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The Descriptive Content Analysis of Theses with the Topic of Metacognition Published in Turkey on Mathematics Education

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Abstract

In this research, it was aimed to investigate the graduate theses with metacognition theme on mathematics education according to their structural properties (publication year, method, study group, data collection tools and data analysis technique) and study topics. 80 graduate theses were reached within the scope of the research. At a result of the descriptive analyses, it was noticed that the number of theses has increased until recent years except from 2009, 2014 and 2017 and the highest number of conducted researches were in 2019. It was determined that generally the quantitative research approach was employed in the studies; accordingly, it was focused on descriptive and experimental studies. It was also found that most of the researches were carried with secondary school students, mostly questionnaires/ open-ended questionnaires/ scales/ tests were applied and mostly t-test, descriptive statistics and correlation tests were used in the analyses process. In addition, it was reached to the conclusion that mainly metacognitive awareness, metacognitive skill/experience and metacognitive learning/self-regulation strategies were studies in terms of the study topic.

Keywords: Metacognition, mathematics education, descriptive analysis

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Türkiye'de Matematik Eğitimi Alanında Yayınlanan Üstbiliş Konulu Tezlerin Betimsel İçerik Analizi

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Öz

Bu araştırmada matematik eğitimi alanındaki üstbiliş temalı yapılan lisansüstü tezlerin yapısal özellikleri (yayım yılı, yöntem, çalışma grubu, veri toplama araçları, veri analiz yöntemi) ve çalışma konusuna göre incelenmesi amaçlanmıştır. Araştırma kapsamında 80 adet lisansüstü teze ulaşılmıştır. Yapılan betimsel analizler sonucunda; tezlerin 2009, 2014 ve 2017 yılları hariç son yıllara doğru bir artış gösterdiği ve yapılan araştırmaların en çok 2019 yılına ait olduğu görülmüştür. Çalışmalarda genellikle nicel araştırma yaklaşımı benimsenmiş olup buna bağlı olarak da betimsel ve deneysel çalışmalar üzerinde yoğunlaşıldığı belirlenmiştir. Araştırmaların büyük bir bölümünün ortaokul öğrencileri ile gerçekleştirildiği, en fazla anket/açık uçlu anket/ölçek/test kullanıldığı ve analiz sürecinde en fazla t testi, betimsel istatistik ve korelasyon testlerine başvurulduğu tespit edilmiştir. Ayrıca konu alanında daha çok üstbilişsel farkındalık, üstbilişsel beceri/deneyim ve üstbilişsel öğrenme/öz-düzenleme stratejileri üzerinde çalışıldığı sonucuna ulaşılmıştır.

Anahtar Sözcükler: Üstbiliş, matematik eğitimi, betimsel analiz

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Introduction

One of the goals tried to be reached with the competencies dealt with in the mathematics curriculum is to educate individuals, aiming self-learning, being aware of what and how they learn and can arrange and direct this process (The Ministry of National Education, 2018). To achieve the relevant purposes, it is one of the remarkable points that students should have the metacognitive knowledge and skills and can take responsibility for the learning process (Çiltaş, 2011). Accordingly, the person, who added the metacognition concept first to the literature by substantiating with a study on meta-memory in the 1970s, is Flavell. According to Flavell (1979), metacognition is defined as a concept that individual can arrange and control the activities by following the activities in the learning process related to the functioning of intelligence such as knowing, understanding, perceiving and being aware of etc. In addition, it is noticed that metacognition is defined as the skill of an individual to create and evaluate mental abilities for his/her cognition (Brown, 1987), awareness of the individual for learning (Doğanay and Kara, 1995) and determining the methods that individual can use during the learning process, determining where and how these methods that s/he will use, reviewing each step to progress within the framework of the process; also, the ability to change the method or strategy that s/he use (Özsoy, 2007). Besides, according to Akın (2006), it is known that several concepts such as executive control, executive cognition, metacognition, self-regulation etc. are used instead of metacognition concept in the literature. The sequence of these concepts according to the frequency of use in the literature of our country is as metacognition, metacognitive, beyond cognition, cognitive awareness and executive cognition (Mert, 2018) and this sequence was determined as in this way even in the reviewed theses in this research.

As the literature was analyzed, it is seen that the metacognition generally consisted of two structures including metacognitive knowledge and cognitive regulation (Aydın, 2007; Brown, 1987; Demircioğlu, 2008; Desoete and Roeyers, 2006; Ifenthaler, 2012; Panaoura and Philippou, 2003; Schraw and Dennison, 1994; Schraw, 1998; Cited: Erdoğan, 2013). Although it describes the knowledge that an individual has about his/her mental function, metacognitive knowledge consists of three headings as how an individual will successfully perform a task (procedural knowledge), what information s/he will use in the conditions encountered during performing this task, (situational knowledge) (Flavell,1979), the knowledge of what factors are effective in an individual's ability to perform the given task (declarative knowledge) (Schraw and Moshman, 1995)

Türk (2011) refers that cognitive regulation, which is another element constituting metacognition, is called in different ways in the literature such as executive strategy, metacognitive control, self-regulation and self-assessment. In addition, factors that support control of an individual's mental factors or learning can be defined as the metacognitive arrangement or metacognitive control (Schraw and Moshman, 1995). The individual expresses positive or negative thoughts that occurred related to fulfilling the given tasks with these strategies (prediction); determines the actions that can be used to complete the task (planning); focuses on the progress between the determined actions (tracing) and transfers all the experiences that s/he had during the task to subsequent actions (assessment) (Gourgey, 1998). In addition, metacognitive experiences emerge as a result of the interaction between metacognitive knowledge and metacognitive regulation. Individuals use the metacognitive experiences into renewing, categorizing or improving their knowledge (Aktürk and Şahin, 2011).

Students' skill to uncover metacognitive awareness related to their learning can be ensured with teaching with considering metacognition; that is active participation in the process and controlling the process (Özsoy, 2008). Thus, according to El-hindi (1996), improving the metacognitive skills can be realized with teaching maintained with students' knowing where, when and how to use the required strategies and being active in the process. In the conducted researches, the necessity, that most social support environments should be established by benefiting frequently with strategies such as asking reflective questions, interactive problem solving, providing feedback, judging situation information, using checklists, was noticed (Özsoy, 2008). In teaching these strategies, four approaches, in which direct teaching of metacognitive skills to students is considered in the development of students' metacognitive skills (direct teaching), the teaching of metacognitive skills with structured, effective communication and prepared content within a determined plan is adopted (constructivist practical teaching), consisting of direct explanation, encouragement and mutual dialogue (cognitive guidance),

in which metacognitive skills are taught along with various cooperative learning techniques (collaborative learning) are mentioned (Gelen, 2003).

It is suggested that the level of maturity in children has an important role in the acquisition of metacognitive skills; however, age level progress in parallel with metacognitive development (Özsoy, 2008). The use of strategy consisting of three steps in general in the solution of the encountered problems is mentioned. These are the first periods including the first five years strategies for any purpose could not be used or teaching function could not be provided, the second period consisting of the ages between 6 and 9 at which the strategy for solving the problem can be used but the new strategy cannot be put forward by the individual and the third period, which approximately corresponds to the 4th-grade level, at which the strategy to be used can be assimilated and the strategy that is suitable for solving the problem can be selected (Senemoğlu, 2005). In addition, it is noticed that the awareness of individuals about their learning is higher in adults depending on their life and experience, and also adults can transfer information about their cognition better than young people (Mclnerney and Mclnerney, 2002: 114, Cited: Demirsöz, 2014).

The trends of 136 studies on the metacognition in the field of education and published as articles in Turkey between 2002 and 2016 were analysed by Baş and Özturan- Sağırlı (2017). As a result of the analysis, it was claimed that the number of metacognition themed studies has increased gradually throughout the years except for 2013 and demonstrated a rapid increase in recent five years, that a great number of the studies were carried with pre-service teachers, the researches were designed quantitatively and descriptively, so mainly the quantitative data collection tools were applied. In addition, the researchers also stated that mostly hypothesis and correlational tests were used in the analysis process; on the other hand, the correlations between a metacognitive feature and different features and variables that can affect a metacognitive feature are the most discussed topics. Finally, it was determined that the study focused on general characteristics of the participants such as their awareness of metacognition or a particular aspect of metacognition, strategies, and levels of use. In Turkey, there are many studies with the theme of metacognition and graduate theses have an important place in these studies. As a matter of fact, examining postgraduate thesis studies in a field allows to determine the boundaries of the subject in the field and to look at the subject from a broad perspective (Karadağ, 2009). In the light of the reviewed literature, no study was found in which metacognitionm themed theses were analyzed and evaluated in mathematics education. From this point of view, in this study, it is aimed to determine the characteristics and tendencies of metacognition themed thesis in the field of mathematics education, to present them to educators and researchers and to contribute to mathematics education by creating a basis for new studies. Accordingly, the study aims to review the metacognition themed graduate and doctoral theses in the field of mathematics education within the scope of structural features and topics. According to this purpose, these research questions were asked.

1. What is the distribution of metacognition themed thesis in the field of mathematics education in Turkey according to their structural features (publication year, method, study group, data collection tools and data analysis technique)?

2. What is the distribution of the metacognition themed theses in the field of mathematics education in Turkey according to their topics?

Method

The descriptive content analysis method was employed in this research. This method is a content analysis type in which a general trend is observed by analysing and organising quantitative and qualitative research that is presented differently from each other, in this way, it has a characteristic of a significant resource for future studies in the literature (Cohen, Manion and Morrison 2007; Çalık & Sözbilir, 2014; Selçuk, Palancı, Kandemir and Dündar, 2014).

Collection of the Data

In data collection process, at first, scanning was done with the keywords as metacognition, metacognitive, beyond cognition, metacognitive awareness and executive cognition, using the electronic scanning page of the National Thesis Centre of CoHE. As a result of the scanning, 88 theses conducted between 2005 and 2019 were reached. 8 theses with access restriction were omitted and the

rest 80 theses were recorded. 61 of the 80 theses were graduate theses, 19 were doctoral theses. The theses were coded as T1, T2, T3… in the download order.

Analysis of the Data

The descriptive analysis technique was used in the analysis of the collected data. According to this technique, data are summarised and interpreted according to the formerly determined themes. The purpose of this sort of analysis is to present gathered findings in an arranged and interpreted way (Yıldırım and Şimşek, 2018, p.239). Accordingly, the data analysis pattern prepared by Baş and Özturan-Sağırlı (2017) was taken as the base in data analysis. The most significant points taken into consideration in the analysis process can be summarised as:

• In coding related to the used method, the method expressed by the researcher was taken into consideration.
• Coding related to the study group was performed according to the framework determined in today's education program based on 12-year formal education. For instance, fifth-graders were coded as the secondary school level.
• In coding related to the data collection tools, only the tools applied to measure a metacognitive feature were included in the analysis.
• In coding related to the data analysis technique, only the analysis methods applied for a measure related to metacognition were analysed in the relevant studies.
• In coding related to their topics, each feature related to the metacognitive feature was taken as an analysis unit and in this way, the features within the scope of a study were coded separately.

Cooperative work was done with an academic expert in metacognition and qualitative data analysis in collecting examining and analysis process, arrangements were done according to the feedback and recommendations from the expert within the scope of the processes. For instance, in T5 coded research, the scale, used as the data collection tool, measured a metacognitive structure was determined and corrected according to the feedback by the expert, whose metacognitive structure was measured.

In order to ensure the reliability of the coding process in the analyzes, 40 of the theses were randomly selected and recoded by the researcher after about three months. The agreement between the two encodings was found to be 90%. When the difference between the two encodings is examined; It was seen that 4 theses, which were examined according to the subject tendencies, were coded differently by the researcher in the second coding. In line with expert opinions, the relevant codes were left as they were in the first coding. For example, the research on the effect of problem posing practices in mathematics on the problem posing skills and metacognitive awareness levels of pre-service teachers was coded as a metacognitive skill in the second coding process according to the subject tendency. However, in line with the expert opinion, this research was coded as metacognitive awareness as it was in the first coding. The frequency and percentage values for the data were calculated, gathered findings were presented with tables and graphs.

Findings

Findings gathered within the scope of sub-problems are presented respectively in this section.

Findings Related to the First Sub-problem

The analysis results of the metacognition themed theses on mathematics education in Turkey according to their structural features (publication year, method, study group, data collection tools and data analysis techniques) are presented orderly below.

Distribution According to Years

Findings of the distribution of the numbers of the reviewed theses according to years are presented in Figure 1.
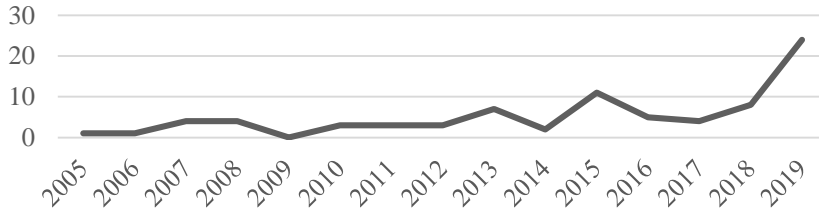
Figure 1. *Distribution of the Numbers of Reviewed Theses according to Their Publication Years*

As it is presented in Figure 1, metacognition-themed articles were started to be conducted in Turkey by the year 2005. It was determined that the number of theses reviewed has maintained its changes with one study in 2005 and 2006, four studies in 2007 and 2008, and three studies in 2010, 2011 and 2012, and that studies have increased through the last years, except for 2009, 2014 and 2017. However, it was observed that the highest number of studies were conducted in 2019 with 24 pieces of research, followed by 11 studies in 2015. On the other hand, it was found that there was no study on the relevant topic in 2009.

Distribution According to Method

Findings of the distribution of the reviewed numbers of theses according to their methods are presented in Figure 2.
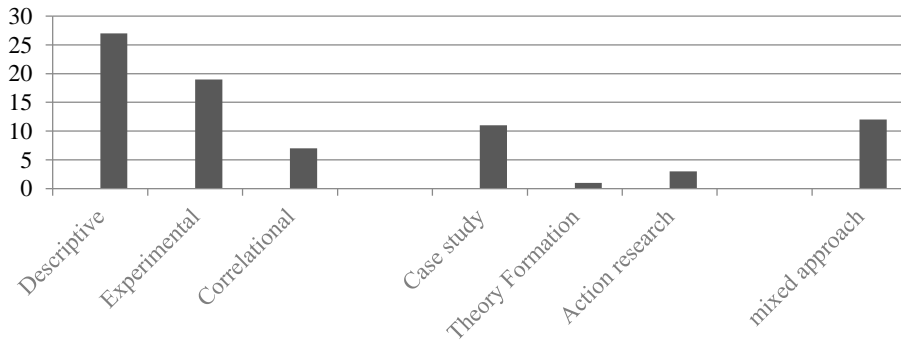

Figure 2. *Distribution of the Number of Reviewed Theses according to Their Methods*

As it is presented in Figure 2, 66 % of the reviewed theses were designed quantitatively, 19% qualitatively and 15% mixed approach. It is observed that 51% of the quantitative studies are descriptive 36% experimental and 73% of the qualitative studies were designed with the case study method.

Distribution According to Study Group

Findings of the distribution of the reviewed numbers of theses according to their study groups are presented in Figure 3.
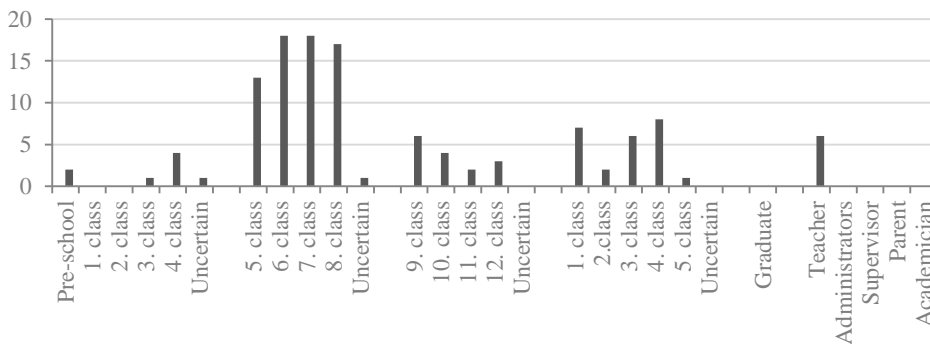

Figure 3. *Distribution of the Number of Reviewed Theses according to Their Study Groups*

As it is presented in Figure 3, it is observed that the theses conducted on the topic of metacognition in mathematics education in Turkey were carried at the level of secondary school, high school and undergraduate. It was determined that there were more studies at 6th and 7th class level at secondary school, 9th class at high school and 1st, 3rd and 4th class level at the undergraduate level. While the number of theses at the primary school and the pre-school level was low, the density at the primary school level is at the 4th class level. As teachers were included in 6 theses, postgraduate students, administrators, parents, supervisors and academicians were not included in any studies.

Distribution According to Data Collection Tools

Findings of the distribution of the reviewed numbers of theses according to their data collection tools are presented in Figure 4.
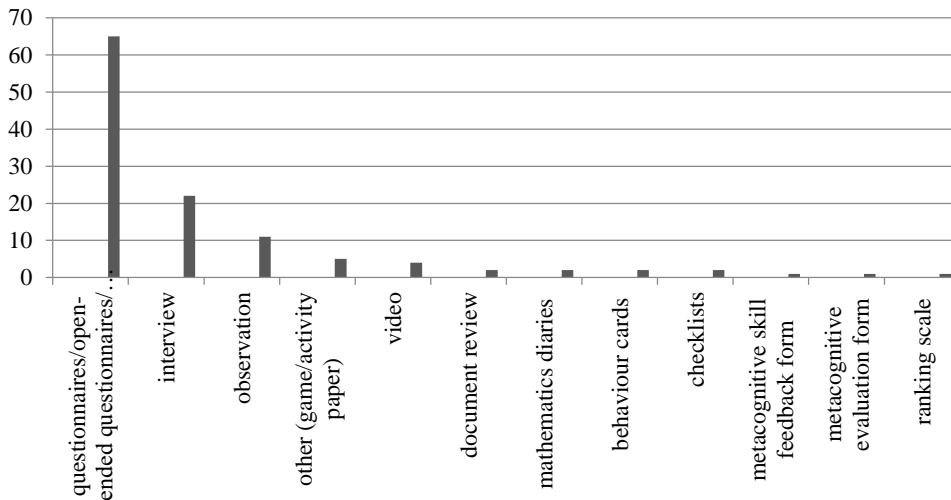

Figure 4. *Distribution of the Reviewed Numbers of Theses according to Their Data Collection Tools*

As it is presented in Figure 4, it is seen that as the data collection tools applied in the metacognition themed theses on mathematics education in Turkey, questionnaires/open-ended questionnaires/ scales/ tests were distinctly more than others (65); however, interviews (22) and observations (11) were preferred than the others. It is also noticed that video (4), mathematics diaries (2), behaviour cards (2), checklists (2), ranking scale (1), metacognitive skill feedback form (1) and metacognitive evaluation form (1) were preferred less in general. The data collection tools classified under the heading of 'others' (5) were game and activity papers.

Distribution According to Data Analysis Techniques

Findings of the distribution of the reviewed numbers of theses according to their data analysis techniques are presented in Figure 5.
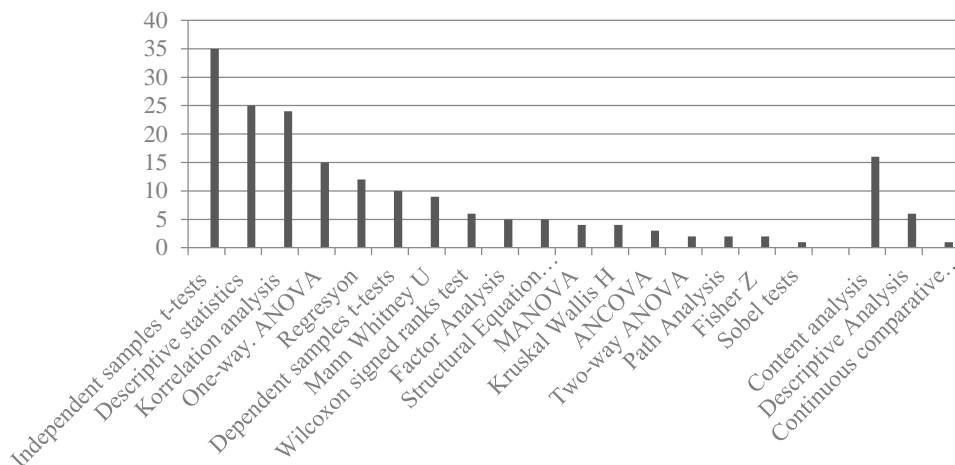
Figure 5. *Distribution of the Reviewed Numbers of Theses according to Their Data Analysis Techniques*

As it is presented in Figure 5, it is determined that mainly the independent samples t-tests (21%), descriptive statistics (15%) and correlation analysis (approximately 13%) were used in the analysis of the quantitative data. On the other hand, the content analysis (8%) was applied most in the analysis of the qualitative data.

Findings Related to the Second Sub-problem

Findings related to the distribution of the metacognitive themed theses on mathematics education in Turkey according to their topics are presented respectively in Table 1, 2, 3, 4 and 5.

The distribution of the features associated with metacognitive features in the reviewed theses is presented in Table 1.

Table 1

Features Associated with a Metacognitive Feature in the Reviewed Theses

Metacognitive Feature	*Other Associated Feature*	*f*
	Mathematics achievement scores	6
	Mathematics anxiety	2
	Mathematical metacognitive awareness	2
	Life experiences	1
	Model and modelling	1
	Mathematical problem-solving levels	1
	Report card scores	1
	Reflective thinking related to problem-solving	1
	Problem posing performances	1
Metacognitive Awareness Level	Social anxiety	1
	Positive belief	1
	Cognitive awareness	1
	Uncontrollability and danger	1
	Cognitive confidence	1
	Mathematics oriented risk-taking behaviour	1
	Mathematical thinking skills	1
	Anxiety towards teaching mathematics	1
	Mathematics course anxiety	1
	Mathematics practise anxiety	1
	Calculation anxiety	1

	Academic achievement	4
	Problem-solving	2
	Attitude towards mathematics course	1
Metacognitive Skill/Experience	Attitude towards educational mathematics games	1
	Problem-solving strategies	1
	Mathematical self-efficacy	1
	Self-regulation skills	1
	Inhibition	1
	Substructures of metacognition	1
	Problem-solving achievement	3
	Mathematical reasoning skills	2
Metacognitive Learning/Self-regulation Strategies	Problem-solving skill perceptions	1
	Self-efficacy perceptions	1
	Academic achievement	1
Total		48

As it is presented in Table 1, metacognitive awareness is associated with 20 features, metacognitive skill/experience with 9 and metacognitive learning/self-regulation strategies with 5. It is noticed that the highest associated skills are as mathematics achievement scores (6), academic achievement (4) and problem-solving achievement (3). In addition, it was determined that academic achievement is associated both with metacognitive skill/experience and metacognitive learning/self-regulation strategies.

Findings related to determining a metacognitive feature or situation in the reviewed theses are presented in Table 2.

Table 2

Metacognitive Features or Situations Determined in the Reviewed Theses

Determined Metacognitive Feature	*f*
Metacognitive awareness level	9
Metacognitive strategy use	3
Metacognitive behaviours in problem-solving	2
Metacognitive behaviours in problem posing	2
The accuracy level of metacognitive tracking	1
Comparing of the online and offline methods used in the metacognition measurement	1
Metacognitive skill and self-regulation level	1
Mathematical metacognition levels	1
Comprehension awareness of teachers related to problem-solving and metacognition issues	1
Metacognitive knowledge and skill levels in activities in which mathematical software can be used	1
Metacognitive structures used for mathematical modelling in technology-supported environments	1
Secondary school teachers 'behaviours to activate students' metacognition in problem-solving environments	1
Educational status designed to influence metacognitive behaviour	1
Metacognitive behaviours of primary school graduate Turkish students towards PISA 2003 mathematics literacy	1
Metacognition and self-regulation behaviours in mathematical measurement processes	1
Metacognitive skills in algebraic non-verbal problem solving	1
Total	28

As it is presented in Table 2, mostly the level-determining studies related to metacognitive awareness (9) metacognitive strategy use (3), metacognitive behaviours in problem-solving (3) and metacognitive behaviours in problem-posing (3) were conducted by the researchers. Other 12 metacognitive features are analysed within the scope of one each research.

Findings related to a metacognitive feature being dependent and independent variable in the reviewed theses are presented in Table 3.

Table 3

The Status of a Metacognitive Feature as a Dependent and Independent Variable in the Reviewed Theses

Dependent Variable	Independent Variable	f
Metacognitive awareness	Collaborative learning	2
	The game supported mathematics teaching	1
	Project-based learning	1
	Mathematics diary use	1
	Problem posing studies	1
Metacognitive skill	Differentiated teaching	1
	Metacognitive strategy use	1
	Writing activities	1
	Metacognition focused problem-solving support program	1
	Algebraic verbal problem teaching	1
	Metacognitive strategy teaching	1
	Teaching related to multiple intelligences	1
	Collaborative learning	1
	Reflective question-based wiki environments	1
Academic achievement	Metacognitive strategy use	1
	Metacognition supported collaborative learning	1
	Metacognition awareness level	1
	Metacognitive str.learn. and self-regulation skills	1
Attitude	Metacognitive strategy use	1
	Metacognition supported collaborative learning	1
Metacognitive behaviours	7e model	1
Metacognitive strategies	Education year	1
Problem-solving process	Metacognitive strategy use	1
Conceptual knowledge development	Metacognitive strategy use	1
Operational knowledge development	Metacognitive strategy use	1
Total		25

As it is presented in Table 3, it is seen that metacognitive awareness, metacognitive skills, academic achievement, attitude, metacognitive behaviour, metacognitive strategies, problem-solving process, conceptual and operational knowledge development were investigated as dependent variables in experimental theses and metacognitive skills (9) was focused mostly in the studies. It is realised that t metacognitive strategy use (6) and cooperative learning (4) is the most studied topics as independent variables. In some of the reviewed theses, the predicting status of a metacognitive feature alone or with different features, or their status of being predicted were investigated. Gathered findings are presented in Table 4.

Table 4

Features Predicting a Metacognitive Feature and a Metacognitive Feature is Predicted in the Reviewed Theses

Predicting Feature		Predicted Feature	f
Metacognitive awareness		Problem-solving skills	2
		Mathematics achievement	1
		Mathematics achievement	1
	+ Perception assoc. with problem-solving skill	Self -efficacy perceptions towards the teaching profession	1
		Problem-solving skill perception	1
		Self-efficacy levels for the teaching	1

		Thinking styles	1
		Mathematics achievements	1
		Mathematics self-concept scores	1
Metacognitive strategies	+ problem-solving skill perceptions + self-efficacy perceptions + university entrance exam scores	Mathematics achievement	1
Metacognitive skills		Mathematics achievement	1
	+ inhibition	Mathematics achievement	1
Problem-solving skills		Metacognitive awareness	1
metacognitive str+metacognitive experience+metacognitive knowledge	+ cognitive str	Mathematics achievement	1
Total			**15**

As it is presented in Table 4, it is seen that a feature related to metacognition predicts 14 features with single or various variables (6). The feature, whose predicting status was investigated most is metacognitive awareness with the frequency of 7. The feature, which was predicted most, is mathematics achievement with the frequency of 6. No research, in which a metacognitive feature (metacognitive awareness) was predicted with a different feature (problem-solving skill), was encountered. In some of the reviewed theses, it was investigated whether demographic variables are effective on a metacognitive feature or not. Findings related to these studies are presented in Table 5.

Table 5

Variables whose Effects on a Metacognitive Feature are Investigated in the Reviewed Theses

Feature	*Variable*	*f*	*Feature*	*Variable*	*f*
Metacognitive Awareness	Gender	18	Metacognitive skills	gender	2
	Class level	9		Mother's education level	1
	Age	4		Father's education level	1
	Academic achievement	3		School type	1
	Graduated school type	2		Different teaching methods	1
	Mother's education level	2	Metacognitive learning and self-regulation strategies	Gender	2
	Father's education level	2		Mathematics achievement	1
	School type	2		Score type of uni. entr. exam (ÖSS)	1
	Studied university	2		School type	1
	Graduation status	1		Years of education	1
	Professional rank	1		Department of education	1
	Achievement perception	1	Metacognitive experience	Mathematics achievement	1
	Income level	1		Gender	1
	Mathematics achievement	1		School type	1
	Mother's profession	1		Problem difficulty level	1
	Father's profession	1		Student's group level	1
	Field of graduation	1	Metacognitive strategy use frequency	Problem difficulty level	1
	Geographic region	1		Student's group level	1
	Group of education	1	Possessed metacognitive knowledge	Student's group level	1
Mathematical metacognition awareness	Gender	2			
	Class level	1			
	Studied department	1			
	Branch	1			
	Number of the book read	1			

As it is presented in Table 6, it is seen that totally the effects of 81 variables on 7 features, consisting of metacognitive awareness related to metacognition, mathematical metacognitive awareness, metacognitive skills, metacognitive learning and self-regulation strategies, metacognitive experience, frequency of metacognitive strategies use, and possessed metacognitive knowledge. It was determined that the metacognitive awareness was studied most among the metacognitive features (54); besides, the variable whose effect was investigated most was gender (25). Some of the other variables were orderly as class level (10), school type (5), age (4), mother's education level (3), father's education level (3), academic achievement (3), mathematics achievement (3), student group level (3) and graduated school type (2).

Discussion, Conclusion and Recommendations

In this study, the metacognition themed theses on mathematics education in Turkey were reviewed in terms of their publication year, used method, study groups, data collection tools, data analysis techniques and topics. Results gathered in terms of each review topic are summarised below.

It was found that the metacognition themed theses on mathematics education in Turkey were begun to be conducted in 2005, the number of theses has increased in recent years except for 2009, 2014 and 2017. In addition, it was reached that most studies were conducted in 2019. This result of the research, even if the metacognitive studies that started in the 1970s were reflected in our country later, as Baş and Özturan-Sağırlı (2017) suggest, supports the view that it is still more popular today.

It can be stated that the quantitative approach was employed and the researchers focused on the descriptive/experimental studies in most of the reviewed theses. This result of the research demonstrates a similarity with the study conducted by Baş and Özturan-Sağırlı (2017). On the other hand, it was realised that in the researches, in which the qualitative approach was employed, the case study method was applied. Case study, which provides the opportunity to investigate and interpret a group, event or correlation in-depth, is one of the qualitative research methods (Cohen et al., 2007). This case can be expressed as the researchers try to investigate the metacognition concept in mathematics education in depth from different perspectives in Turkey.

As it was taken into consideration in terms of the study groups, it was noticed that the theses were conducted mostly at the secondary school 6th, 7th and 8th class levels, at graduate 1st, 3rd and 4th class levels and high school 1st class levels; however, the number of studies was low at the primary and pre-school periods (except for 4th class).

This result of the study supports the view of Senemoğlu (2005), who refers that metacognitive development begins in children approximately in the fourth grade and they can understand the strategy and choose the appropriate strategy. In addition, it can be stated that the view in the study by Demirsöz (2014), cited by Mclnerney and Mclnerney (2002) that individuals' awareness of their learning is higher in adults depending on their life and experience, also, supports this view that adults are better able to convey information about their cognition than young people. In addition, it can be thought that the respectively low number of studies at the high school level is because of students taking the university entrance exams at upper-class levels. Furthermore, it was found that sub-study was conducted with teachers, but no study with graduate students, administrators, supervisors or academicians were encountered. Considering that the development of students' knowledge and skills is closely related to the teaching process, it can be stated that teachers have a critical role in providing this integration (Jaworski, 2006), and in this context, the number of studies with teachers is low. It is known that it is impossible to reach different results by applying similar methods in a dynamic structure like the school system. As it is known that school administrators can develop different strategies when they encounter new and different situations by using metacognitive skills (Blakey and Spence, 1990), that no research was conducted in this field is regarded as a deficiency.

It was determined that mostly questionnaires/ open-ended questionnaires/ scales/ tests were applied as data collection tools. It can be stated that this result originates from that the reviewed theses within the scope of the research were analysed with a quantitative approach. This result of the study is parallel with the study conducted by Baş and Özturan-Sağırlı (2017). In addition, it was observed that interview and observation were secondly applied data collection tools.

As the data analysis techniques were evaluated, the most applied data analysis techniques in the theses were determined as t-test, descriptive statistics, correlation and one way ANOVA analyses. The reason why these analyses were applied in the reviewed theses can be referred as that there are many studies in which metacognitive features were associated, descriptive results were derived from the observation values obtained about metacognition, and variables that may affect metacognitive features were analysed.

As it was handled within the scope of study topics, it was observed that in association-based theses, metacognitive awareness, metacognitive skills/experience, and metacognitive learning/self-regulation strategies were mostly studied and associated with academic achievement features. In the theses in which metacognitive feature level was determined, it was also found that the studies in which metacognitive awareness was investigated were more. In studies, in which metacognitive feature is the dependent variable, mostly the effect of teaching strategies on metacognitive skills was investigated; in the studies, in which metacognitive feature is the independent variable, mostly the effect of metacognitive strategies use on the features such as cognitive knowledge development, attitude, academic achievement, problem-solving process and metacognitive skills, was investigated. In prediction studies, it was noticed that the feature, in which the predictive status was investigated most, was metacognitive awareness, and the most predicted feature was mathematics achievement. In studies, in which the effect on a metacognitive feature was investigated, the effect of variables on metacognitive awareness was investigated most. Furthermore, gender, class level and school type were the most studied variables whose effects on metacognitive features were studied most.

Considering these results;

- The number of studies on metacognition topic in the field of mathematics teaching at high school level and with teachers can be increased, studies consisting of school administrators can also be conducted.
- Studies, on metacognition topic in the field of mathematics education in which demographic variables whose effects on metacognitive features are investigated and considered as a whole can be conducted.
- Studies, in which a metacognitive feature is associated with epistemological understanding and belief, can be conducted in the field of mathematics education.

References

Akın, A. (2006). *The relationships between achievement Goal Orientations and Metacognitive Awareness, parenting styles and academic achievement.* (Unpublished master thesis). Sakarya University Institute of Social Sciences, Sakarya.

Aktürk, A.O., & Şahin, İ. (2011). Metacognıtıon and computer teachıng. *Journal of Ahmet Keleşoğlu Education Faculty, 31*, 383-407.

Aydın, U. (2007). *A structural equation modeling study: The metacognition-knowledge model for geometry.* (Unpublished master thesis). Middle East Technical University Institute of Science, Ankara.

Baş, F., & Özturan-Sağırlı, M. (2017). A content analysis of the articles on metacognition in education in Turkey. *Education and Science, 42*(192), 1-33.

Blakey, E., & Spence, S. (1990). *Developing Metacognition*. ERIC Digest.

Brown, A. L. (1987). Metacognition, executive control, self-regulation, and other even more mysterious mechanisms. In Weinert, F.E., & Kluwe, R.H. (Eds.), *Metacognition, motivation and understanding* (pp. 65-116). Hillsdale, Nj: Lawrence Erlbaum Associates.

Cohen, L., Manion, L., & Morrison, K. (2007). *Research methods in education* (6th ed.). New York, NY: Routledge.

Çalık, M., &Sözbilir, M. (2014). Parameters of content analysis. *Education and Science, 39*(174), 33-38.

Çiltaş, A. (2011). A study on the ımportance of self-regulation teaching in education. *Mehmet Akif Ersoy University Journal of Social Sciences Institute, 3*(5), 1-11.

Demircioğlu, H. (2008). *Effectiveness of educational events designed for the development of metacognitive behaviours of prospective mathematics teachers.* (Unpublished doctoral dissertation). Gazi University Institute of Education Sciences, Ankara.

Desoete, A., & Roeyers, H. (2006). Metacognitive macro evaluations in mathematical problem solving. *Learning and Instruction, 16*, 12–25.

Doğanay, A., & Kara, Z. (1995). Dimensions of thinking. *Çukurova University Journal of Education Faculty, 1*(11), 25-38.

El-Hindi, A. E. (1996). Enchancing metacognitive awareness of college learners. *Reading Horizons, 37*, 214-230.

Erdoğan, F. (2013). *Research on the effect of cooperative learning method enhanced with metacognitive strategies, on the academic achievement, metacognitive skills and attitude towards mathematics of 6th grade students in mathematics teaching.* (Unpublished doctoral dissertation). Marmara University Institute of Education Sciences, Istanbul.

Flavell, J. H. (1979). Metacognition and cognitive monitoring: A new area of cognitive development inquiry. *American Psychologist, 34*(10), 906-911.

Gelen, İ. (2003). *The effects of metacognitive strategies on attitudes toward Turkish course, reading comprehension achievement and retention.* (Unpublished doctoral dissertation). Çukurova University Institute of Social Sciences, Adana.

Gourgey, A.F. (1998). Metacognition in Basic Skills Instruction. *Instructional Science, 26*, 81-96.

Ifenthaler, D. (2012). Determining the effectiveness of prompts for self-regulated learning in problem-solving scenarios. *Educational Technology & Society, 15*(1), 38–52.

Jaworski, B. (2006). Theory and practice in mathematics teaching development: critical ınquiry as a mode of learning in teaching. *Journal of Mathematics Teacher Education, 9*, 187-211.

Ministry of Education. (2018).*Elementary mathematics curriculum and guide: 6-8. classes.* Ankara: State Books Directorate.

Mert, M. (2018). *The effect of levels of respect and student awareness for mathematics in mathematical success of secondary school students.* (Unpublished master thesis). Erzincan University Institute of Science and Technology Elementary Education Department, Erzincan.

Mclneryney, D. M., & Mclnerney, V. (2002). *Educational Psychology-Constructing Learning,* Pearson Education Australia Pty Limited, Prentice Hall.

Özsoy, G. (2007). *The effect of metacognitive instruction on problem solving achievement of fifth grade primary school students.* (Unpublished doctoral dissertation). Gazi University Institute of Education Sciences, Ankara.

Özsoy, G. (2008). Metacognıtıon. *Turkish Journal of Educational Sciences, 6*(4),713-740.

Panaoura, A., & Philippou, G. (2003). The construct validity of an inventory for the measurement of young pupils' metacognitive abilities in mathematics. In N. A. Pateman, B. J. Doherty, & J. Zilliox (Eds.), *Proc. 27th Conf. of the Int. Group for the Psychology of Mathematics Education* (pp. 437-444). Honolulu, Usa: Pme.

Schraw, G. (1998). Promoting general metacognitive awareness. *Instructional Science, 26* (1-2), 113-125.

Schraw, G., &Moshman, D. (1995). Metacognitive theories. *Educational Psychological Review, 7*, 351–371.

Schraw, G., & Sperling-Dennison, R. (1994). Assessing metacognitive awareness. *Contemporary Educational Psychology, 19*, 460-470

Selçioğlu-Demirsöz, E. (2014). Metacognitive awareness and ıts developing. *Trakya University Journal of Education 4*(2), 112-123.

Selçuk, Z., Palancı, M., Kandemir, M., & Dündar, H. (2014). Tendencies of the researches published in education and science journal: content analysis. *Education and Science,39*, 173, s.430-453.

Senemoğlu, N. (2005). *Development, learning and teaching: From Theory to Practice* (12th ed). Gazi Bookstore.

Türk, E.G. (2011). *Factors predicting adolescents? thinking styles: Parents, metacogniton and epistemological beliefs. (*Unpublished doctoral dissertation). Ankara University Institute of Educational Sciences, Ankara.

Yıdırım, A., & Şimşek, H. (2018). *Qualitative research methods in the social sciences* (11th ed.). Ankara: Seçkin.