Kurnila & Ningsi, 2021; Peker & Erol, 2017; Rahayu, Sartono, & Miftakhuddin, 2019; Segarra & Julià, 2022; Segarra, Julià & Valls, 2021; Takır & Özder, 2022; Takunyacı, 2021; Takunyacı & Yerlikaya, 2020; Tarım, Özsezer& Canbazoğlu, 2017; Taşdemir, 2019; Yenilmez, 2016; Zehir, Zehir & Ağgül Yalçın, 2019). In these studies, the self-efficacy beliefs of both in-service and pre-service mathematics teachers have been analysed. However, the studies on the self-efficacy beliefs of the classroom teachers are relatively less (Arcan & Şahin, 2020; Dinç Artur &Ulum, 2019; Perera & John, 2020; Pul, 2019; Şahin et. al., 2014; Ünal & Çil, 2021; Takır, 2018). Although teachers are expected to have a high self-efficacy belief, this is not always possible. Because the individuals' self-efficacy is not a static quality, and it is known that their competence level changes depending on their experiences or actions (Pajares & Miller, 1994). Research suggests that there are four factors affecting the individuals' self-efficacy: performance achievements (direct experiences), indirect experiences, verbal persuasion, physiological and emotional states (Wood & Bandura, 1989). Of them, the most effective factors are direct experiences that the individuals can infer as a result of their experiences (Demirdağ, 2015). The COVID-19 pandemic emerged unexpectedly and affected many areas of life, particularly fields of health-care and education. Distance education activities were implemented instead of face-to-face applications during this period, and education and training activities continued using various social media tools, programs and applications (Akkaş Baysal & Ocak, 2020).

This situation created an environment for teachers to gain new experiences that they have never had before. Mathematics teaching was also affected by this situation. Many studies have been conducted regarding distance education mathematics teaching during the COVID-19 pandemic period (Aldon, Cusi &Swidan, 2021; Aydoğdu İskenderoğlu & Konyalıhatipoğlu, 2021; Batdal Karaduman, Akşak Ertaş & Duran Baytar, 2021; Csachová & Jurečková, 2020; Drijvers et. al., 2021; Erduran & İnce Muslu, 2020; Fakhrunisa & Prabawanto, 2020; Filiz & Güneş, 2021; Hamurcu & Çapraz, 2021; Jukić Matić, 2021; Kılınç, 2021; Kilit & Güner, 2021; Mihajloviç, Maricic & Vuloviç, 2021; Özçakır Sümen, 2021; Özdemir Baki & Çelik, 2021; Roman, 2021; Şen, 2021; Tican & Toksoy Gökoğlu, 2021; Tokay & Çelebi, 2021; Toptaş & Öztop, 2021; Yaşar & Şimşek, 2022; Yazıcı, 2021). Such studies mainly examined the views of mathematics teachers regarding distance education in mathematics, and but, very few studies are carried out on the sample of classroom teachers (Batdal Karaduman et al., 2021; Filiz & Güneş, 2021; Hamurcu & Çapraz, 2021; Kılınç, 2021; Özçakır Sümen, 2021; Tokay & Çelebi, 2021; Toptaş & Öztop, 2021; Yazıcı, 2021).

The aim of the study is to reveal the effects of the distance education process on classroom teachers' beliefs in mathematics teaching in terms of their self-efficacy levels and their views on distance education mathematics teaching. The study is important in that it will shed light on the conditions that future studies may analyse and provide information to people related to this subject (education politicians, teachers, administrators, etc.). The aim of the study was to determine the mathematics teaching self-efficacy

beliefs of classroom teachers and the effects of distance education during the COVID-19 pandemic period on their mathematics self-efficacy. Based on these aims, the study attempts to answer the following research questions:

1. What is the level of classroom teachers' self-efficacy beliefs in mathematics teaching?

2. Are classroom teachers' self-efficacy belief levels regarding mathematics teaching affected by variables such as gender, educational status, professional experience, place of duty, and grade level taught?

3. What are the views of classroom teachers about the distance education practices during the COVID-19 pandemic?

4. What are the contributions of the distance education practices during the COVID-19 pandemic to the self-efficacy of classroom teachers?

Method

Design

In this study, it is aimed to reveal classroom teachers' self-efficacy beliefs in mathematics teaching and their views on teaching mathematics in distance education during the COVID-19 pandemic period and to examine these topics from a holistic perspective. Due to the research questions and aims, the study employs a mixed method, in which quantitative and qualitative research methods are used together. The mixed method means not only combining quantitative and qualitative research methods, but also collecting and analyzing data and purposefully integrating the results of the

analysis (Creswell & Plano Clark, 2018). The reason for using the mixed method is to extend the study. The aim of expansion is to answer different research questions within a single research with different methodologies (Aydın Çakır & Türkeş Kılıç, 2021). An explanatory sequential mixed design was used in the study, in which first quantitative and then qualitative data were collected. In the explanatory sequential mixed designs, the quantitative and qualitative data are first analyzed separately, and then these data are combined and interpreted in the discussion (Creswell & Plano Clark, 2018).

The quantitative part of the study was conducted through the descriptive survey model. The survey model is a method that aims to collect data to reveal certain characteristics of a group (Büyüköztürk et. al., 2012). In this study, the instant scanning model was used since the study is aimed to describe the self-efficacy beliefs of classroom teachers concerning the mathematics teaching in their existing form. The steps followed in the survey research are given in Figure 1.

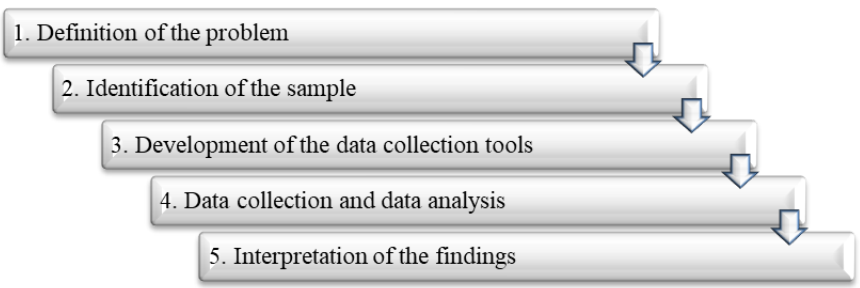

Figure 1: Steps Followed in the Survey Research

The qualitative part of the study was conducted through a case study, one of the qualitative research methods. Case study is a

frequently preferred method in qualitative research in the field of education (Gall, Gall & Borg, 2003). One of the reasons for its frequent use is related to its nature. It focuses on answering the questions of how and why and attempts to uncover the details of a fact or and event which is not under the control of researchers (Yıldırım & Şimşek, 2018). In the current study the case is the use of distance education methods in mathematics education during the COVID-19 pandemic. The steps used in the case study methodology are given in Figure 2.

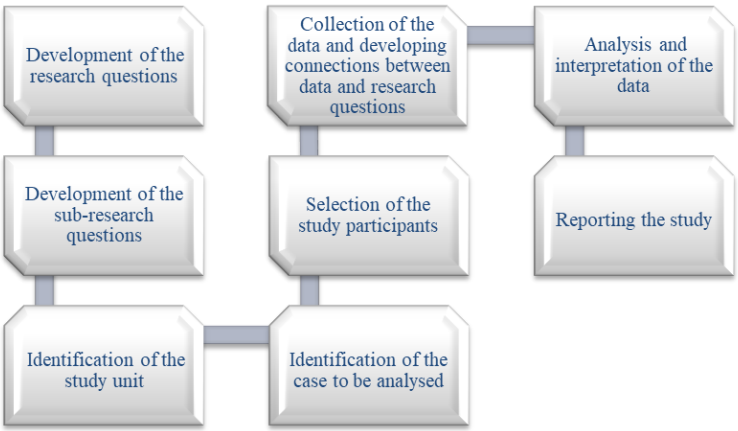

Figure 2: Steps of the case study

Participants

There were a total of 2300 classroom teachers in the province of Afyonkarahisar Directorate of National Education during the school year of 2021-2022. The participants were selected from this group using the simple random sampling, and a total 580 of classroom teachers participated in the study. It is a sampling type in which every element in the population has an equal chance and probability of being selected (Karasar, 2009).

Table 1 shows the demographic information on the participants in the quantitative part of the study.

Table 1: Demographic Information on the Participants in the Quantitative Part

Demographic Information	**Variables**	**f**	**%**
Gender	Female	308	53
	Male	272	47
Educational background	University graduates	559	96
	Graduate degrees	21	4
Working institution	Working in villages or towns	243	42
	Working districts	173	30
	Working in provinces	164	28
Professional experience	1-5 years	55	10
	6-10 years	84	15
	11-15 years	148	25
	16 years or more	293	50
The grade level of the classroom teachers	1. grade	154	27
	2. grade	137	23
	3. grade	139	24
	4. grade	150	26
Total		**580**	**100**

Table 1 presents information on the gender, educational background, working institution, Professional experience and the grade level of the classroom teachers who took part in the quantitative part of the study. As can be seen above of them 53% were female (308), and 47 % of them were male (272). Concerning educational background 96% were university graduates (559) and 4% had graduate degrees (21). In terms of the working location 42 % working in villages or towns (243), 30% were working districts (173), and 28% were working in provinces (164). The participants

had the following professional experience: 10% 1-5 years (55), 15% 6-10 years (84), 25% 11-15 years (148), and 50% 16 years or more (293). It is seen that 27of the participants taught 1. grade (154), 23% 2. grade (137), 24'% 3. grade (139) and 26% 4. grade (150).

They were selected using the maximum variation sampling technique which is one of the purposive sampling methods. The purposive sampling method allows in-depth examination of situations that are thought to provide rich information. Thus, in many cases, it is useful in discovering and explaining facts and events. The goal of using the maximum variation sampling method is to determine whether there are any common or shared facts among diverse situations and to reveal different dimensions of the problem at hand (Yıldırım & Şimşek, 2018). An information form was employed to employ the maximum variation. The factors which were used to explain the variation included the participants' gender, educational background, working location, Professional experience and grade level they taught.

Table 2 presents the demographical information on the participants who took part in the qualitative part of the study.

Table 2: Demographic Information on the Participants in the Qualitative Part

Demographic Information	**Variables**	**f**	**%**
Gender	Female	53	51
	Male	51	49
Educational background	University graduates	96	92
	Graduate degrees	8	8
Working institution	Working in villages or towns	36	35
	Working districts	31	30
	Working in provinces	37	35
Professional experience	1-5 years	3	3
	6-10 years	14	13
	11-15 years	28	27
	16 years or more	59	57
The grade level of the classroom teachers	1. grade	27	26
	2. grade	24	23
	3. grade	29	28
	4. grade	24	23
Total		**104**	**100**

As can be seen in Table 2 of the participants 51% were female (53) and 49% were male (51). Of them 92% were university graduates (96) and 8% had graduate degrees (8). In terms of working location 35% were working in villages or towns (36), 30% in districts (31), and 35% in provinces (37). Their educational background is found to be as follows: 3% 1-5 years (3), 13% 6-10 years (14), 27% 11-15 years (28), and 57% 16 years or more (59). It is found that 26% were teaching 1. grade (27), 23% 2. Grade (24), 28% 3. grade (29) and 23% 4. grade (24).

Data Collection and Analysis

The Mathematics Teaching Self-Efficacy Belief Scale (MTEBS) was used to uncover the self-efficacy beliefs of the classroom teachers in regard to mathematics teaching. The MTEBS was developed by Enochs et. al. (2000) and was adapted in to Turkish by Hacıömeroğlu and Şahin Taşkın (2010). In order to collect data on the demographic characteristics of the classroom teachers, a personal information form was developed by the researcher. The original MTEBS includes the following two subscales: "Personal Mathematics Teaching Efficacy" and "Mathematics Teaching Outcome Expectancy". The Turkish version of the MTEBS contains the following three subscales: "Personal Mathematics Teaching Efficacy", "Role of Teachers in the Efficient Teaching" and "Teacher Performance in Teaching". The reason for the different distribution of items in the Turkish version of the scale is that the original version was administered to the pre-service teachers in the United States who took totally different courses and had distinct experiences (Hacıömeroğlu & Şahin Taşkın, 2010). The Cronbach alpha internal consistency coefficients of the subscales in the Turkish version of the subscales are found to be 0,814, 0,795 and 0,661. The Cronbach alpha internal consistency coefficient for the scale as whole is reported to be 0,712 (Hacıömeroğlu & Şahin Taşkın, 2010). In the current study the Cronbach alpha coefficient was found to be 0,794. This value indicates that the internal consistency of the scale is high and reliable (Field, 2005).

In order to reveal the views of the participants about the distance education process in the mathematics courses during the COVID-19 pandemic a survey questionnaire with four open-ended

items was developed. The open-ended items are preferred when the study participants are asked to answer questions freely. Such items are advantageous in that they enable the researcher to receive answers that he or she did not expect or plan, thus gaining broader and more detailed information about the topic at hand (Büyüköztürk, 2005). Since it is aimed to examine in detail and comprehensively the views of the classroom teachers regarding the distance education mathematics teaching during the COVID-19 pandemic, a survey questionnaire with the open-ended items was employed in the study.

Data Collection Procedure

Before the start of the data collection process necessary permissions were taken from the Social Sciences Institute of the Afyon Kocatepe University (17.12.2021/13) and Afyonkarahisar National Education (11.01.2021/41045487). In order to access all participants the MTEBS was transferred to the Internet through the Google Forms. From 12 January 2022 the link was shared with 2300 classroom teachers via WhatsApp. The teachers were informated that the participation was voluntary and the filled forms should be submitted until 12 February 2022.

After taking the necessary permissions the qualitative data of the study were collected using a survey questionnaire with open-ended items which was developed by the author. The data collection procedure lasted between 28 February and 30 April 2022. The data were collected from following schools based on their locations: seven in the province, nine in a district and twelve in villages and towns. Therefore, the qualitative data were collected from twenty-

eight schools. The survey questionnaire was administered by the authors to the teachers.

Data Analysis

The data on the self-efficacy beliefs of the classroom teachers concerning the distance education process during the mathematics teaching in the COVID 19 pandemic were analysed using the SPSS 26.0. Before the analysis the values of the Skewness and Kurtosis were found to see whether or not the data were distributed in a normal manner. The values of the Skewness (.056) and Kurtosis (-.012) indicated that the data were normally distributed. Because if these values range between -1,5 and +1,5, the data have a normal distribution (Tabachnick & Fidell, 2013). Based on these results, the parametric statistical methods were used to analyze the data. More specifically, the following methods are employed: Descriptive statistics, t-test for two different independent variables and one-way analysis of variance (ANOVA) test for more than two independent variables. After the one-way ANOVA was performed, the Tukey HSD test, one of the post-hoc tests, was employed to determine the source of the difference. The formula of the Interval Width = Sequence Width / Number of Groups to Be Formed (Tekin, 1993) was used to determine the levels of the classroom teachers based on the scores they received from the scale. According to the formula, the range width of the scale was calculated as 4/5 = 0.80. The levels of the participants were evaluated using the following values: 1.00-1.80 “very low”, 1.81-2.60 “low”, 2.61-3.40 “medium”, 3.41-4.20 “high”, and 4.21-5.00 “very high”.

Content analysis was used to analyze the qualitative data to determine the views of the classroom teachers about distance education mathematics teaching during the COVID-19 pandemic. The main purpose of content analysis is to find concepts and relationships that can account for the data collected. The basic process of the content analysis is to bring together similar data within the scope of certain concepts and themes and to organize and interpret them in a way that the reader can understand (Yıldırım & Şimşek, 2018). Yıldırım and Şimşek (2018) argue that the analysis of the qualitative data involves four steps which are given as follows: coding of the data, identifying the themes, organizing the codes and themes, and interpretation of the findings. The data collected through the survey questionnaire were first transferred to the digital setting. Then the author read them many times to identify the codes which were reviewed by the field specialists to uncover the themes. Based on their feedback the codes and themes were reorganized. Finally, the findings were interpreted and presented in tables and were supported with direct quotations from the statements of the participants. The participants are coded based on their gender. Therefore, F stands for female participants and M male participants. These codes are used after the direct quotations such as KT1, KT2, KT3… and MT1, MT2, MT3...

In order to improve the internal validity of the qualitative data the authors attempted to avoid using their own subjective views and evaluations. In addition, the related sources were reviewed in terms of research design, data collection tools and data analysis. In order to ensure generalizability (external validity) of the study findings, the participants were identified using the purposive

sampling, the data collection and analysis processes were described in detail, and the findings were presented with detailed descriptions using direct quotations from participant statements. In order to improve the reliability or consistency (internal reliability) of the study, the authors developed codes and sub-themes separately from each other. Interrater consistency was determined using the Miles and Huberman's following formula (Miles & Huberman, 1994): "[Agreement / (Agreement + Disagreement) x 100]", and it was found to be 89%. It is reported that if it is over 70%, it indicates that the study is reliable (Miles & Huberman, 1994).

Findings

This section presents the findings collected from the quantitative and qualitative parts of the study.

The quantitative findings are presented in Tables and show the classroom teachers' self-efficacy belief levels in regard to the mathematics teaching and the effects of the variables of their gender, educational background, professional experience, working location and grade level they taught. Table 3 gives the mean scores of the classroom teachers from the MTEBS.

Table 3: Mean scores of the participants in the MTEBS

Variables	**Item**	**N**	**Mean**	**sd**	**Skewness**	**Kurtosis**	**Min.**	**Max.**
Scale (Total)	17	580	3,84	0.41	,056	-,012	2,59	5,00

*Note. *p<.05*

As can be seen in Table 3 the mean score of the classroom teachers from the MTEBS is found to be 3,84±0,41. Therefore, it can be stated that the level of the participants' self-efficacy belief in

mathematics education is high. Their minimum mean score from the MTEBS is found to be 2,59 whereas their maximum mean score is 5,00.

Table 4 presents the results of the independent groups t-test which analysed the potential significant effects of the gender of the participants on their self-efficacy belief in mathematics.

Table 4: T-test results on the effects of gender on the participants' self-efficacy belief in mathematics education

Variables	**Groups**	**N**	**X̄**	**sd**	**t-test**		
					T	**sd**	**p**
MTEBS	Female	308	3,83	0.41	-.948	578	.344
	Male	272	3,86	0.41			

*Note. *p<.05,*

Table 4 indicates that the mean score of the participants from the scale do not significantly differ in terms of their gender [t(578)=-0,948; p=0,344>0,05)]. It also shows that the mean score of the female participants is $\bar{x}$=3,83±0,41, and that of the male participants is $\bar{x}$=3,86±0,41. The mean scores of two groups appear to be similar.

Table 5 presents the results of the independent groups t-test which analysed the potential significant effects of the educational background of the participants on their self-efficacy belief in mathematics.

Table 5: T-test results on the effects of educational background on the participants' self-efficacy belief in mathematics education

Variables	**Groups**	**N**	**X̄**	**sd**	**t-test**		
					T	**sd**	**p**
MTEBS	University degree	559	3,84	0.41	-1,181	578	.238
	Graduate degree	21	3,95	0.48			

*Note. *p<.05*

As can be seen in Table 5 the mean score of the participants from the scale do not significantly differ in terms of their educational background [t(578)=-1,181; p=0,238>0,05)]. It also shows that the mean score of the participants with a university degree is $\bar{x}$=3,84±0,41, and that of the participants with a graduate degree is $\bar{x}$=3,95±0,48. Therefore, the mean scores of two groups appear to be similar.

Table 6 presents the results of the one-way ANOVA which analysed the potential significant effects of the professional experience of the participants on their self-efficacy belief in mathematics.

Table 6: ANOVA results on the effects of professional experience on the participants' self-efficacy belief in mathematics education

Professional experience	**N**	**X̄**	**sd**	**The Source of the Variance**	**KT**	**sd**	**KO**	**F**	**p**	**Significance**
1-5 years	55	3,76	0.34	**Intergroup Decoupling**	1,134	3	,378			None
6-10 years	84	3,79	0.41	**Intra-Group**	98,485	576	,171			
11-15 years	148	3,82	0.42	**Total**	99,619	579		2,211	,086	
16 years or more	293	3,88	0.41							
Total	580	3,84	0.41							

*Note. *p<.05*

Table 6 shows that the mean scores of the participants from the MTEBS do not significantly differ based on their professional

experience [(F=2,211; p>0.05)]. It suggests that the self-efficacy belief of the classroom teachers does not differ in parallel to the their professional experience.

Table 7 presents the results of the one-way ANOVA which analysed the potential significant effects of the working location of the participants on their self-efficacy belief in mathematics education.

Table 7: ANOVA results on the effects of working location on the participants' self-efficacy belief in mathematics education

Working institution	**N**	**X̄**	**sd**	**The Source of the Variance**	**KT**	**sd**	**KO**	**F**	**p**	**Significance**
Working in provinces	164	3,91	0,41	**Intergroup Decoupling**	1,097	2	,548			1←3
Working districts	173	3,84	0.41	**Intra-Group**	98,522	577	,171	3,212	,041	
Working in villages or towns	243	3,80	0.41	**Total**	99,619	579				
Total	580	3,84	0.41							

*Note. *p<.05*

Table 7 indicates that the mean scores of the participants from the MTEBS significantly differ based on their working locations [(F=3,212; p<0.05)]. It is clear that working locations have a significant effect on their self-efficacy belief in mathematics education. The Tukey HSD test was performed to see the source of difference. The results of the test showed that the self-efficacy scores of the classroom teachers working in the province (($\bar{x}$=3,91±0,41) is much higher than those of the classroom teachers working in villages or towns (($\bar{x}$=3,80±0,41).

Table 8 presents the results of the one-way ANOVA which analysed the potential significant effects of the grade level the participants taught on their self-efficacy belief in mathematics education.

Table 8. ANOVA results on the effects of grade level on the participants' self-efficacy belief in mathematics education

The grade level of the classroom teachers	**N**	**X̄**	**sd**	**The Source of the Variance**	**KT**	**sd**	**KO**	**F**	**p**	**Significance**
1. grade	154	3,82	0.42	**Intergroup Decoupling**	,658	3	,219			None
2. grade	137	3,85	0.39	**Intra-Group**	98,961	576	,172			
3. grade	139	3,89	0.40	**Total**	99,619	579		1,277	,281	

4. grade	150	3,81	0.42							
Total	580	3,84	0.41							

*Note. *p<.05*

Table 8 indicates that the mean scores of the participants from the MTEBS do not significantly differ based on the grade level they taught [(F=1,277; p>0.05)]. Therefore, grade levels they were teaching do not have any significant effect on their self-efficacy belief in mathematics education.

The following section presents the qualitative findings obtained through the administration of the survey questionnaire with open-ended items.

Table 9 presents the positive and negative views of the participants concerning the distance education process in mathematics teaching during the COVID 19 pandemic based on the working location.

Table 9: Positive and negative views of the participants concerning the distance education process in mathematics teaching during the COVID 19 pandemic based on the working location

Themes	**Views**	**f (Village)**	**f (District)**	**f (Province)**	**f (T)**
Negative views	Difficult and tiring process	15	9	9	33
	Unproductive	14	12	6	32
	Lower levels of participation	14	3	6	23
	Problems about internet access	15	2	4	21
	Lack of evaluation, correction and feedback	9	3	5	17
	Causing inequality of opportunity	7	4	6	17
	Not full replacement of face-to face teaching	8	5	4	17

	Lack of equipment	10	3	3	16
	Loss of full learning	2	4	5	11
	Lack of interaction	7	1	2	10
	Making the individual differences more apparent	3	1	2	6
	Being a undesired and obligatory process	4	-	2	6
	Not being suitable for primary school students	1	2	2	5
	Not being suitable for making exercises	2	1	1	4
	Being a boring process	1	-	2	3
	It had to be employed without any preparation	-	2	1	3
	Making students asocial	-	-	3	3
	Requiring a long preparation process	2	-	1	3
	Not creating a classroom atmosphere	1	-	1	2
	Longer class hours	2	-	-	2
	Making students passive	1	-	1	2
	Not being suitable for course outlines	1	1	-	2
	It disrupted the students' psychology	-	-	2	2
	Parents' inadequacy in using technology	2	-	-	2
	Problems related to online platforms	1	-	-	1
	Lack of classroom management	-	1	-	1
	Insufficient reinforcement process	-	1	-	1
	Insufficiency in all parts	-	1	-	1
	Limited interaction with parents	1	-	-	1
	Having negative effects on student development	-	-	1	1
	Difficulty in student motivation	-	-	1	1
	Irregular weekly course schedules	-	-	1	1
Total		123	56	71	250
Positive views	Productive if equal opportunity and participation are provided	8	4	4	16

	Being a good alternative	2	1	1	4
	Improving the use of technology in an efficient wat	2	-	2	4
	Continuation of the teaching-learning process	1	-	2	3
	Provision of rich content	2	-	1	3
	Being fun	1	-	1	2
	Having experience about the distance education process	-	1	1	2
	Preventing students from being away from school	-	1	1	2
	More opportunity to repeat the content	1	-	-	1
	Higher participation	-	-	1	1
	Giving students responsibility	-	-	1	1
Total		**17**	**7**	**15**	**39**

As can be seen in Table 9 the participants have both positive and negative views about the distance education process in regard to mathematics teaching during the COVID 19 pandemic. In terms of negative views about the distance education process the participants emphasized the following: being a difficult and tiring process, being inefficient, low participation, limited internet access, lack of evaluation and feedback, causing inequality of opportunity, not being a substitute for face-to-face education, lack of devices, causing learning loss, lack of warm contact and interaction. They also reported the following undesired points about the distance education process: It widens the level gap between students; it is an undesirable process; it is not suitable for students at the primary school age; it is not possible to make practices; it is boring; it was an unprepared experience; it makes students antisocial; it takes long time to prepare for the lesson; there is no genuine atmosphere in the classroom environment; the class hours are long; it makes students passive; it is not suitable for the functioning of the educational program; it

disrupts the psychology of the students; the parents are not capable of using technology; the platforms used are useless; the classroom management is incomplete; reinforcement is insufficient; there are problems in every dimension; it restricts the interaction with the parents; it negatively affects the individual development of the students; it is difficult to motivate students; and the weekly class schedule is irregular. Their most frequently reported positive view about the distance education process was that distance education can be productive when equal opportunity and participation are ensured. The other positive views of the participants are as follows: It is a good alternative; it increases the effective use of technology; it ensures the continuity of education; it is fun; it provides distance education experience; and it prevents students from moving away from school. They also reported that distance education provides an opportunity to make more practices about the content and that it improves the student attendance and makes students responsible.

When the views of the participants about distance education process during the COVID-19 pandemic period are considered in terms of the working location, it is seen that the teachers working in villages feel themselves more inadequate than the teachers working in the city center who reported that distance education is the most inefficient, difficult and tiring. The teachers working in villages or towns frequently stated that distance education was inefficient, difficult and tiring, and they argued that there were some problems such as internet access limitations, low participation, and the lack of interaction and devices.

The views of the classroom teachers about this topic are as follows:

One of the participants, FT16, reported that distance education was difficult and tiring: *"I think distance education is tiring for both the students and me. Not being able to see what students are doing during the lesson is a very difficult situation for the teacher."* Another participant, MT17, stated *"I definitely think distance education is more tiring. We had a hard time attracting students' attention and ensuring their participation in the lesson."* The unproductivity of the distance education was reported by MT1 as follow: *"It was not productive due to the lack warm interaction."* Another participant, FT37, also stated a similar view: *"I couldn't say that it was productive."* There were participants who reported that distance education led to inequal opportunity. One of them was FT19: *"Since not all students can participate in distance education, it created inequality of opportunity."* The view that distance education is not a full replacement of face-to-face education was reported by FT28: *"Unfortunately, despite the use of all technological opportunities, the distance education cannot create the outcomes of the face-to-face education."* There were also participants who claimed that distance education led to learning loss. One of them was FT10: *"It reduced the permanence of what they learned due to students' inadequacy in educational practices and interaction."*

The participants also produced positive views about distance education. Some of them argued that if equal opportunity and student attendance are ensured, it would be productive. The participant

MT15 was one of them: *"I think if students had an equal opportunity, it would be very productive."* Another participant, FT7, reported the following: *"If students attended the courses, it may be productive."* The participant MT10 stated *"It was the best alternative during the pandemic."* There are other participants who argued that distance education contributed their skills. For instance, MT48 stated *"The distance education process was more useful and convenient in terms of the use of technological tools and course materials."*

Table 10 presents the views of the participants about their self-efficacy in mathematics teaching during the distance education process used in the COVID-19 pandemic.

Table 10: Views of the participants about their self-efficacy in mathematics teaching during the distance education process used in the COVID-19 pandemic

Contributions	**Teacher views**	**f (F)**	**f (M)**	**f (T)**
Personal development	My ability to use technology improved.	26	17	43
	My belief about the fact that teaching can be given under any condition.	7	10	17
	It made me to attend in-service training activities.	1	4	5
	I became accustomed to teaching lessons under parent supervision.	2	1	3
	It made me to find quick solutions.	1	2	3
	I had experience in crisis management.	1	2	3
	I improved my creativity.	3	-	3
	It taught me how to use time efficiently	1	-	1
	It improved my interactions with parents	1	-	1
	I became accustomed to the use of Web 2.0.	9	8	17
	I had experience in distance education.	7	8	15
	It made me to evaluate my capacity in teaching.	4	4	8

Contributions to professional experience	Using different teaching methods and techniques	2	4	6
	I could develop novice materials and content.	2	3	5
	It showed me that lessons taught with technological tools are more effective	4	-	4
	It allowed me to follow technological developments closely.	1	1	2
	It provided easy access to students through different channels	2	-	2
	I began to use educational websites	2	-	2
	I began to make more research	2	-	2
	My cooperation with other teachers improved	1	-	1
	It showed me the value of teaching profession	1	-	1
	It showed me that there must be more training on distance education	-	1	1
	It gave me an opportunity to assess student achievement using technology.	-	1	1
No contribution	I did not contribute to anything.	7	10	17
	It showed us the value of face-to-face education.	3	3	6
	It made me dull in teaching.	1	4	5
Total		**91**	**83**	**174**

As can be seen in Table 10 the participants produced views about the contributions of the distance education process during the COVID 19 pandemic on their self-efficacy in terms of professional and personal development. There are also participants who did not state any contribution of the distance education.

For the participants who emphasized the contributions of the distance education on their personal development stated the following: It increases their proficiency in using technology, increases the belief that education can be provided under all conditions, directs them to receive in-service training to improve

themselves, helps them get used to studying under the supervision of parents, enables them to discover quick solutions, provides experience in crisis management, increases creativity, teaches them to use time effectively and improves communication with parents. The professional contributions of the distance education were stated as follows: being familiar with the web 2.0 tools and having experience about distance education process. They also added that it enables self-assessment regarding professional competence, enables the use of different methods and techniques, enables the production of new materials and contents, through it courses taught with technological tools are more effective, enables the student to follow technological developments closely, provides easy access to the student through different channels, and uses the resources of various educational sites, it directs students to do more research, increases cooperation between teachers, teaches the value of the teaching profession, shows that training on distance education should be increased, and provides and opportunity to better evaluate students with technology. In addition, some of the classroom teachers stated that distance education did not contribute to them. They stated that it had no contribution at any dimension, that the value of face-to-face education was understood, and that it dulled them professionally.

When the contributions of the distance education process during the COVID-19 pandemic period are considered in terms of the gender of the classroom teachers, it is seen that male and female teachers express similar thoughts.

The views of the participants about these topics are given as follows:

In terms of professional contributions of the distance education some participants emphasized its positive effects on using technology and following the advances in technology. For instance, MT3 states *"We had an opportunity to pay more attention to and examine the computer-aided materials used in the distance education during the pandemic period."* and FT12 argues *"Distance education enabled me to follow technological innovations more closely."* One of the participants, MT33, emphasized the development of new content and states *"We were able to develop digital materials during the distance education period."* Another participant, MT30, argues that distance education made him to use technology in an efficient manner: *"We learned to use the Internet and web tools more effectively during the distance education period."*

In terms of personal contributions of the distance education the participant MT21 argues *"I think that teachers can be solution-oriented despite all the negative conditions and are always open to development in this direction."* The participant MT27 states *"Through distance education we improved our skills in crisis management."* The participant MT31 reported that distance education provided an opportunity to make a professional self-evaluation and adds *"It contributed to us generating ideas about how we can provide distance education and under difficult conditions how we can be productive."* Similarly, FT17 states *"We started to produce instant solutions in distance education, do more research and think more about how we can use effective processes in the distance education process that are used in face-to-face education."* The participant FT14 argues *"Teachers began to participate more in*

in-service training on distance education in order to improve themselves both personally and professionally." The views of the participant MT19 are as follows: *"We used our professional knowledge and practiced it in a different environment."*

There were some participants who argued that distance education did not make any contribution at all. For instance, MT29 reports *"I do not think distance education has any contribution."* And MT23 argues *"I think that distance education during the pandemic period has professional disadvantages rather than its contributions."*

Discussion, Conclusion and Suggestions

In this section, the findings obtained through the quantitative and qualitative parts are discussed. In addition, the conclusions are discussed in relation to the previous findings. These results are presented and interpreted in accordance with the research questions. In the last section some suggestions are developed for teachers and researchers.

The analysis of the quantitative findings indicated that the classroom teachers' self-efficacy beliefs regarding mathematics teaching were high. This finding is consistent with those of previous studies (Arcan & Şahin, 2020; Çelik, 2017; Dinç et. al., 2019; Julaihi et. al., 2020; Mulu et. al., 2021; Peker & Erol, 2017; Pul, 2019; Segarra & Julià, 2022; Segarra et. al., 2021; Şahin et. al., 2014; Takır, 2018; Takır & Özder, 2022; Takunyacı, 2021; Takunyacı & Yerlikaya, 2020; Ünal & Çil, 2021; Zehir et. al., 2019). It is important for classroom teachers to have higher self-efficacy belief levels in regard to mathematics teaching to provide effective

mathematics teaching. The scores received by the classroom teachers from the scale did not show a significant difference in terms of gender variable. Therefore, the mathematics self-efficacy beliefs of male and female teachers were at similar levels. Denizoğlu (2008) explains the reasons why self-efficacy belief level does not show a significant difference in terms of gender variable and attributed it to the fact that gender-based inequality in family, school and professional life is less common than before. It is also added that women have taken a more active role in social life, especially in recent years, and that the gap in the professional lives of men and women disappears day by day.

The scores of the classroom teachers from the MTEBS are not significantly different in terms of their educational background. The studies by Julaihi et. al. (2020) and Küçük et. al. (2010) also did not find any significantly difference in the self-efficacy beliefs of the teachers in terms of their educational background.

The scores of the classroom teachers from the MTEBS do not significantly differ in terms of their professional experience. This can be interpreted arguing that the professional experience does not affect the classroom teachers' self-efficacy beliefs concerning the mathematics teaching. There are studies of which findings are consistent with our findings (Arcan & Şahin, 2020; Dinç et. al., 2019; Julaihi et. al., 2020; Mulu et. al., 2021; Peker & Erol, 2017; Pul, 2019; Şahin et. al., 2014; Takunyacı, 2021; Yerlikaya, 2020), but there are also other studies which reported inconsistent findings (Gürbüz et. al., 2013; Küçük et. al., 2010; Stuart, 2017; Zehir et. al., 2019). Stuart (2017) argues that teachers' self-efficacy beliefs

concerning the mathematics teaching increase in parallel to the increase in their professional experience. However, Küçük et. al. (2010) concluded that primary school teachers' self-efficacy belief levels in the field of mathematics teaching started to decrease after the fifteenth year of teaching.

The scores of the classroom teachers from the MTEBS significantly differ in terms of working location. In order to see the source of difference the Tukey HSD test was performed. The test results showed that those teachers working in the city center have higher levels of self-efficacy beliefs in contrast to those working in villages or towns. However, the levels of self-efficacy beliefs of the teachers working in districts are not different from those of the other groups of classroom teachers. These findings are consistent with the previous findings (Küçük et. al., 2010; Pul, 2019). Pul (2019) reported that the levels of self-efficacy beliefs of teachers in regard to mathematics teaching are significantly different based on the working location and that those teachers working in Giresun have levels of self-efficacy beliefs in regard to mathematics teaching in contrast to those of teachers working in Kilis.

The scores of the classroom teachers from the MTEBS do not significantly differ in terms of the grade level they taught. This finding is consistent with that of Pul (2019) who conducted a study to determine the self-efficacy beliefs of in-service classroom teachers and pre-service classroom teacher regarding mathematics teaching. However, it is inconsistent with the findings of Dinç Artut and Ulum (2019) who analysed the self-efficacy beliefs of the classroom teachers about mathematics teaching.

In the study, the views of the classroom teachers regarding distance education mathematics teaching during the COVID-19 pandemic period were evaluated. The findings regarding the qualitative dimension of the study indicate that the classroom teachers generally stated that distance education during the COVID-19 pandemic period had some inadequacies (being difficult and tiring, inefficient, low student attendance, internet limitation, lack of feedback and evaluation, inequality of opportunity, not being able to replace face-to-face teaching, lack of devices, loss of learning, lack of interaction, etc.). This findings is consistent with the findings of the previous studies on distance education during the pandemic period (Abuhammad, 2020; Batmaz et. al., 2021; Fakhrunisa & Prabawanto, 2020; Kızıltaş & Çetinkaya Özdemir, 2021; Kurt et. al., 2021; Kurtdede Fidan & Uğuz, 2022; Parczewska, 2020; Sarışık et. al., 2021; Saygı, 2021; Şenel Çoruhlu & Uzun, 2021; Yazıcı, 2022).

When the inadequacies caused by distance education during the COVID-19 pandemic period are evaluated in terms of the variable of working location, it is seen that teachers working in villages are more affected from disadvantages and feel themselves more inadequate about the distance education due to internet access problems, low student attendance, lack of interaction and lack of devices in contrast to teachers working in the city centers. The reasons for this situation can be given as the greater lack of infrastructure in villages and towns and the fact that students living in villages have limited economic access to technology.

The participants also expressed the contributions of distance education during the COVID-19 pandemic period (i.e., being

efficient when students attend the courses, being a good alternative, using technology effectively, ensuring continuity of education, providing rich content, giving students responsibility). The benefits of the distance education reported in the previous studies on this topic are as follows: it ensures the continuity of education (Kurt et al., 2021; Yazıcı, 2022), contributes to the protection of health, provides rich content (Yazıcı, 2022), it is fun (Demir & Özdaş, 2020), it allows for repetition, it provides an opportunity to use technology (Kızıltaş & Çetinkaya Özdemir, 2021; Yazıcı, 2022), it provides responsibility (Aldon et al., 2021), and improves the individuals in terms of using technology (Ergüç Şahan & Parlar, 2021). When the contributions of the distance education during the COVID-19 pandemic period were evaluated in terms of the variable of working location, it is seen that teachers working in villages and city centers had a similar views. This situation suggests that the teachers working in the village believe that their students can benefit from distance education if they have sufficient opportunities.

In the study it is found that classroom teachers are of the opinion that the COVID-19 distance education process contributes to their personal and professional self-efficacy. The main contributions include increasing the proficiency in using technology and increasing the belief that education can be provided under all conditions. In addition, it has been determined that distance education process contributes to various issues such as directing people to receive in-service training to improve themselves, getting used to teaching under the supervision of parents, enabling them to discover quick solutions, becoming experienced in crisis management, increasing creativity, using time effectively, and

increasing communication with parents. Its contributions to professional self-efficacy were determined as knowing web 2.0 tools and gaining online distance education experience. In their study, Canpolat and Yıldırım (2021) found that teachers achieved professional satisfaction as they provided their students with the necessary skills during the distance education process. Aydoğdu İskenderoğlu and Konyalıhatipoğlu (2021) concluded that teachers discovered new educational tools and different approaches in distance education and that they felt the need to update themselves in order to be more professionally effective. There are teachers who state that distance education has no contribution whatsoever. They emphasized the importance of face-to-face education and stated that the distance education process dulled them in terms of professional self-efficacy. In the study by Tokay and Çelebi (2021) it is concluded that only 25% of teachers felt satisfied during the distance education process, 50% did not feel professional satisfaction, and 25% questioned their profession.

It is found that classroom teachers' self-efficacy beliefs in mathematics teaching are high and that the distance education process contributes to their professional and personal development, although they had difficulty in achieving self-efficacy in distance education during the COVID-19 pandemic period. In the study it is found that the classroom teachers' self-efficacy beliefs in mathematics teaching did not differ in terms of their gender, educational background, professional experience and grade level they taught. Therefore, these variables did not affect their views on distance education mathematics teaching during the COVID-19

pandemic period. However, their self-efficacy beliefs significantly differ in terms of the variable of working location.

Based on the findings of the study some suggestions were developed for classroom teachers and future studies on the topic:

- The reasons for the problems that arise in distance education mathematics teaching need to be investigated by taking into account the location variable.
- In order for distance education mathematics teaching to contribute to their personal and professional self-efficacy, classroom teachers must participate in in-service training on the integration of technology into education.
- It is necessary to expand the findings regarding the effect of distance education on the mathematics teaching process during the COVID-19 pandemic period through observation method.

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CHAPTER II

Meta-analysis in Educational Sciences (1980-2022): A bibliometric study

Sedat KANADLI[1]

Introduction

Education is an activity that lasts from birth to death. Through this activity, people become a member of the society they live in and acquire knowledge and skills in various fields. For this activity to be successful, it must be carried out by experts (teachers) in various fields within a certain plan and program. This necessitates the institutionalization of education and the transformation of education into a science. Therefore, the educational sciences have an institutional and managerial reality like the university (Charlot, 2010). Educational sciences consist of sciences that research the theory, method, practice, and outcomes of education. In this respect,

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educational sciences are an interdisciplinary field that has a close relationship with disciplines such as psychology, sociology, philosophy, language, and anthropology (Lodico et al, 2010).

Educational sciences conduct various research on pedagogy, curriculum, teaching methods, teacher education, and educational administration. This research focuses more on the effectiveness of the learning-teaching process. Creswell (2008) considers educational research important in terms of adding new knowledge to existing knowledge about education, improving educational practices, and informing decision-makers in the field of education. Thus, more effective solutions can be found to the problems that arise in education with the information produced from the context of educational research. There are four types of knowledge that educational research contributes to education (Gall, et al., 2003): (i) Describing; This type of knowledge aims to determine the structure of the educational phenomenon, its effectiveness, its change over time, and its relations with other phenomena. (ii) Predicting; It is the type of knowledge obtained as a result of determining the factors that may affect the educational phenomenon. (iii) Developing; It aims to improve educational practices by making various interventions in the educational phenomenon. (iv) Explaining; This type of knowledge aims to develop theories about the educational phenomenon by including the other three types of knowledge. Thus, it is possible to identify the problems that will arise about the education phenomenon in advance.

In educational research, various research methods are used to describe, predict, develop, and explain the educational phenomenon.

In general, educational research is conducted with quantitative, qualitative, and mixed methods (Fraenkel & Wallen, 2006; Creswell, 2008). One of the most frequently used methods in educational research is quantitative research methods. Quantitative research attempts to explain phenomena by collecting numerical data analyzed using mathematically based methods (Aliaga & Gunderson, 2002). Quantitative educational research uses descriptive, relational, and experimental designs (Creswell, 2008). Descriptive research aims to define the educational phenomenon, correlational research aims to determine the relationship between the educational phenomenon and other educational phenomena, while experimental research aims to improve educational practices by making various interventions in the educational phenomenon (Gall, et al., 2003). For example, descriptive research is conducted to determine the reasons for student failure, relational research is conducted to determine the relationship between student failure and motivation, and experimental studies can be conducted by developing various teaching practices to increase student success.

In quantitative educational research, as in research in other fields (such as psychology, health, etc.), there are primary studies on any educational phenomenon, especially in relational and experimental studies, which obtain conflicting findings. For example, when student academic achievement is considered an educational phenomenon, in some experimental studies in the literature, studies finding that cooperative learning is effective on academic achievement (e.g. Tok, 2008; Ho & Boo, 2007; Shachar, 2004) as well as studies finding that it does not affect academic achievement (e.g. Stevens, 2003; Tan et al., 2007; Arslan, 2012) are

also found. In this case, "Is cooperative teaching method effective on students' academic achievement? Why are cooperative teaching practices effective in some populations but not in others?" questions come to the agenda. To answer such questions, which are important for researchers, practitioners, and policymakers, especially when making decisions about any educational phenomenon, meta-analytic studies are also carried out in educational research. Thus, thanks to meta-analysis, contradictory results in the literature on the phenomenon of education are resolved, and conceptual and methodological suggestions can be made for future studies (Kanadlı & Akay, 2019). In addition, decisions can be made about the appropriateness of the intervention and the validity of the tested hypotheses (Why perform a meta-analysis, 2023).

Meta-analysis is a statistical method used to combine the results of quantitative studies conducted on similar topics. The term meta-analysis was first introduced by Gene Glass (1976) and used in the sense of statistical analysis of the results obtained from individual studies to combine findings. The first studies using meta-analysis were conducted in the field of psychology (e.g. Smith & Glass, 1977; Rosenthal & Rubin, 1978). The first study in the field of educational sciences was conducted by Glass and Smith (1979) to determine the relationship between class size and academic achievement. Later on, the meta-analysis method continued to be developed with the contributions of Jackson (1980), Cooper (1982), Glass et al. (1981), and Rosenthal (1984), but the actual milestone was the book "Statistical Methods for Meta-Analysis" published by Hedges & Olkin (1985). This book has expanded by summarizing nearly a decade of developments in meta-analysis and legitimized

the procedures performed by presenting substantial statistical evidence (Cooper, 2010, p.10). Although performing a meta-analysis study required good mathematical-statistical knowledge at that time, today it has become easy to do with the development of computer software such as Comprehensive Meta-Analysis [CMA] (Borenstein et al., 2005) or R (R Core Team, 2021). Seven steps are required to conduct a research synthesis using meta-analysis (Cooper, 2010): (i) formulating the research problem, (ii) reviewing the literature, (iii) collecting information from primary studies, (iv) assessing the quality of primary studies, (v) analyzing and combining study findings, (vi) interpreting the evidence, and (vii) reporting the results.

Although meta-analysis is a powerful statistical method widely used in many fields today, it also has some limitations. According to Sharpe (1997), these limitations that may threaten the validity of meta-analysis studies are the inclusion of dissimilar studies, the inclusion of studies that are not representative of the entire population, and the inclusion of studies of low quality. The first of these limitations is the apples and oranges problem (Smith et al., 1980), which is defined as combining methodologically dissimilar primary studies in meta-analysis. According to Borenstein et al. (2009), meta-analysis inherently brings together studies with different characteristics, but if these differences are identified and defined, this will make meta-analysis studies stronger. The second limitation is the file drawer problem (Rosenthal, 1976), which is known as the fact that the studies included in the meta-analysis do not represent the population because not all studies related to the subject under investigation are published. Researchers may give up

publishing these studies, especially when they fail to reach significant or expected results (Card, 2012, p.26). This situation shows that studies with positive effects are more likely to be published than studies with negative effects (Borenstein et al., 2009). This limitation, known as publication bias, can be identified and corrected with various techniques in meta-analysis studies (Borenstein et al., 2009; Card, 2012). The third limitation is the "garbage in, garbage out" problem (Eysenck, 1978), which is thought to negatively affect the validity of the results obtained from the meta-analysis by including low-quality primary studies in the meta-analysis. This problem can be reduced by evaluating the quality of the studies to be included in the meta-analysis (Harrer et al., 2022). In addition, by identifying study characteristics, it can be investigated whether these differences are related to effect size (Borenstein et al., 2009).

Despite these limitations of meta-analysis, it is widely used in the field of education as in other fields. Examining the historical development of these studies and determining the trends emerging in these studies can contribute to meta-analysis studies in the field of education. For this reason, this study aims to examine the meta-analysis studies conducted in the field of education with the bibliometric method. Bibliometric, similar to meta-analytic studies, requires previously published studies on that subject or field to determine the trends observed in a particular subject area (Guilera et al., 2012). Thus, it will be possible to understand the historical development processes of meta-analysis studies in the field of education since their emergence and to map the relationships between the components of the publications (e.g. authors, subjects,

institutes, and countries). Accordingly, this study aims to examine the evolutionary development of meta-analysis studies in the field of education and to determine the impact of these studies on scientific knowledge in the field of education. For this purpose, performance analysis (e.g. total number of publications, number of contributing authors, total number of citations, etc.) was used to determine the contribution of research components to the field of education and science mapping (e.g. co-citation analysis, co-word analysis, co-authorship analysis) techniques were used to examine the relationships between research components.

Methods

Data Collection

We obtained the meta-analysis studies included in this study from the Web of Science (WOS). To access the existing studies conducted in the field of education, I searched in WOS in the category of Education Educational Research until 2023 in the subject field (Topic). During the search, I used the words meta-analysis* or meta-analysis*. I determined the document type as Articles, Review Articles, and Proceeding Papers published only in English. In this case, I reached 5244 studies. In WOS, the keywords entered in the "Topic" field are searched in the title, abstract, author keywords, and keyword plus. Keyword plus is created by using a computer algorithm from the words or phrases that are most frequently repeated in the titles of the studies in the reference section of a study (Garfield, 1990). However, keyword plus is less comprehensive than author keyword in determining the content of the study (Zhang et al., 2015). Similarly, keyword plus is not suitable for determining whether a study is a meta-analysis. For this reason, I limited the

search to only “Title”, and “Abstract and Author Keyword” fields. For this, I searched by entering the algorithm ((TI=(meta-analysis* or meta-analysis*)) OR AB=(meta-analysis* or meta-analysis*)) OR AK=(meta-analysis* or meta-analysis*) in the advanced search. In this case, I accessed 2130 studies. After uploading these studies as zip files to Biblioshiny software and applying the date (2023 not included) and language filter (only English publications), 1979 studies were included. The graph of the process of including the accessed studies in the bibliometric analysis is given below.

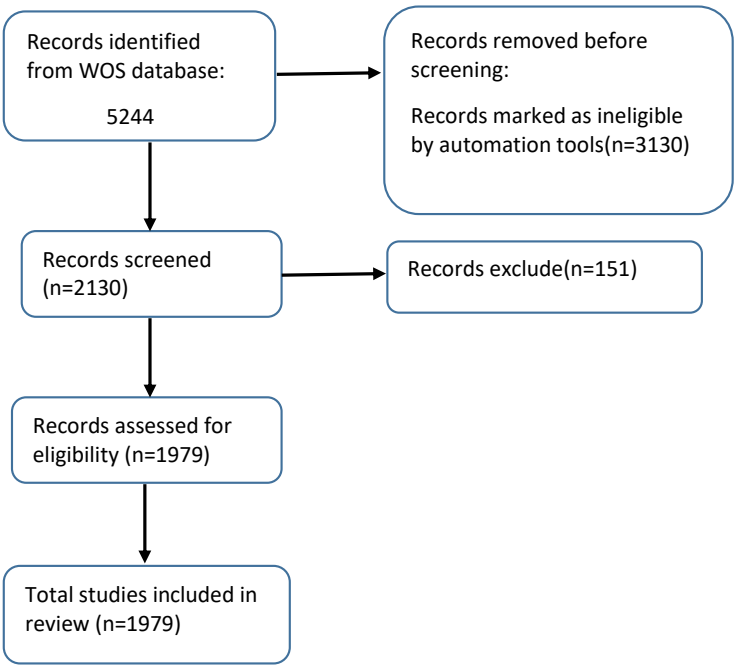

Figure 1: The PRISMA 2020 Flow Diagram (Page et al., 2021)

Data Analysis

I conducted a performance analysis to determine the contribution of the components of meta-analysis studies (authors, topics, citations, institutes, countries, etc.) to the field, and science mapping to determine the relationships between these components. In performance analysis, I tabulated basic information (number of documents, sources, author keys, etc.), most prolific authors, key sources, most influential studies and authors, most prolific countries, and most frequently used words. In addition, I applied Lotka Law for author productivity and Bradford Law for journal productivity. Lotka Law estimates how many authors will publish a certain number of publications according to the inverse square law using the number of authors contributing with a single study (Andres, 2009, p.23).). According to this law, as the number of studies published in a particular field increases, the number of authors who publish more than one publication decreases. Bradford's law states that there is an inverse relationship between the number of articles published and the number of journals that publish these articles (Andres, 2009, p.31). This law can be used to identify the most important journals in a particular field.

Science mapping is used to visualize the structural and dynamic aspects of scientific research (Börner et al., 2003). Science mapping examines scientific knowledge in terms of conceptual (main themes and trends), intellectual (the impact of an author's work on a particular field) and social (the interaction of authors, institutes and countries) structure (Aria & Cuccurullo, 2017). In this study, I conducted co-word analysis for conceptual structure, co-authorship analysis for social structure, and co-citation analysis for

intellectual structure. The methodological basis of co-word analysis is the idea that the co-occurrence of author keywords defines the content of publications (Callon et al., 1991). Thus, themes and trends in that field can be identified. Co-authorship analysis is the study of interactions between two or more scholars in a social context (Fonseca et al., 2016). Co-citation analysis is the study of the relationships between co-cited publications in any field. (Donthu et al., 2021). These analyses were conducted using the Bibliometrix package (Aria & Cuccurullo, 2017) and VOSviewer (van Eck & Waltman, 2010).

Results

1. Performance Analysis

For the 1979 studies included in the bibliometric analysis, basic statistics were examined within the scope of performance analysis, and the most influential authors, sources and documents were identified.

1.2. Basic Statistics

1979 studies published between 1980 and 2022 in the field of education in the Web of Science database were included in the bibliometric analysis. The basic statistics of these studies are given in Table 1.

Table 1: Main statistic about the included studies

Description	Result
Timespan	1980:2022
Sources (Journals, Books, etc)	455
Average citations per document	58.39
References	106011
Author's keywords	3756
Keywords Plus	3445
Authors	4593
Author Appearance	5806
Authors of single-authored documents	319
Single-authored documents	397
Multi-authored documents	1582
Authors of multi-authored documents	4274
Co-Authors per documents	2.93
Collaboration Index (CI)	2.7
Article	1417
Review	552
Proceeding paper	10

As seen in Table 1, between 1980 and 2022, 1979 documents were obtained from 455 sources (journals, books, proceedings). Of these documents, 71.6% (n=1417) were published as articles, 27.9% (n=552) as reviews and 0.5% (n=10) as proceedings. The average number of citations per publication was 58.39. 4593 authors contributed to the meta-analysis studies. While the number of authors of single-author documents is 319, the number of authors of multi-author documents is 5806. While the number of single-authored documents is 397, the number of multi-authored documents is 1582. The number of co-authors per document is 2.93. The commonality index determines the level of commonality in multi-

authored documents in the data and is calculated by dividing the total number of authors of multi-authored documents (4274) by the number of multi-authored documents (1582). Accordingly, the commonality index of the publications was calculated as 2.7. Therefore, it can be said that approximately three authors came together in meta-analysis studies and conducted a meta- analysis study in educational sciences. 106011 references were used in all documents. In these documents, there are 3756 author keywords and 3445 keyword plus.

The distribution of studies conducted by meta-analysis method according to years is given in Figure 1.

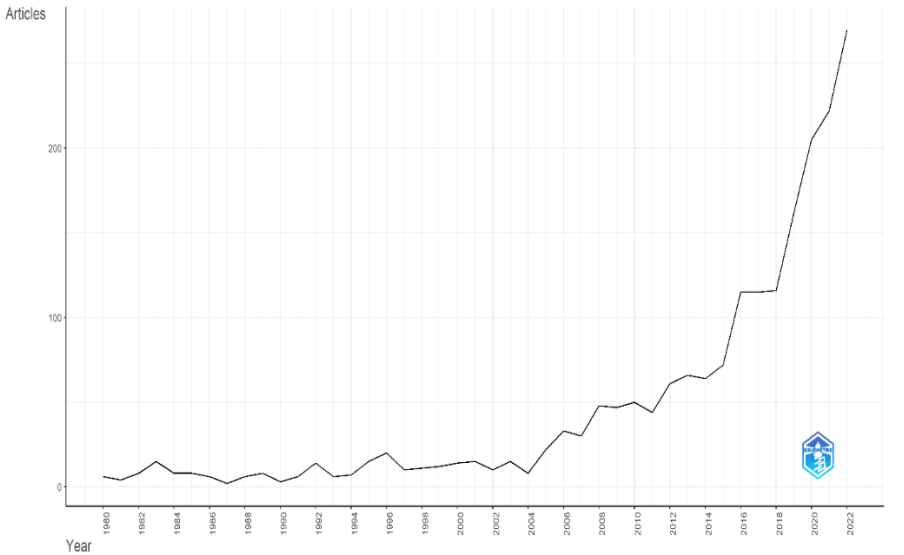

Figure 2: Annual scientific production

As seen in Figure 2, while the number of studies conducted with the meta-analysis method in the field of education was

approximately close to each other between 1980 and 2004, it is seen that meta- analysis studies increased rapidly after 2004.

1.3. Sources

The 10 most influential journals in the field of education in which studies conducted with meta-analysis method are published and the number of citations and h-indexes of these journals are given in Table 2.

Table 2: Top ten most important sources in terms of the number of documents, citations, and h-index

Journal	TP	%	TC	H-Index
Review of Educational Research	202	10.21	37684	101
Educational Research Review	113	5.71	7567	52
Computers & Education	38	1.92	4364	30
BMC Medical Education	38	1.92	1396	21
Journal of Educational and Behavioral Statistics	32	1.62	3679	19
Journal of Computer-Assisted Learning	28	1.41	1044	12
Language Learning	28	1.41	4482	21
Education Sciences	27	1.36	97	6
Journal of Educational Computing Research	25	1.26	848	14
Journal of Experimental Education	24	1.21	453	12

*TP; Total Publication, TC: Total Citation

According to Table 2, the most productive journal is "Review of Educational Research" with 202 (10.21%) publications, followed by "Educational Research Review" with 113 (5.71%) publications, and "Computers & Education" with 38 (1.92%) publications. Similarly, when the total number of citations and h-indexes are analyzed, it can be said that these three journals are the most productive. Bradford's law was applied to identify the core journals

publishing meta-analyzed studies in the field of educational sciences. The results of this application are given in Figure 3.

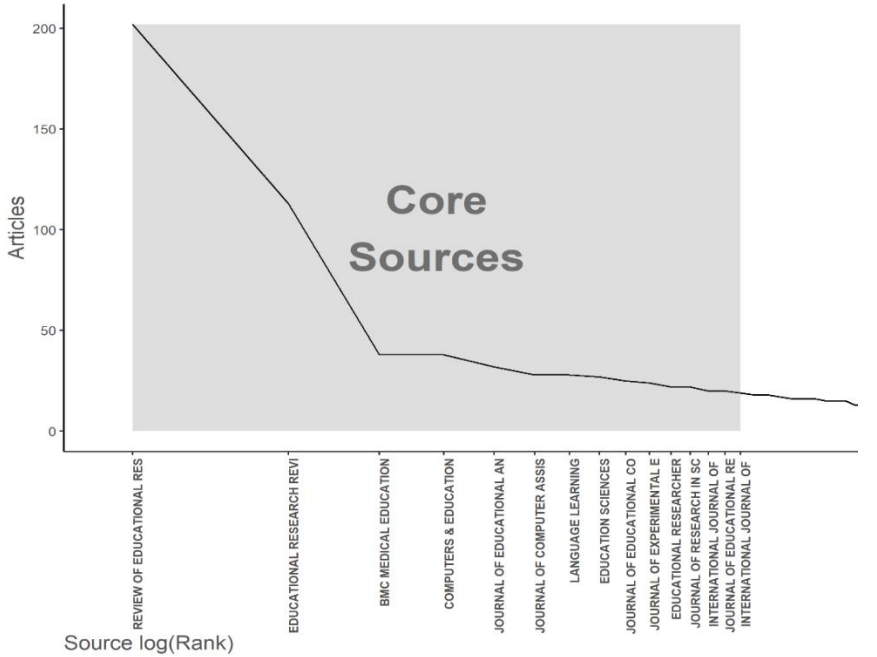

Figure 3: Bradford Law

When Figure 3 is examined, it is seen that 15 journals are core journals that publish meta-analysed studies in educational sciences. These journals published approximately 33.2% (n=658) of the total studies published between 1980 and 2022. The first three of these 15 journals are "Review of Educational Research", "Educational Research Review" and "BMC Medical Education".

1.4. Authors

The authors who published in the field of education using the meta-analysis method and the number of citations and h-indexes of these authors are given in Table 3.

Table 3: Top ten most important authors in terms of number of documents, citations, and H-index

Author	TP	%	TC	H-Index
ABRAMI, P.C.	19	0.96	3688	16
BERNARD, R.M.	16	0.81	3025	13
BOROKHOVSKI, E.	15	0.76	1170	12
JEYNES, W.H	15	0.76	2077	11
GRAHAM, S.	14	0.71	1170	13
PLONSKY, L.	13	0.66	1575	13
HATTIE, J.	11	0.56	2092	9
HIGGINS S	11	0.56	69	4
BATDI V	10	0.51	86	6
GLASS, G.V.	9	0.46	811	9

*TP; Total Publication, TC: Total Citation

According to Table 3, the most prolific author is "Abrami, P.C." with 19 publications and 3688 citations, followed by "Bernard, R.M." with 16 publications and 3025 citations, and "Borokhovski, E." with 15 publications and 1170 citations.. When the h-indexes of these authors are analyzed, 19 studies of "Abrami, P.C." received at least 16 citations, 16 studies of "Bernard, R.M." received 13 citations, and 15 studies of "Graham, S." received at least 12 citations. Accordingly, it can be said that "Abrami, P.C." and "Borokhovski, E." are the two most influential authors who publish using the meta-analysis method in the field of educational sciences. Lotka's law was applied to the data to determine how many authors

would publish in a certain number. The distribution is given in Table 4 and Figure 4.

Table 4: The frequency of the documents

Document	*N*	*%*
1	*3957*	*86.2*
2	*395*	*8.6*
3	*125*	*2.7*
4	*51*	*1.1*
5	*23*	*0.5*
6	*12*	*0.3*
7	*9*	*0.2*
8	*8*	*0.2*
9	*5*	*0.1*
10	*1*	*0.0*
11	*2*	*0.0*
13	*1*	*0.0*
14	*1*	*0.0*

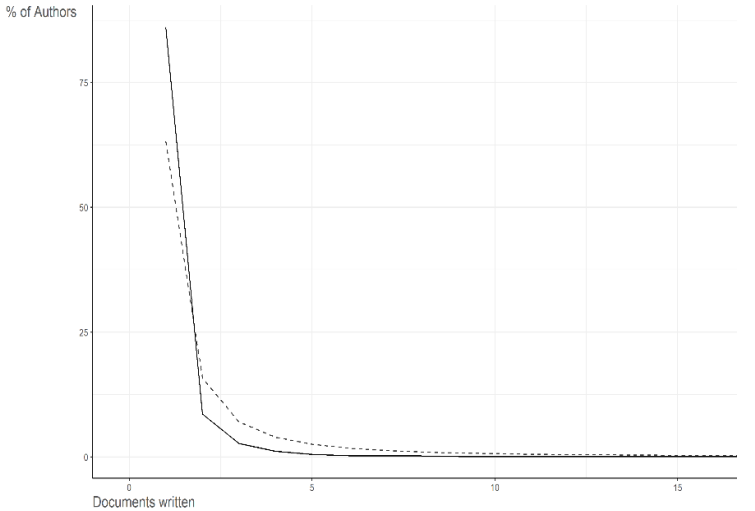

Figure 4: The frequency distribution of scientific productivity

Table 4 shows that 86.2% (n=3957) of the authors who conducted meta-analysis studies contributed only once, 8.6% (n=395) contributed twice and 2.7% (n=125) contributed three times. According to Lotka's law, the ratio of authors contributing with a single publication to all contributing authors is approximately 60%, two-time contributors are one-fourth of one-time contributors, and three-time contributors are approximately one-ninth of one-time contributors (Lotka, 1926). In Figure 3, the dashed line is the theoretical distribution while the continuous line is the observed distribution. The Kolmogorov-Smirnov test to determine whether the observed distribution conforms to the theoretical distribution was not significant (p>0.5). This result indicates that author productivity is distributed according to Lotka's law.

1.5. Documents

The 10 most cited articles in the field of education are given in the table below.

Table 5: Top ten most cited articles

Paper	TC	TC per Year
SIRIN SR, 2005, REV EDUC RES	2214	116.53
BUS AG, 1995, REV EDUC RES	1134	39.10
BENJAMINI Y, 2000, J EDUC BEHAV STAT	1131	47.13
ROORDA DL, 2011, REV EDUC RES	997	76.69
ROBINSON VMJ, 2008, EDUC ADMIN QUART	975	60.94
NORRIS JM, 2000, LANG LEARN	921	38.38
SPRINGER L, 1999, REV EDUC RES	918	36.72
DOCHY F, 2003, LEARN INSTR	804	38.29
PLONSKY L, 2014 LANG LEARN	758	75.80
VALENTINE JC, 2004, EDUC PSYCHOL-US	740	52.86

As seen in Table 5, three studies stand out when the total number of citations is taken into consideration. Accordingly, the most cited study in the field of education is the article titled "Socioeconomic Status and Academic Achievement: A Meta-Analytic Review Research" published by Sirin (2005) in Review of Educational Research. This article received a total of 2214 citations with an annual citation average of 116.53. The second study is "Joint Book Reading Makes for Success in Learning to Read: A Meta-Analysis on Intergenerational Transmission of Literacy" by Bus et al. (1995) published in Review of Educational Research. This article received a total of 1134 citations with an annual citation average of 39.10. The third study is the methodological study "On the Adaptive

Control of the False Discovery Rate in Multiple Testing with Independent Statistics" by Benjamini and Hochberg (2000) published in the Journal of Educational and Behavioral Statistics. This study received a total of 1131 citations with an annual citation average of 47.13.

2. Science Mapping

Co-citation analysis, co-word analysis, and co-authorship analysis were performed for 1979 studies included in the bibliometric analysis within the scope of science mapping.

Co-Citation Analysis

Within the scope of this analysis, it was aimed to identify themes from the studies cited together in meta-analysis studies conducted in the field of education. For this purpose, the minimum number of citations of cited references was determined as 50. In this case, 38 out of 113033 cited references meet the threshold.

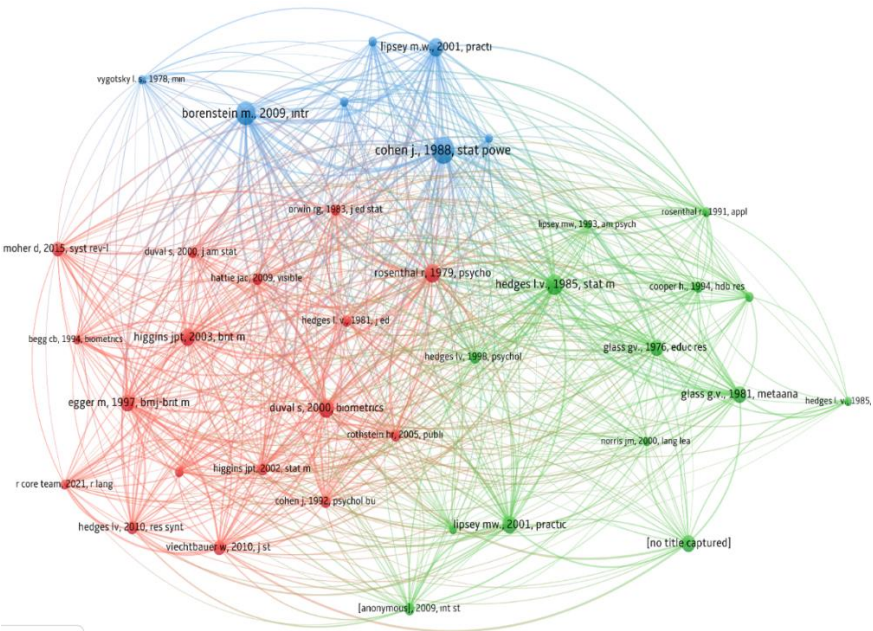

Figure 5: Co-citation analysis of papers

As shown in Figure 5, the article co-citation network consists of three clusters (red, blue, and green). The red cluster (cluster 1) consists of 17 studies and represents "statistical methods", the green cluster (cluster 2) consists of 14 studies and represents "introduction of meta-analysis method" and the blue cluster (cluster 3) consists of 7 studies and represents "application and reporting of meta-analysis". In this network, each node represents a publication. The size of the node indicates the number of co-citations of the publications, and the density of the links connecting the nodes indicates the number of times a publication is co-cited with another publication. The measures of central tendency for the publications in the network are given in Table 6.

Table 6: Measures of central tendency for the top three articles in the co-citation network

Node	Cluster	Betweenness	Closeness	PageRank
cohen j. 1988	1	112.116	0.016	0.059
borenstein m.2009	1	105.914	0.016	0.057
lipsey m.w. 2001	1	32.011	0.015	0.042
hedges l.v.1985	2	51.964	0.016	0.038
no title	2	0.869	0.012	0.009
glass g.v. 1981	2	7.455	0.015	0.026
duval s 2000-1	3	41.764	0.014	0.035
egger m 1997	3	15.239	0.014	0.036
higgins ipt 2003	3	23.025	0.014	0.035

Table 6 reports the most important and influential publications in each cluster. In this table, betweenness measures the ability of a node to move information between independent nodes, closeness measures the speed with which a node disseminates information to other nodes, and pagerank measures the prestige of publications that influence the most important publications in the research area. (Donthu et al., 2021). Accordingly, publications with a higher betweenness measure and a lower closeness measure are considered publications with a high speed of carrying and disseminating information in the field. A publication with a high Pagerank is a prestigious publication and is considered "high quality".

According to Table 6, in the first cluster (blue), the ability to carry knowledge and the most prestigious publication is the book titled "Statistical Power Analysis for the Behavioral Sciences" published by Cohen (1988). Other prominent publications in this

cluster are "Introduction to Meta-analysis" by Borenstein et al (2009) and "Practical Meta-analysis" by Lipsey and Wilson (2001). The second cluster (red) is the book "Statistical Method for Meta-Analysis" by Hedges and Olkin (1985), which has the highest prestige and ability to convey information. The other prominent publication in this cluster is "Meta-Analysis in Social Research" by Glass et al (1981). In the third cluster (green), in the theme of "introducing the meta-analysis method", the publication with both the ability to convey information and the speed of conveying information is "Trim and fill: A simple funnel-plot-based method of testing and adjusting for publication bias in meta-analysis" by Duval and Tweedie (2001). The most prestigious publication is "Bias in meta-analysis detected by a simple, graphical test" by Egger et al. (1997). Another prominent publication in this cluster is "Measuring inconsistency in meta-analyses" by Higgins et al. (2003).

2.2. Co-Word Analysis

To identify common themes and trends in the meta-analysis studies conducted in the field of educational sciences, a co-word analysis was conducted using the keywords of the author. The results of this analysis are given in Fig. 5. In this graph, each node represents an author keyword. As the frequency of use of the author keyword increases, its size in the co-word network grows. In the graph, the nodes are connected. As the frequency of co-occurrence of two words increases, this connection becomes thicker and is positioned close to each other in the graph. Nodes are represented by different colors and nodes with the same color are in the same cluster. To make the graph more readable, the 40 nodes with the highest

frequency are represented. These nodes repeat at least 15 times and are grouped into 8 clusters.

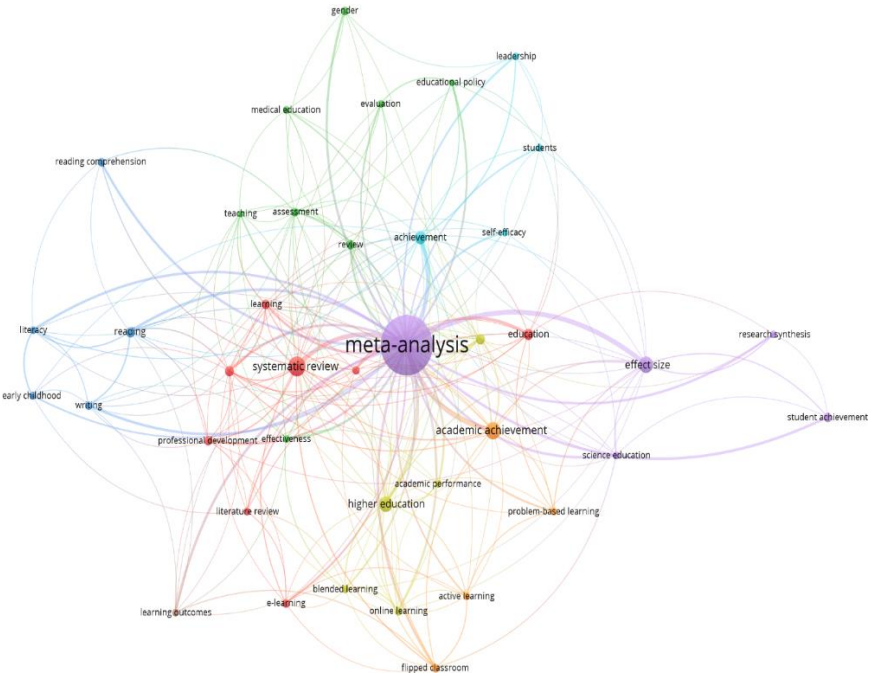

Figure 6: Word co-occurrence map.

As seen in Figure 5, the most recurring keyword is "meta-analysis". This may be because both MARS (Meta-analysis reporting Standards) and PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) protocols recommend the word "meta-analysis" in the title of meta-analysis studies. For this reason, authors often use keywords such as "meta-analysis", "systematic review", "research synthesis", and "effect size" to express the method of the study in keywords. Since the nature of meta-analysis studies is to examine the effect of an educational intervention on various learning outcomes, the graph includes

keywords that can be dependent and independent variables. The main dependent variables in the graph are "academic achievement", "academic performance", "learning outcomes", "attitude", "efficacy", and "reading comprehension". The independent variables are "flipped classroom", "e-learning", "blended learning", "active learning", "problem-based learning", and "online learning". Studies are frequently conducted in the context of "higher education", "early childhood", "medical education", "science education", and "and mathematic".

The thematic map technique was used to identify the themes that emerged based on co-word analysis. In this technique, themes are placed on the graph according to centrality and density measures. The centrality measure measures the degree and strength of a cluster's connections with other clusters in the network, while the density measure measures the strength of connections between words in the same cluster (Callon et al., 1991). As the centrality and density measure increases, it can be said that the associated theme is important and consistent. The resulting thematic map is given in Figure 7.

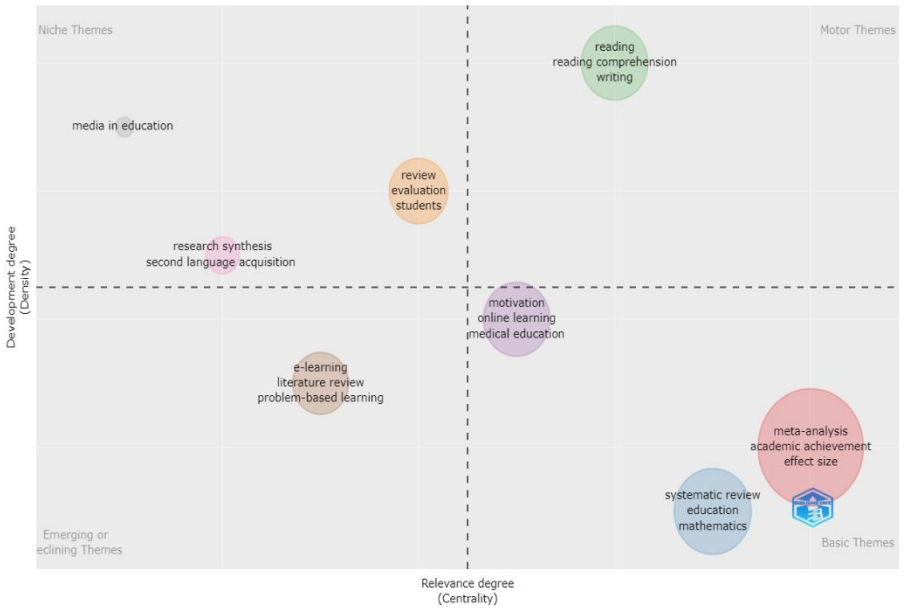

Figure 7: Thematic map of the meta-analysis studies

As seen in Figure 7, the two-dimensional map consists of four quadrants. According to Collon et al. (1991), the themes in the upper right quadrant are both well-developed and important motor themes for structuring the field, while the upper left themes are well-developed and isolated themes, but very specialized and peripheral due to their lower level of interconnection with other themes. To them, the bottom right themes are important for a research field but underdeveloped, while the bottom left themes are both underdeveloped and quite marginal. According to these explanations, the most developed, important, and consistent theme in the field of educational sciences consists of the key concepts of "reading", "writing" and "reading comprehension". When the meta-analysis studies that include the key concepts of "reading", "writing"

and "reading comprehension" are examined, it is seen that these studies examine the effectiveness of interventions related to the development of reading and writing skills in the mother tongue or a foreign language.

Important but underdeveloped themes for the field of educational sciences are located in the lower right quadrant of the graph. When the key concepts in these themes are analyzed, it is seen that the concept of "academic achievement" is used the most. Since one of the main objectives of the learning-teaching process in educational sciences is to increase the academic achievement of students, the dependent variable of the meta-analysis studies conducted on this subject is academic achievement. After academic achievement, another one of the most studied dependent variables is motivation. The independent variables whose effects on these dependent variables have been studied the most are "learning strategies" and "online learning". Meta-analysis studies are mostly conducted in the field of mathematics teaching. According to the table, it is seen that both undeveloped and marginal themes are studies on problem-based instruction and e-learning.

2.3. Co-Authorship Analysis

Co-authorship analysis was used to determine which co-authors wrote the meta-analysis studies published in the field of educational sciences and the social relationships between these authors. Co-authorship analysis is also used to discover regular working groups, hidden author groups, and important authors in the field (Aria & Cuccurullo, 2018). The resulting network for this analysis is given in Figure 8.

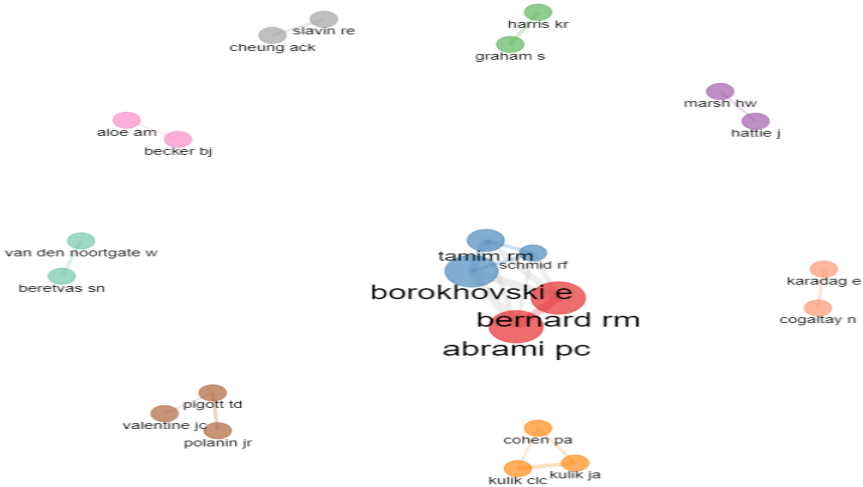

Figure 8: Author collaboration network

Figure 8 shows eight distinct communities of authors. The largest group contains 5 authors: Abrami pc, bernard rm, borokhovski e, tamim rm, and schimid rf. Within this group, the strongest relationship is between abrami pc (the most prolific author), bernard rm (the second most prolific author), and borokhovski e (the third most prolific author) - all three of whom work at Concordia University in Canada. Together, these three authors have conducted meta-analyses on critical thinking, distance education, blended learning, instructional technology, and the use of technology in higher education. After this group, two groups of three authors came to the fore. The first one is the group of authors led by pigott td, valentine jc and polanin jr. In this group, pigott td, polanin jr and valentine jc worked on methodological guidelines for meta-analysis (characteristics of high quality meta-analysis studies, protocol for assessing the risk of reporting results in systematic reviews). The second group is the author group consisting of kulik

clc, kulik ja and cohen pa. In this group, the strongest relationship is between kulik clc and kulik ja - both authors work at the University of Michigan. Together, these two authors conducted meta-analysis studies on topics such as instructional technologies, accelerated learning, computer-based instruction, feedback, skill groups, coaching, mastery learning, tutoring, programmed instruction and individualized instruction.

The world collaboration map (Fig. 8) was analysed to identify collaborations between countries. In this graph, the countries shown in dark blue indicate the countries with the highest number of meta- analysis publications related to education. These countries are the United States of America (USA), Australia, China, United Kingdom (UK), Canada and Turkey.

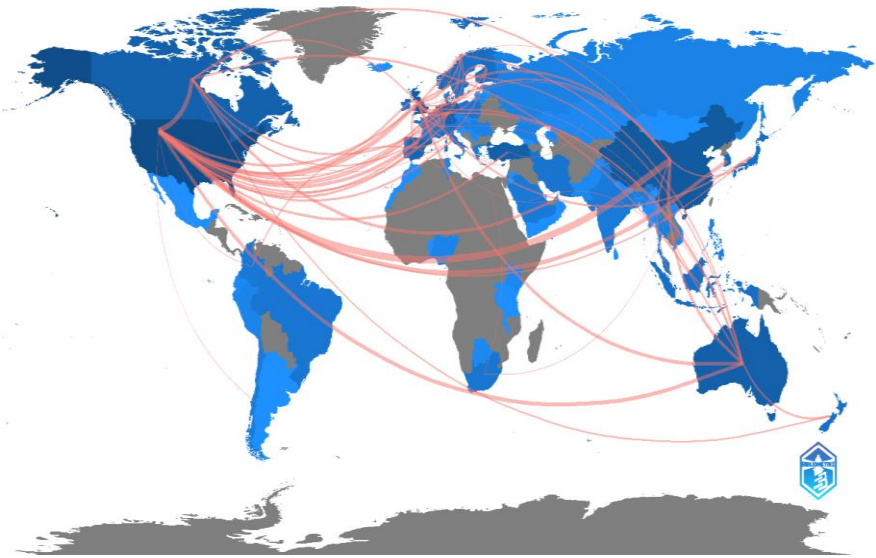

Figure 9: World Collaboration Map

According to the Figure 9, the highest number of meta-analysis studies in the field of educational sciences (*f*=45) is between USA and China. This is followed by USA and Canada (*f*=26) and USA and UK (*f*=21).

Discussion and Conclusion

The aim of this study is to examine the evolutionary development of meta-analysis studies in the field of education and to determine the impact of these studies on scientific knowledge in the field of education. For this purpose, 1970 publications using meta-analysis method between 1980 and 2022 were subjected to bibliometric analysis. I used performance analysis to determine the contribution of the components of the studies included in the analysis (authors, topics, citations, institutes, countries, etc.) to the field, and science mapping (co-citation analysis, co-word analysis and co-authorship analysis) to determine the relationships between these components.

As a result of the performance analysis, it was determined that the most productive author was "Abrami, P.C." with 19 studies and 3688 citations. When the author productivity graph of the authors conducting meta-analysis studies was analysed, it was determined that this graph showed a distribution in accordance with Lotka's law. Accordingly, while very few authors conducted many meta-analysis studies in the field of educational sciences, many authors conducted very few meta- analysis studies. As a matter of fact, when the scientific productivity graph is analysed, 86.2% of the authors contributed to the meta-analysis study once, while 2.7% contributed three times. In support of this result, Guilera et al. (2013)

determined that meta-analysis studies conducted in the field of psychology also show a distribution in accordance with lotka's law. The fact that the distribution is in accordance with lotka's law also shows the level of development and change in the research field. When the annual productivity graph is analysed, it is seen that meta-analysis studies remained relatively at the same level between 1980 and 2004, although there were small increases from time to time, but there was a large increase in the number of meta-analysis studies after 2004. The possible reason for this may be that there was no suitable software on the market to conduct meta- analysis studies until 2004. Because a good knowledge of statistics is required to conduct a meta- analysis study and the first commercial versions have been released since 2004. The most popular of these software is Comprehensive Meta-analysis [CMA] (CMA, 2023). CMA is one of the most widely used software in meta-analysis studies because it is user-friendly and allows data entry in different formats (Bax et al., 2007). Meta-analysis can be easily performed with paid software such as CMA, Review Maneger [RevMan] (RevMan, 2023), Statistical software for data science [Stata] (Stata, 2023) or free, open source software such as R (R Core Team, 2021), JASP (JASP, 2023), Jamovi (Jamovi, 2023).

As a result of the performance analysis, it was determined that the most influential journal in which meta-analysis studies are published is "Review of Educational Research (RER)". The Review of Educational Research publishes comprehensive reviews including conceptualizations, interpretations, and syntheses of literature such as critical, integrative reviews of research literature related to education (RER, 2023). It was determined that this journal, which

started its publication life in 1931, published 10.21% (n=202) of the meta-analysis studies published between 1980-2022. In parallel with this finding, Devi (2021) determined that the word "meta-analysis" was the most frequently occurring word in the bibliometric analysis of this journal. According to Web of Science (2023), this journal ranks third among 269 journals in the field of educational sciences. In 2022, this journal, which has an impact factor of 11.2, is scanned in many indexes such as Scopus, Wilson Education index, ERIC, especially social science citation index (RER, 2023). As a matter of fact, as a result of the Bradford law applied to find out which journals publish the most important and relevant publications related to meta-analysis in educational sciences, 15 journals (see Figure 3) were identified, especially the Review of Educational Research. These journals published 33.2% (n=658) of the total 1970 meta- analysis studies published between 1980 and 2022.

A citation is a reference made in a publication to show to whom the information or finding from another publication belongs. Another indicator used in performance analysis is the determination of the most cited publication. Determining the most cited publication is considered important in terms of identifying the highest quality and reliable publications in the relevant research field. Accordingly, the most cited study among the meta-analysis studies conducted in the field of educational sciences is the article titled "Socioeconomic Status and Academic Achievement: A Meta- Analytic Review Research" published by Sirin (2005) in Review of Educational Research. This article received a total of 2214 citations with an annual citation average of 116.53. According to Sirin (2005), the purpose of this meta-analysis was to calculate the magnitude of the

relationship between socioeconomic status and academic achievement and to determine whether the SES-achievement correlation has changed since White's (1982) first meta-analysis on this topic. The study found that there was a slight decrease in the average correlation.

Co-citation analysis was performed to determine the relationships between studies that cited the same publications together. As a result of this analysis, a citation network consisting of three clusters emerged. When the publications forming the citation network were analyzed, three themes were identified: (i) statistical methods, (ii) introduction of the meta-analysis method, and (iii) application and reporting of meta-analysis. When the measures of central tendency (betweenness, closeness and PageRank) of the publications within these themes were examined, it was determined that the ability and quality of the book titled "Statistical Power Analysis for the Behavioral Sciences" published by Cohen (1988) in the theme of "application and interpretation of meta-analysis" was higher than the other publications in this cluster. This book is mostly referred to because of the classification proposed for the interpretation of calculated effect sizes (Cohen's d and Pearson's r). According to this classification, Cohen's d of 0.2 is interpreted as "small", 0.5 as "medium" and 0.8 as "large" (Cohen, 1988, p.25). Pearson's r is interpreted as "small" if 0.1, medium if 0.30 and large if 0.50 (Cohen, 1988, pp.79-80). In the "Statistical Methods" theme, the book with the highest prestige and ability to convey information is "Statistical Method for Meta-Analysis" by Hedges and Olkin (1985). This book introduces statistical methods for combining the results of studies in the social and behavioral sciences. Although this

is not the first book on meta-analysis, whereas most of the other books are more concerned with how to collect data for meta-analysis (such as Glass et al., 1981), this book is more comprehensive in that it focuses more on the statistical techniques needed for meta-analysis and includes a selected bibliography of meta-analyses published up to 1983 (Wasserman, 1988). In the theme "Introducing the meta-analysis method", two pioneering studies on publication bias stand out. The first one is "Trim and fill: A simple funnel-plot-based method of testing and adjusting for publication bias in meta-analysis" by Duval and Tweedie (2001). In this article, they examined nonparametric methods for estimating the number of missing studies that may be included in a meta-analysis and their impact on the overall effect size. The other is "Bias in meta- analysis detected by a simple, graphical test" by Egger et al. (1997). This article describes how to determine whether the asymmetry in the funnel plot is significant.

In order to determine the basic concepts, themes and trends in meta-analysis studies in the field of educational sciences, a co-word analysis was conducted using the keywords of the study. As a result of the analysis, it was determined that the most recurring keyword was "meta- analysis". The term meta-analysis was first introduced by Gene Glass (1976) and was used to mean the statistical analysis of the results from individual studies in order to combine findings. The most frequent occurrence of this word may be due to the fact that meta-analysis publication standards such as MARS (Cooper, 2010) and PRISMA (Page et al., 2020) suggest that the word meta-analysis should be included in the title or keywords for meta-analysis studies. When the thematic map of the word "meta-

analysis" is analyzed, it is seen that it is an important but underdeveloped theme for the field of educational sciences. It was determined that one of the most important, consistent and developing themes in this field is related to "reading comprehension". Reading comprehension is the understanding and interpretation of written language and the ability to derive meaning from text (Kirby, 2007). Meta-analyses indicate that strategy instruction (metacognitive strategies), which helps students understand the purpose of reading, adapt to the demands of the task, and monitor comprehension processes, is effective in improving students' reading comprehension skills (Corso et al. 2023). In the field of educational sciences, both undeveloped (or emerging) and marginal themes were identified as "e learning" and "problem-based learning". E-learning is defined as the realization of teaching processes through electronic tools and the internet (Gülbahar, 2012). When the word co- occurrence map is examined, it is seen that the e learning theme is related to the concepts of "blended learning", "online learning" and "flipped classroom". In the bibliometric study on "flipped classroom", it was determined that the primary studies on this subject have increased since 2013 and reached a peak in the last two years (del Arco et al., 2022). As it is known, in order to conduct a meta-analysis study in any field, there should be a sufficient number of primary studies in that field. Therefore, it can be said that this theme is a newly developing theme for meta-analysis studies in the field of educational sciences since the meta-analysis studies on "e learning" scanned in the web of science started to be published since 2011 (e.g. Šumak et al., 2011).

As a result of the co-authorship analysis conducted to determine the social relationships between the authors conducting the meta-analysis studies, it was determined that the strongest relationship was between abrami pc (the most prolific author), bernard rm (the second most prolific author) and borokhovski e (the third most prolific author) working at the same university. It is seen that the studies published jointly by these three authors are mostly related to instructional technology issues. The most cited studies of these three authors in the field of instructional technologies are on distance education. Distance education is education in which teaching and learning take place in a different place, communication is provided by technological means, and education is given institutionally within the framework of a specific education program (Moore & Kearsley, 2005). This education is carried out synchronously (synchronous) and asynchronously (asynchronous). The meta-analysis study on distance education, which was co-authored by these three authors and received the highest number of citations (662 citations), was titled "How does distance education compare with classroom instruction? A meta-analysis of the empirical literature" (Bernard et al., 2004). In this study, the effects of distance education and traditional face-to-face education on academic achievement, attitude and retention were compared. As a result of the study, it was determined that the effect of distance education on academic achievement was not significant, while the effect on attitude and retention was low but had a significant effect size. However, while synchronous distance education has a significant ($p<.05$) effect on achievement and attitude, asynchronous distance education has a significant ($p<.05$) effect on achievement

and retention. The other study (468 citations) is "A Meta-Analysis of Three Types of Interaction Treatments in Distance Education" (Bernard et al., 2009). In this study, they examined the effects of three different interaction treatments (student-student, student-teacher and student-content) on academic achievement in distance education. As a result of the study, it was determined that all three interaction types had a moderately significant ($p<.05$) effect size on academic achievement. As a result of the post-hoc test, it was determined that student-student and teacher-student interaction had a significantly ($p<.05$) larger effect size than student-content interaction, but there was no significant difference between student-student and student-teacher interaction.

As a result, this study is limited to the data obtained from the web of science database. In future bibliometric studies, other databases such as Scopus and ERIC can also be used. Similarly, in future studies, previous meta-analysis studies (e.g. socio-economic status, distance education, e-learning, problem-based learning, flipped classroom, critical thinking) can be conducted again to examine whether there is a change in effect sizes compared to previous meta-analysis studies. In addition, meta-analysis of meta-analyses or secondary meta-analysis can be conducted by collecting previously conducted meta-analysis studies on such topics in educational sciences. Thus, more reliable results can be obtained with a broader perspective on the effectiveness of interventions in educational sciences.

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CHAPTER III

School Dropout: An Evaluation Based on the Opinions of Teachers Working in Vocational and Technical Secondary Education Institutions

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Introduction

Absenteeism initiates a process that limits the child's right to education and even causes the child to drop out of school. Ensuring that children of compulsory education age attend school is the common obligation of all stakeholders in education. Elimination of absenteeism is possible by increasing the awareness of all stakeholders about absenteeism and school dropout and by joint

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initiatives and efforts of these stakeholders to eliminate the reasons for absenteeism (Ögel, 2011). Absenteeism is a student attitude that may result from many factors such as family, environment, cultural, social and individual factors and is not thought to negatively affect the student's academic success. Absenteeism occurs in two ways: students studying in educational institutions come to school from time to time or do not come at all. intermittent absence; This is the type of absenteeism that occurs when students sometimes come to school and sometimes do not. Continuous absence: It is the situation of constantly not coming to school, even though the student's attendance at school is sufficient (Gül et al., 2016). Şanlı et al. As a result of the research conducted by (2015), students; They state that they are absent from school due to personal problems or their parents, school environment, school administration and teachers. Students; It is said that schools should be much more fun, there should be more social activities, block classes should end, teachers should pay more attention to their students, there should be a health specialist in schools and teachers should be more tolerant.

in the literature on absenteeism or school dropout and that they are multidimensional (Güngör, 2019). School absenteeism or dropout is evaluated with different factors in the literature, and the general reasons that arise are family, school, student and social environment. When scientific and academic studies are examined, the reasons for students not attending school are generally listed below (Şanlı et al., 2015):

1. The main factors that cause absenteeism are the student's health problems and fear of failure.

2. The student's refusal to go to school due to many psychological problems, in other words, not wanting to continue school, results in absenteeism and dropping out of school.

3. It also appears that students' parents are effective in absenteeism. For example, it has been found that parents who care about their children and cooperate with the school are effective in ensuring their children's success, motivation and regular attendance.

4. In families with financial problems, inadequate response to children's educational needs and even the fact that the child has to work cause significant school absenteeism. For example, the most important factors that cause students to exhibit absenteeism behaviors are their lack of self-confidence as a result of poverty, which causes their children to be absent.

5. In parallel with the effect of family factors on absenteeism, friendship environment and social environment in the living environment may also play a role in absenteeism. For example, it is stated that those who are unsuccessful, absent, not attending school, drug addicts and those who commit crimes are most at risk.

6. The fact that students do not receive enough support from the school, that there is a lot of illegal behavior at school, and that they are victimized by this increases the likelihood of absenteeism.

7. Finally, studies have also investigated whether gender differences affect school absenteeism and dropout. Although absenteeism and school dropouts can be seen in both gender groups, it is observed that males are more likely to be absent from school in Turkey.

In this context, the reasons for school dropout and absenteeism were examined under four subheadings in this study and these reasons are summarized below.

Causes Originating from A *:* Family culture can also be the basis for success or failure in school. It is stated that a family with a low socioeconomic level may be weak in supporting the student's school activities and parents will be inadequate in home education activities. On the other hand, in families with high socioeconomic status, mentoring support for educational activities (life coach, group leader, etc.) is provided in addition to family support, and this creates a gap in terms of educational opportunities. In addition, behavioral patterns in the individual are first learned in the family environment. For this reason, it is emphasized that the education level and life culture of the family are reflected in the behavioral patterns of the students, and that the participation and support of the family supports the sustainability of academic success at school. Therefore, it is stated that parental attachment at home, parents' education level and contribution to educational activities may be effective in students' behaviors such as dropping out and not attending school. Demographic factors that cause school dropout or absenteeism can be listed as the education level of the parents, the profession of the

parents, other sources of income of the family and the ethnic origins of the families. Factors affecting the decision to leave school in terms of family characteristics, family size and structure, socioeconomic level of the family, difference in mother tongue and religious compatibility of the family are also effective in absenteeism. On the other hand, since students living in a broken family structure during adolescence have less support in school activities, they are more likely to drop out of school and be absent than children from families living together. While students with better household income are more likely to attend school, children from poor families are more likely to drop out of school as they get older (Hoşgörur and Polat, 2015).

School Based Reasons: Reasons related to school are low academic success, dislike of school, expulsion from school due to disciplinary punishment, finding the school objectionable, insufficient attendance and discipline problems. In some studies, school-related factors are considered as cognitive factors, for example, grade retention, low academic achievement, persistently low exam scores, and non-purposeful reasons are considered as reasons for dropping out of school. In another study, the reasons for dropping out of school were lack of sociocultural activities, excessive course load, difficulty of classes, negative friendships, and reasons for school dropout and absenteeism in case of being ridiculed by peers. It is underlined that students who drop out generally have a poor academic record at school and are more likely to repeat the course. In addition, it is stated that students at risk of dropping out of school may receive disciplinary punishments due to in-school behavioral problems, may be reluctant to participate in

school activities, and may decrease due to shortened individual attention periods in teaching classes. It is also said that the reasons for dropping out or absenteeism are related to the student-teacher ratio, depending on the school structure. It is also observed that the risk of dropping out of school is higher in large schools (Güngör, 2019).

Student-Based Reasons : There are many student-related reasons for absenteeism and school drop-out. The most common of these are marriage and pregnancy, being older than classmates, physical disability, ethnicity, illness or ongoing health problems, violence at school, drug and alcohol addiction, and sensory characteristics of the student (Bayhan and Dalgıç, 2012). Students; Having to work outside of school, psychological disorders, not being motivated enough due to dissatisfaction with school, and future anxiety may cause absenteeism (Altinkurt , 2008).

Reasons Originating from the Social Environment : Problems encountered in students' relationships with friends, teachers, family and people in the region they live in may cause deviations and negative attitudes in their social relationships. School dropout or absenteeism also appears to be related to the social environment. At the macro-social level, it is emphasized that school dropout and absenteeism occur more frequently in environments where school performance is not highly valued (for example, the school is in places with low socioeconomic status). On the other hand, as extracurricular activities are more attractive and the student thinks of the external environment as a freer and less regulated place,

it becomes easier for students in the risk group to drop out of school or be absent (Altinkurt , 2008).

The importance of this research is to ensure that students who have the opportunity to benefit from the constitutionally guaranteed and free education right , but cannot use this right voluntarily or due to other reasons, use this right or give up using this right . There are approximately two million students enrolled in vocational and technical secondary education in Turkey. It is inevitable that absenteeism rates are high in an area with such a high student density. The fact that our young people, who are the guarantee of our future, leave the education system against their will or worse, on their own, increases the importance of our research even more.

With this research, in Vocational and Technical Secondary Education Institutions; It is aimed to reveal the reasons why students drop out of school based on the opinions of teachers working in vocational and technical secondary education institutions.

Method

Model of the Research

This study was designed with the case study pattern, one of the qualitative research approaches that aims to enable the researcher to collect detailed and in-depth data on the subject, directly learn the individual perceptions, experiences and perspectives of the participants, and understand and explain current situations (Patton, 2014). Case study analyzes one or more situations holistically within its own boundaries with factors such as environment, time, individual, event and process. Since situations are different, it is not possible to generalize the results. However, the results obtained

regarding a situation are expected to create examples and experiences for understanding similar situations (Yıldırım and Şimşek, 2018). In order to investigate the reasons for school dropout and solution suggestions of students studying in Vocational and Technical Secondary Education Institutions in Turkey, interviews were conducted with teachers using a semi-structured form.

Working group

25 teachers working in Karapürçek district of Sakarya province participated in this study in the 2023-2024 academic year. The teachers in the study group were determined on a voluntary basis according to the appropriate sampling technique. Convenience sampling technique is one of the simple non-random sampling methods and this technique is to select the sample from easily accessible and applicable units due to the limitations in terms of time, money and labor (Büyüköztürk et al., 2017). 14 of the participants in the research are female (56.5%) and 11 are male (43.5%) teachers.

Data Collection Tool and Data Collection

This research was conducted in the Karapürçek district of Sakarya province in the 2023-2024 academic year. Research data was collected through a semi-structured interview form. Semi-structured interviews are frequently preferred by researchers due to their certain level of standardization and flexibility, eliminating the limitations of tests and surveys based on writing and filling out, and helping to obtain in-depth information on a particular subject (Yıldırım and Şimşek, 2018). While preparing the interview form, firstly, a literature review was conducted on the subject. Then, six

open-ended questions were prepared to obtain in-depth information. One day before the interview dates, school principals were contacted by phone and schools were visited on the specified date and time. Before the interview with the teachers, the teachers, the researcher and the school principal held a short meeting and the teachers agreed to participate in the research voluntarily. The teachers' answers to the questions were recorded by the researcher with the voice recording program of his mobile phone. A total of 50 pages of data were obtained from the interviews. During the interviews, the following questions were asked to the teachers:

1. What are the reasons for school dropout?
   a.) Family related reasons
   b.) Reasons related to the social environment
   c.) Reasons originating from the student himself
2. What kind of work do you do to prevent school dropout?
   a.) Your work for families
   b.) Work you do for your students
   c.) Studies you have done for your institution
3. What needs to be done systematically to prevent school dropouts?
   a.) What needs to be done at the level of our Ministry
   b.) What needs to be done at the level of Provincial Directorates of National Education
   c.) What needs to be done at the level of District National Education Directorates

Analysis of Data

The data were interpreted and evaluated by analyzing the descriptive content analysis technique. Descriptive content analysis method is a method that allows studies that have been conducted independently on a certain subject within a certain time period to be examined according to various categories and classes using some descriptive statistics (frequency, percentage). Thus, it is possible to reveal general trends and tendencies regarding a particular field and subject. Descriptive content analysis also directs new research on the subject, as it reveals with statistics which aspect of the relevant subject the researchers focus on more or which aspect they neglect (Dinçer, 2018).

Results

The theme was accepted based on the research findings and interview questions. Sentences that were thought to be used as verbatim quotations were identified and, when deemed necessary, were included as verbatim quotations in the findings section. Additionally, the frequency with which the sub-themes recurred was calculated and tabulated as frequency.

Under the first main theme, "What are the reasons for school dropout?", three sub-themes were created and the findings are presented in a table.

Table 1: Findings on Family-Related Reasons for School Dropout

Codes	n
Divorced families	12
Financial impossibilities	7
Family vocational to education opposite negative attitude	3
Early marriage	1
Culture difference	1
By family start up	1

When Table 1 is examined, the most important opinion that emerges is that divorced families do not attend school. Participants' opinions on this issue; *"Due to the region, we often come across children whose parents are separated. The student in a dilemma reflects these problems to the school (G.7)", "Reasons such as parental indifference, parents' divorce, low economic income level and the student's need to work, the student's absenteeism due to the family's indifference, and the decrease in course success, failing the class." It increases the school dropout rate (G.2).* "

Table 2: School of Abandonment Social to the Environment Connected reasons

Codes	n
Negative friend surroundings	17
Drugs article use of	5
Peer edition	2
Hunger for love	1

Table 2 is examined your teachers big part "negative *friend around* the *school* abandonment main Reason aspect what he sees is seen. Beyond from the side love hunger, appreciation sense of and wannabe like in cases other reasons aspect is seen. Participants This

on the subject " *Student friend in choosing what he did mistakes , student social around peoples education of the level inadequacy (G.17)", " Student around school leaving your friends to construction increasingly short earn money from the road sees . For this reason school attractive (G.11)", " The child social around what he sees wrong to examples imitation , friends around him like work and earn money desire (G.10), " wannabe , easy run away girl children for love hunger , liking , self-confidence lack (G.16)"* expressions They used .

Table 3: School of Abandonment Your Student from Yourself Welding reasons

Codes	n
Your desire to read not having	12
To cola escape tendency	6
Low basis level education	6
School fun not finding	1

When we consider the reasons for school dropouts originating from students, the striking point is that students' lack of desire to study comes first. Participants on this subject; " *The child does not want to go to school, is unhappy at school, does not believe that school will be beneficial to him/her, or does not understand this (G.1)", "Lack of desire to study, Some students who have economic difficulties want to get into life as soon as possible, Some political tendencies (G.21)" They used* the expressions . Moreover, according to some interviewees, the tendency to take the easy way out is another reason for school dropout. " *The emptiness of adolescence is difficult for them to study, work and earn money. They think they can reach some things more easily outside (G.14)", He is an example of*

the types of students we encounter most. Students who do not want to study at school may see working for themselves as a difficult job and choose the shortcut to life (G.7)", "Students have not fully understood the relationship between the school and their future, The weakness of the development of the education level throughout the country is reflected on the students, New The expressions "the generation is experiencing the disease of boredom and laziness (G.6)" indicate the importance of the participants' lack of taking the easy way out and self-improvement.

Under the second main theme, "School Dropout Prevention Studies", three sub-themes were created: family, student and institution-oriented studies. Findings related to these themes are shown below.

Table 4: School Dropout to Prevent For The Family Aimed At Doing Studies

Codes	n
Parent meetings	16
Parent visits	7
One to one talks	1
Parent information seminars to be done	1

When Table 4 is examined, it can be seen that parent meetings are among the primary activities carried out by teachers for families in order to prevent school dropouts. Participants also stated that they tried to prevent school dropouts by using methods such as parent visits and one-on-one meetings. In this context, teachers; " *We inform families at meetings, we make parent visits, we make an effort to make families proud of their students by inviting them to every event held at the school (G.13), "We hold parent-teacher meetings*

frequently. We are trying to ensure teacher-student-parent cooperation (G.10) ", We must raise awareness of families about education and training. We are trying to raise awareness of families through seminars, parent meetings and conferences. The future of school, family, student and education is introduced (G.6)". They used the expressions.

Table 5: To Prevent School Dropout, Students Aim to Do Studies

Codes	n
Guidance studies	18
School seduction studies	4
Incentives	2
Simplification and simplification	one

Table 5 is examined school abandonment to prevent for teachers for -most important of the subject guidance of their work necessity and effectiveness is is seen. In this context, teachers; *" I tell my students at every opportunity From where education to take should regarding information I do . Studentship in my years my memories tells And school of the process How more easy could be about what I know I will transfer it. Them at every opportunity A lot valuable one each individuals is reminds And their time effective to use towards in suggestion I will be found (G.2)".* They used the expressions.

Table 6: To Prevent School Dropout, Drying Aims at Making Studies.

Codes	n
Physical facilities to improve to work	17
parent meetings to be arranged	3
Social and sports activities to organise	3
Guidance studies to do	2

When Table 6 is examined, teachers regarding the studies carried out for the institution to prevent school dropouts; “We are trying to make the institution an environment that students can enjoy, We are trying to make the school more social and enjoyable, We are trying to provide an environment where students can enjoy being there (G.6)”, “School family visits, More effective cooperation in reducing problems, Frequent parent meetings (G.6)” G.5)”, We are trying to improve the physical facilities of the school. We ensure that students have an effective time at school through social and sports activities (G.24) . ”

Under the third main theme, "Systematic Recommendations to Prevent School Dropout", studies at the Ministry level and regulations made in Provincial and District Directorates of National Education emerge as sub-themes. Findings related to these themes are shown below.

Table 7: Ministry Aims to Prevent School Dropout at The Level of Desired Studies to Be Done

Codes	n
12 years old compulsory your education removal	16
Lesson hours reducing	4
School post- work find opportunities increasing	3
Internship from the last year of activities former to classes receiving	2

When Table 7 is examined, most of the teachers stated that compulsory education should be abandoned. In this context, teachers; *"Students should be guided correctly starting from primary school. 12 years of compulsory education should be abolished. The attendance of students who want to come to school should be ensured.* They stated: " *Schools should be made centers of attraction in the eyes of parents, students and education staff (G.19)."* Increasing course hours and reducing course content intensity is another work expected to be carried out at the Ministry level. *"Course hours should not be too long (such as 10 hours per day), Not every student should be placed in a school as a result of the exams; Students who get below a certain score should continue studying openly. From the beginning; Students who are not interested should not be admitted to school at all and should be directed to open high school. School averages should be highlighted (G.8)" "High school education should be made compulsory, vocational education should be given in businesses rather than schools, theoretical courses should be reduced and practical courses and internship days should be more, and the duration of education*

should be reduced from 4 years to 3 years (G.15)." In order to prevent school dropouts, other issues that the participants included in their opinions were that students' opportunities to find employment after school should be increased and that the internship activity, which is mandatory in the last year of vocational high schools, should be taken from the last year and carried out in the previous classes. *" Course contents and course intensity can be reduced. Senior year internships in vocational high schools should be in lower grades, not in the senior year. School internships in the last year are challenging for students (G.3)".*

Table 8: School Dropout To prevent Provincial National Education Directorates at the level to be done Wanted Studies

Codes	n
To graduates own in the province work possibility presenting	12
schooling of the rate increasing	5
Project activities out of sight passing	3
Document of your burden reducing	2
to the reasons focus on	2
Guidance studies to be done	one

When Table 8 is examined, teachers regarding the work that needs to be done at the level of Provincial Directorates of National Education; They stated that studies such as increasing job opportunities throughout the province, increasing schooling rates, updating project activities carried out throughout the province, reducing the paperwork burden, and guidance studies should be carried out. In this context, teachers; *"Children who cannot access education in that province should be identified and schooling rates should be increased to provide access to school to these students*

(G.1)", "The reasons for school dropouts should be investigated and appropriate studies should be carried out. Employment opportunities should be expanded on a provincial basis , vocational high schools should be given the opportunity to produce, and they should be included in the sector (G.4)", "Regional organization of schools and fields can be made more effectively. Improvement of equipment and field facilities in schools. Improvements can be made regarding the transfer of equipment, opportunities and experience between schools (G.9)", " *I do not believe that the Provincial Directorates of National Education will do much due to their legal obligations. They can increase the opportunities in their own provinces only by carrying out various projects (G.15)" and "We should try to ensure the socialization of students rather than producing new projects specifically for Samsun (G.24)" .*

Table 9: School Dropout To prevent aimed at District National Education Directorates At the level to be done Wanted Studies

Codes	n
Orientation studies	8
Security precautions	5
of schools work of your burden reducing	4
To students aim in determining helper to be	4
express opinion not doing	4

When Table 9 is examined, the most important emphasis of the participants on preventing school dropouts at the District National Education level was that "Guidance Studies" should be carried out. Teachers on this subject; *"The promotional activities of vocational high schools should be effectively supported. It should*

change the image of the school attended by students with low success in vocational high schools in society (G.2)", "Students should be placed in the field they are interested in and should be transferred according to their expectations in their fields, School and field promotions should be made effectively and correctly (G.9)", " If families live in villages They should also go there and make them feel that their children are valuable to us. Information posters and brochures can be distributed. Disciplinary incidents should be taken more seriously. They expressed their opinion as follows: "Studies should be carried out to prevent peer bullying in schools (G.13)".

Conclusion and Recommendations

According to the findings of this study, the main family reasons for school dropout are parental indifference, economic inadequacy, education level, domestic violence and health problems, while the social environment is concerned with the circle of friends, wrong examples in the environment and negative habits such as drugs. . Among student-related problems, social media, academic failure, mental deficiencies, and lack of future plans come first. As for suggestions to prevent school leaving, parent meetings and home visits were emphasized by almost all interviewees. In addition, it is important to increase students' motivation through student adaptation studies. Finally, it is important for institutions to engage in encouraging and rewarding behavior by carrying out social activities for students. Within the scope of systemic recommendations, it is suggested that the Ministry should abolish compulsory education in high schools and the curriculum should be updated. Within the scope of Provincial and District Directorates of National Education, it is recommended that they give priority to

guidance services, conferences, seminars, projects and encouraging social activities.

The recommendations to be made to reduce absenteeism within the scope of the study are as follows.

- Students and parents should be made aware of the necessity of education and should be informed correctly.
- Vocational high schools need to be especially encouraged. Within the scope of these incentives, after-school job opportunities should be offered.
- At the ministry level, the curriculum should be overhauled. The necessity of updates within the scope of EU directives is especially important. It is also important that compulsory education continues.
- In vocational high schools, more practice than theory should be given so that students can start business life quickly after education.
- Rehabilitating problematic students is essential for their achievements.

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