UDC 378.4
CSCSTI 14.35.09
DOI 10.52301/1991-0614-2024-1-47-64

Yasin Gokbulut*[1], Esra Yenidunya[2], Dilek Sahinpınar[3]

[1] Tokat Gaziosmanpasa University, Tokat, Turkiye.
[2] Ministry of Education, Turkiye.
[3] Agrı İbrahim CeCen University, Agrı, Turkiye.
yasin.gokbulut@gop.edu.tr

METACOGNITIVE TENDENCIES IN GRADUATE MATHEMATICS THESES IN TURKEY BETWEEN 2008–2023

Annotation. *This study aims to analyse the theses on metacognitive mathematics written in Turkey between 2008 and 2023 according to some variables. Metacognitive mathematics is an important field that includes high-level cognitive skills such as understanding mathematical problem solving processes, using learning strategies and developing metacognitive awareness about mathematics. This study will evaluate the number of theses in this field in Turkey, their distribution by years and their increasing trend. In addition, it aims to determine in which areas metacognitive mathematics research is more concentrated by examining the topics and sub-fields that the theses focus on. Data were obtained from Yok National Thesis Centre. As a result of the literature search with 3 keywords (mathematical metacognition, metacognition, metacognitive mathematics), 4 doctoral and 17 master's theses related to the subject between 2008 and 2023 were reached. Descriptive content analysis was used for the analysis. According to the data obtained, it can be said that the keywords metacognition, metacognitive awareness and problem solving were used the most, the most studies were conducted at Cukurova University, the interest in the subject has gradually increased in recent years, the most studies were conducted in 2019, 2021 and 2022, access to theses is open, Master's studies on the subject are more preferred, the sample level is generally secondary school, and the studies conducted in 7th grades in secondary school are more.*

Keywords: *metacognitive mathematics, research trends, metacognition, mathematics teaching, metacognitive strategies, higher education, professional development.*

Introduction

This study aims to identify the higher education theses associated with the keyword «Metacognitive Mathematics» in the YOK National Thesis Centre between 2008 and 2023 and to make a detailed description of these theses within the framework of the specified criteria.

The key questions that determine the problem situation of the study are as follows:

How is the distribution of the studies published between 2008–2023 containing metacognitive mathematics keywords according to the keywords they use?

What is the distribution of the studies published between the years 2008–2023, which contain the keywords of metacognitive mathematics, according to the universities to which the institutes are affiliated?

What is the distribution of the studies published between 2008–2023 containing metacognitive mathematics keywords according to the year of publication?

What is the distribution of the studies published between 2008–2023 containing metacognitive mathematics keywords according to their distribution and whether they are open to access or not?

What is the thesis type of the studies containing metacognitive mathematics keywords published between 2008–2023?

What is the distribution of the studies published between 2008–2023 containing metacognitive mathematics keywords according to the sample/study group?

What is the distribution of the studies published between the years 2008–2023 containing metacognitive mathematics keywords according to the research design/ methods used?

What is the distribution of the studies published between 2008–2023, which include metacognitive mathematics keywords, according to the data collection tools they use?

What is the distribution of the studies published between 2008–2023 on the data analysis methods used in the studies containing metacognitive mathematics keywords?

Metacognition is important for the effective realisation and control of learning processes. This means creating students' awareness of learning processes and showing strategic behaviours. Metacognition is associated with the student's conscious execution of learning actions and is a factor that increases student success.

Sare Sengul used the term metamemory for the first time in a study conducted to determine children's metamemory abilities and introduced this concept to the literature [1].

Metacognition is defined as the ability to control and direct one's own cognitive processes [2].

Some researchers have explained metacognition as determining and understanding the factors affecting cognition, monitoring and controlling the cognitive process.

Metacognition is an important concept that enables individuals to control and direct their learning processes. Metacognitive knowledge refers to the individual's knowledge about his/her own cognitive processes, strategies and variables in the learning process. This knowledge is based on the individual's awareness of how well he/she knows himself/ herself and what kind of strategies he/she should use in the learning process.

Metacognitive judgements and monitoring/controlling involve individuals making evaluations about the difficulty of the tasks they undertake. This stage also includes monitoring and evaluating one's own learning process. The individual evaluates how well

he/she understands himself/herself, how he/she manages the learning process and his/her self-confidence.

Self-regulation and control of cognition include the skills necessary for the individual to effectively direct the learning process. The individual uses the ability to plan, identify strategies and gather resources to take control of his/her will. This means that the individual organises and takes control of his/her own learning efforts.

All these metacognitive processes are the cornerstones of effective learning. Individuals can direct their learning processes more consciously and strategically by developing their metacognitive skills. This contributes to an increase in student success and a more effective learning experience [4].

The concept of metacognition has been analysed in different dimensions by different researchers. Wells defined the three dimensions of metacognition as metacognitive knowledge, metacognitive experiences and metacognitive control. Metacognitive knowledge refers to the knowledge that an individual has about his/her own cognitive processes and strategies. Metacognitive experiences means that the individual directs the learning process based on his/her previous learning experiences and learns from his/her experiences. Metacognitive control refers to the individual's ability to organise and direct the learning process effectively. Schraw explained metacognition with two main components: Knowledge about cognition and regulation of cognition. In other words, the individual's knowledge of his/her own cognitive processes and strategies and how these cognitive processes are organised and directed play an important role.

These different dimensions emphasise the complexity and importance of the concept of metacognition. Developing metacognitive skills helps individuals to manage their learning processes more effectively and efficiently. Metacognitive awareness plays a critical role in increasing student achievement and having a more effective learning experience [6].

Metacognition is an important concept that includes knowledge and awareness of one's own cognition and regulation of cognition. Knowledge of cognition refers to the knowledge that an individual has about his/her own cognition and learning processes. This knowledge is based on the individual's awareness of what kind of strategies he/she can use, what abilities he/she has and what kind of actions he/she can perform.

The dimension of organising cognition consists of five sub-dimensions to manage the learning process effectively. These dimensions are called planning, monitoring, evaluating, debugging and managing knowledge. Planning involves identifying appropriate strategies and distinguishing resources that affect performance. Monitoring involves analysing performance on the task and momentary awareness. Evaluation involves analysing one's performance and strategies in relation to one's own learning product and learning process.

Debugging is used to identify and correct errors in the learning process. Knowledge management involves the process of summarising, analysing and focusing on knowledge.

There is a close relationship between metacognitive thinking skills and problem solving. Students who solve problems well usually have metacognitive skills. The development of metacognitive skills contributes to more effective and successful learning and problem solving processes [7].

Metacognition refers to the ability of individuals to monitor and regulate their learning processes. Their ability to understand and evaluate their own cognitive processes, learning strategies and variables is referred to as an individual's metacognitive knowledge. This knowledge is based on how well a person realises their own learning potential and their ability to determine which learning approaches are most effective.

Metacognitive evaluation and observation involves the capacity to assess the complexity and difficulties of one's own learning process. This relates to the ability to monitor and analyse one's own learning experiences. How well a person understands their own learning process, how they manage it and how confident they feel depends on the answers to these questions.

Self-regulation and cognitive control include the ability to manage one's learning process efficiently. The ability to plan, set strategies and manage resources represents the ability to organise and control one's learning efforts.

These dimensions of metacognitive abilities are vital for effective learning. Individuals who increase their metacognitive abilities can manage their learning processes more consciously and strategically. This is an important factor in increasing the efficiency and effectiveness of learning experiences.

Individuals' knowledge and awareness of their own cognitive processes and learning experiences is one of the key components of metacognition. Cognitive knowledge refers to a person's knowledge of their own cognition and learning processes. This knowledge is based on a person's awareness of what strategies he/she can use, what abilities he/she has and what kind of actions he/she can perform.

Cognitive knowledge is analysed in three sub-dimensions: explanatory knowledge, situational knowledge and procedural knowledge. Explanatory knowledge includes knowledge about what strategies are and how they are used. Situational knowledge represents the knowledge about when and why to use strategies.Procedural knowledge includes the knowledge about how to apply strategies.

The organisation of cognition dimension represents the ability to manage the learning process and consists of five sub-dimensions: planning, monitoring, evaluation, error correction and knowledge management. These dimensions show how effectively the individual can manage the learning process.

There is a clear relationship between metacognitive thinking ability and problem solving skills. Students with good problem solving skills usually also have metacognitive abilities. This is especially true for students who excel in maths and problem solving skills. The development of metacognitive abilities helps to manage learning and problem solving processes more effectively and successfully.

Many studies have obtained significant results when examining the link between metacognition and mathematical problem solving abilities. For example, they examined the metacognitive behaviours of primary school students in the process of solving arithmetic verbal problems and found differences between the performances of students with and without metacognitive skills [8]. It was observed that students who did not have metacognitive skills could not fully comprehend the problems, got bogged down in unnecessary details, and made mistakes by using misleading strategies. On the other hand, students with metacognitive skills were able to analyse the problems effectively, determine various strategies and were more successful in solving them.

In another study, Demir evaluated the effect of cognitive, metacognitive and affective characteristics of eighth, tenth and third year university students on their success in probability and mathematics. According to the results of the study, it was found that metacognitive abilities and motivation significantly explained mathematical achievement, but affective characteristics did not have a significant contribution in explaining probability achievement. However, cognitive and metacognitive abilities were found to have a significant contribution to probability achievement [9].

A study conducted by Canca aimed to determine the effect of students' cognitive and metacognitive learning strategies on mathematics achievement [10]. The participants of this study were 106 students attending the mathematics analysis II course. The findings showed that the simultaneous use of metacognitive learning strategies and cognitive strategies had a significant relationship between mathematics achievement levels.

In a study conducted by Saban, the relationship between cognitive awareness and motivation was examined. In the sample of 545 students, it was determined that there was a significant difference in the cognitive awareness of female students in terms of gender, but there was no significant difference in terms of grade level [11].

In a study conducted by Memis and Arıcan, the relationship between mathematical metacognition levels and achievement scores of fifth grade students was analysed. Students' mathematical metacognition levels were measured by using the «Metacognitive Knowledge and Skills Scale» (MSA-TR), which was translated into Turkish by Ozsoy and adapted for fifth grade. According to the results of the study, a strong positive relationship was found between students' metacognition total scores and their end-of-year achievement grades [12].

In a study conducted by Ozsoy and Ataman, the effect of teaching metacognitive strategies on the problem solving skills of fifth grade students was examined. The experimental group was taught metacognitive strategies for a certain period of time and the control group continued their normal course processes. The results of the study showed that the fifth grade students in the experimental group showed a significant increase in their metacognition and problem solving achievement levels during the specified period. In addition, a significant difference was found between the planning scores of the experimental and control group students [13].

In a study conducted by Tok et al., it was shown that there is a link between metacognitive awareness levels and academic achievement of university students. In particular, it was determined that evaluation skill, as a sub-dimension of metacognitive awareness, significantly affected students' academic achievement [14].

Materials and methods

According to the definition of Yıldırım and Simsek, the document review method aims to examine and analyse many sources related to the determined subject in detail. This method provides a comprehensive evaluation of written materials and an in-depth understanding of the existing information on the subject. Document analysis allows researchers to collect and analyse information based on existing data. In this way, important information about the research area is obtained and a more comprehensive perspective is provided. In this study, in order to examine the theses on metacognitive mathematics, the written sources in YOK National Thesis Centre were evaluated by document review method. With this method, the researchers examined many theses in detail and identified the current trends in the field of metacognitive mathematics. The contents of the theses were analysed by descriptive content analysis and the results obtained were evaluated. In this way, detailed information about the themes, approaches and trends in the theses in the field of metacognitive mathematics was obtained. The research contributed to the in-depth analysis of the existing information in the literature and to the understanding of the developments in the field.

In this study, the theses obtained from YOK National Thesis Centre were examined one by one and those with metacognitive mathematics content were included in the study. Three different keywords were used to scan the theses and 21 theses were found as a result of this scan. Of these 21 theses, 17 were master's theses and 4 were doctoral theses. The contents of the theses, trends and findings related to metacognitive mathematics were analysed descriptively. In this way, a comprehensive evaluation of the existing research in the field was made and important data were presented to researchers.

This form is based on the opinions of experts in the field and consists of six sections. The six sections in the form are as follows:

1. Imprint information of the thesis: Basic information of the thesis such as title, author, supervisor are included in this section.

2. Subject of the thesis: The subject on which the thesis focuses and the field it analyses are stated in this section.

3. Method: The methods used in the thesis and how these methods are applied are explained in this section.

4. Data collection tools: The tools used in the data collection process of the thesis and the nature of these tools are included in this section.

5. Sample: The sample group of the thesis, the number of participants and their characteristics are described in detail in this section.

6. Data analysis methods: How the data obtained by the thesis are analysed and which methods are used are explained in this section.

The thesis classification form has a structure that includes important details of the theses examined and thus helps to evaluate and analyse the theses in a systematic way. This method was used to increase the reliability of the research and to ensure a consistent evaluation of the data obtained.

The thesis studies included in this study were collected by the researcher as a result of the search with the key concepts determined by the researcher from YOK National Thesis Centre. It took approximately 12 days to fill in the thesis classification form used in the data collection process.

The researcher used certain key concepts to identify the most appropriate and relevant theses that could be obtained from the Council of Higher Education (YOK) National Thesis Centre. As a result of this search, relevant theses were determined in accordance with the scope of the study.

The thesis classification form used in the data collection process has a structure that includes important details such as the title information, subject, method, data collection tools, sample and data analysis methods. The researcher worked for approximately 12 days for the detailed examination of the collected theses and filling out the form.

This data collection process was carried out meticulously in order to increase the reliability of the study and the accuracy of the results obtained. The screening and form filling processes are of great importance to achieve the aim of the study and to evaluate the relevant information in a systematic way.

The theses obtained from YOK National Thesis Centre were examined one by one and the ones on metacognitive mathematics were included in the study. In this process, a total of 5 theses, 3 master's theses and 2 doctoral theses, randomly selected, were subjected to classification by two different researchers. In order to ensure the reliability of the analyses, disagreements and possible incompatibilities that emerged in the classification process of the theses were taken into consideration and a common point was agreed upon.

Afterwards, the data in the thesis classification form were obtained from the theses and content analyses were performed. Important details such as the title information, subject, method, data collection tools, sample and data analysis methods of the theses were analysed with descriptive statistics.

The findings obtained were visualised and interpreted through tables containing percentage and frequency values. This method was used to achieve the aim of the study and to present the data obtained in a more meaningful way. The analysis and interpretation of the data are of great importance to reach the results of the study and to reveal the trends of theses on metacognitive mathematics.

Results and Discussion

In this study, the title information, research topics, research methods used, sample information, data collection tools and data analysis methods of the theses were examined in detail and presented visually in the tables below. These tables provide a more understandable and comparable presentation of the data obtained.

The tables contain the basic information of each thesis and are classified according to the characteristics analysed in the study. These data obtained by the researchers allow us to better understand the trends and preferred methods of the theses. Presenting the analysed data in tables is an important step to achieve the purpose of the study and to convey the findings in a more descriptive way.

The distribution of theses on metacognitive mathematics between 2008–2021 according to the keywords used is given in Table 1.

Table 1. Frequency and Percentage Distributions of the Keywords Used in the Scanning and the Accessed Postgraduate Theses

Sequence No	Keyword	f	%
1	Metacognition	8	10,96
2	Problem Solving	5	6,85
3	Metacognitive Awareness	5	6,85
4	Maths Achievement	4	5,48
5	Mathematics Education	2	2,74
6	Mathematical Metacognition	2	2,74
7	Secondary School Students	2	2,74
8	Attitude	2	2,74
9	Metacognition Skills	2	2,74
10	Academic Success	1	1,37
11	Argumentation	1	1,37

Sequence No	Keyword	f	%
12	Success	1	1,37
13	Skill	1	1,37
14	Skill Based Maths Questions	1	1,37
15	Knowledge of Cognition	1	1,37
16	Organising Cognition	1	1,37
17	Algebra	1	1,37
18	Algebraic Verbal Problem	1	1,37
19	General Metacognition	1	1,37
20	Realistic Maths Education	1	1,37
21	Cooperative Learning Method	1	1,37
22	Logical Thinking Skills	1	1,37
23	Attitude towards Mathematics	1	1,37
24	Maths	1	1,37
25	Maths Anxiety	1	1,37
26	Maths Oriented Academic Risk-taking	1	1,37
27	Maths Teaching	1	1,37
28	Maths Self-Efficacy	1	1,37
29	Maths Problem	1	1,37
30	Maths Attitude	1	1,37
31	Mathematical Modelling	1	1,37
32	Mathematical Metacognition Awareness	1	1,37
33	Model Building Activities	1	1,37
34	Modelling Competencies	1	1,37
35	Motivation	1	1,37
36	Self-Assessment	1	1,37
37	Problem Solving Success	1	1,37
38	Problem Solving Teaching	1	1,37
39	Problem Formulation	1	1,37
40	Self-efficacy in problem posing	1	1,37
41	Verbal Problem	1	1,37
42	Metacognitive Awareness	1	1,37
43	Metacognition Calibration	1	1,37
44	Metacognitive Skill	1	1,37
45	Metacognitive Skills	1	1,37
46	Metacognitive Knowledge	1	1,37

Sequence No	Keyword	f	%
47	Metacognitive Thinking Skills	1	1,37
48	Metacognitive Control	1	1,37
49	Metacognitive Strategy	1	1,37
50	Metacognitive Strategies	1	1,37

According to Table 1, 50 different keywords were used for the 21 theses analysed. Of these keywords, 8 were «Metacognition», 5 were «Problem Solving», 5 were «Metacognitive Awareness», 4 were «Mathematics Achievement», 2 were «Mathematics Education», 2 were «Mathematical Metacognition», 2 were «Secondary School Students», 2 were «Attitude», 2 were «Metacognitive Skills» and the other 40 keywords were used only once. The frequency and percentage distributions of the universities where the theses on metacognitive mathematics were prepared between 2008–2023 are given in Table 2.

Table 2. Frequency and Percentage Distributions of the Universities Affiliated to the Institutes where the Theses were Prepared

Sequence No	Keyword	f	%
1	Cukurova University	3	14,28
2	Dokuz Eylul University	2	9,52
3	Erzincan Binali Yıldırım University	2	9,52
4	Marmara University	2	9,52
5	Adnan Menderes University	1	4,76
6	Ataturk University	1	4,76
7	Bartın University	1	4,76
8	Bolu Abant İzzet Baysal University	1	4,76
9	Burdur Mehmet Akif Ersoy University	1	4,76
10	Bursa Uludag Univercity	1	4,76
11	Bulent Ecevit University	1	4,76
12	Gazi University	1	4,76
13	Gaziantep University	1	4,76
14	Mugla Sıtkı KoCman University	1	4,76
15	Siirt University	1	4,76
16	Uludag University	1	4,76

According to the information obtained from Table 2, it was determined that postgraduate theses on mathematical metacognition were written in the institutes of 16 different universities. It is seen that 3 of the theses were written in Cukurova University,

2 in Dokuz Eylul University, 2 in Erzincan Binali Yıldırım University and 2 in Marmara University. It was determined that 1 thesis each was written in institutes affiliated to other universities. The frequency and percentage distributions of the writing years of the theses containing metacognitive mathematics keywords published between 2008-2023 are given in Table 3.

Table 3. Frequency and Percentage Distributions of the Years of Thesis Preparation

Sequence No	Year	f	%
1	2019	5	23,8095
2	2021	4	19,0476
3	2022	4	19,0476
4	2017	3	14,2857
5	2013	2	9,5238
6	2018	2	9,5238
7	2008	1	4,7619

According to the information obtained from Table 3, it was determined that theses on mathematical metacognition were written in 7 different years between 2008 and 2023. The maximum number of theses was 5 in 2019. The other years are as follows; 4 theses were written in 2021, 4 theses in 2022, 3 theses in 2017, 2 theses in 2013, 2 theses in 2018 and 1 thesis in 2008. The distribution of the studies published between 2008–2023, including metacognitive mathematics keywords and whether they are open to access or not are given in Table 4.

Table 4. Frequency and Percentage Distributions of Accessibility of Theses

Sequence No	Number of Thesis	Access Status	f	%
1	21	ACık	21	100

According to the information obtained from Table 4, 21 theses were found in the research conducted on Yoktez between 2008–2023 on mathematical metacognition, and all of these theses are open to access. Table 5 shows the thesis type of the studies published between 2008–2023, which include metacognitive mathematics keywords.

According to the information obtained from Table 5, 21 theses were found in the research conducted on Yoktez between 2008–2023 on mathematical metacognition, 17 of these theses are Master's Theses and 4 of them are Doctoral Theses. The distribution of the studies published between the years 2008–2023 containing metacognitive mathematics keywords according to the sample/study group is given in Table 6.

Table 5. Frequency and Percentage Distributions of the Type of Theses

Sequence No	Thesis Type	f	%
1	Doctoral Thesis	4	19,0476
2	Master Thesis	17	80,9523

Table 6. Frequency and Percentage Distributions of the Samples of the Theses

Sequence No	Sampling Level	f	%
1	Middle School	16	76,1904
2	High School	2	9,5238
3	Primary School	3	14,2857

According to the information obtained from Table 6, 21 theses on mathematical metacognition were found in the research conducted on Yoktez between 2008 and 2023, and the sample was Middle School in 16 theses, High School in 2 theses, and Primary School in 3 theses.

If we look more specifically;

Table 7. Frequency and Percentage Distributions of the Samples of the Theses according to Classes

Sequence No	Sampling Level	f	%
1	Secondary School 7	6	28,5714
2	Secondary School 5,6,7,8	4	19,0476
3	Secondary School 6	3	14,2857
4	High School 9,10,11	2	9,5238
5	Secondary School 8	2	9,5238
6	Primary School 3	1	4,7619
7	Primary School 4	1	4,7619
8	Primary School 5	1	4,7619
9	Secondary School 5	1	4,7619

According to the information obtained from Table 7, the sample of 6 theses is Middle School 7th grade, the sample of 4 theses is the whole Middle School (5,6,7,8), the sample of 3 theses is Middle School 6th grade, the sample of 2 theses is High School, and the sample of 2 theses is Middle School 8th grade. The distribution of the studies published between 2008 and 2023, including metacognitive mathematics keywords, regarding the research design/methods they used is given in Table 8.

Table 8. Frequency and Percentage Distributions of Theses According to the Research Design/Method Used

Sequence No	Research Methodology	f	%
1	Quantitative	15	71,43
2	Mixed	4	19,05
3	Qualitative	2	9,52

According to the information obtained from Table 8, maximum 15 research methods were used. f=15, mixed research method was used in 4 theses, qualitative research methods were used in 2 theses. The distribution of the studies published between 2008–2023, including metacognitive mathematics keywords, according to the data collection tools they used is given in Table 9.

Table 9. Frequency and Percentage Distributions According to Data Collection Tools/Scales Used in Theses

Sequence No	Scale	f	%
1	Metacognitive Awareness Scale	4	8
2	Mathematical Metacognition Awareness Scale	3	6
3	Mathematics Achievement Test	2	4
4	Mathematics Attitude Scale	2	4
5	Problem Solving Achievement Test	2	4
6	Metacognition Scale	2	4
7	Academic Achievement Test	1	2
8	Skills Based Mathematics Questions Test (Btms)	1	2
9	Algebraic Verbal Problem Test	1	2
10	Metacognitive Awareness Inventory for Children Form B	1	2
11	Metacognitive Awareness Scale for Children	1	2
12	Metacognitive Awareness Scale for Children Form B	1	2
13	Graded Scoring Key	1	2
14	Group Report Forms	1	2
15	Mathematics Grade in Report Cards	1	2
16	Logical Thinking Ability Test	1	2
17	Attitude Scale towards Mathematics	1	2
18	Mathematics Course Motivation Scale	1	2
19	Mathematics Anxiety Scale	1	2
20	Mathematics Focused Academic Risk Taking Scale	1	2

Sequence No	Scale	f	%
21	Mathematics Problem Solving Attitude Scale	2	4
23	Mathematics Attitude Scale	1	2
24	Mathematics Metacognitive Awareness Inventory	1	2
25	Mathematical Reasoning Scale	1	2
26	Mathematical Problem Solving Test	1	2
27	Modelling Competencies Assessment Rubric	1	2
28	Measurement and Evaluation Problems	1	2
29	Self-Efficacy Resources Scale	1	2
30	Self-Assessment Scale	1	2
31	Problem Constructing Self-Efficacy Scale	1	2
32	Attitude Scale	1	2
33	Metacognition (Metacognition) Scale	1	2
34	Metacognitive Awareness Inventory	1	2
35	Metacognitive Awareness Scale	1	2
36	Metacognitive Ability Questionnaire	1	2
37	Metacognitive Skill Scale	1	2
38	Metacognitive Knowledge and Skills Scale	1	2
39	Mathematics Achievement Test for Metacognitive Knowledge	1	2
40	Metacognitive Awareness Inventory	1	2
41	Metacognitive Scale	1	2

According to the information obtained from Table 9, 41 different scales were used in 21 theses obtained from Yoktez, «Metacognitive Awareness Scale» was used in 4 theses, «Mathematical Metacognition Awareness Scale» was used in 3 theses, «Mathematics Achievement Test» was used in 2 theses, «Mathematics Attitude Scale» was used in 2 theses, «Problem Solving Achievement Test» was used in 2 theses, «Metacognition Scale» was used in 2 theses. Other scales were used 1 time each. The distribution of the studies published between 2008 and 2023, including metacognitive mathematics keywords, according to the data analysis methods they used is given in Table 10.

According to the information obtained from Table 10, 29 different data analysis methods were used in 21 theses obtained from Yoktez; «Anova Test» in 9 theses, «Pearson Product Moment Correlation Analysis» in 6 theses, «t-Test» in 5 theses, «Independent Groups T Test» in 3 theses, «Descriptive Analysis» in 3 theses, «Mann-Whitney U Test» in 3 theses, «Regression Analysis» in 3 theses, «Descriptive Statistical Techniques» in 2 theses, «Multiple Linear Regression Analysis» in 2 theses, «Kruskal Wallis» in 2 theses, «Shapiro Wilk Test» in 2 theses. Other analysis methods were used 1 time each.

Table 10. Frequency and Percentage Distributions According to Data Analysis Methods Used in Theses

Sequence No	Analysis Method	f	%
1	Anova	9	15,52
2	Pearson Product Moment Correlation Analysis	6	10,34
3	T-Test	5	8,62
4	Independent Groups T Test	3	5,17
5	Descriptive Analysis	3	5,17
6	Mann-Whitney U Test	3	5,17
7	Regression Analysis	3	5,17
8	Descriptive Statistics Techniques	2	3,45
9	Multiple Linear Regression Analysis	2	3,45
10	Kruskal Wallis	2	3,45
11	Shapiro Wilk Test	2	3,45
12	Ancova	1	1,72
13	Dependent Group T-Test	1	1,72
14	Independent Sample T-Test	1	1,72
15	Independent T-Test	1	1,72
16	Simple Linear Regression Analysis	1	1,72
17	Multiple Correlation Techniques	1	1,72
18	Multiple Regression Analysis	1	1,72
19	Linear Regression	1	1,72
20	Document Analysis	1	1,72
21	Frequency Analysis	1	1,72
22	Content Analysis	1	1,72
23	Correlation	1	1,72
24	Clustering Method	1	1,72
25	Parametric and Non-Parametric Tests	1	1,72
26	Problem Solving Activities Evaluation Table	1	1,72
27	Spearman Rho Correlation Analysis	1	1,72
28	Metacognition Evaluation Table	1	1,72
29	Metacognitive Skills Method	1	1,72

Conclusion

This study was conducted in order to determine the trends of the theses on metacognitive mathematics in Turkey and to provide guidance to those who plan to work on this subject. It is assumed that this approach will help to obtain more efficient

results from future studies. In the research conducted in this context, a total of 21 theses, including 4 doctoral theses and 17 master's theses, focusing on the use of metacognitive mathematics method and the practice of this method in Turkey between 2008 and 2023 were accessed.

In the literature review, it was determined that the first thesis was written in 2008 and after this date, there were no new thesis studies until 2013. The most intense period of thesis studies focusing on metacognitive mathematics method was recorded as 2019, followed by 2021. When the keywords used in the theses were analysed, it was seen that the keyword metacognition was the most commonly used keyword, followed by problem solving and metacognitive awareness and mathematics achievement keywords. According to the universities where the theses were published, Cukurova University had the highest number of studies, followed by Dokuz Eylul University, Erzincan Binali Yıldırım University and Marmara University. All 21 theses are open access on YOKTEZ. Considering the types of theses, 4 theses were doctoral theses and 17 theses were master's theses. When the samples were examined, it was determined that most studies were conducted in secondary schools, followed by high schools and primary schools. In secondary schools, it was determined that most of the studies were conducted in 7th grades, then in the whole secondary school and 6th grade of secondary school. It was seen that quantitative methods were mostly used in the studies and then mixed methods were used. The most used scales as data collection tools are Metacognitive Awareness Scale, Mathematical Metacognition Awareness Scale, Mathematics Achievement Test, Mathematics Attitude Scale, Problem Solving Achievement Test, Metacognition Scale. Data analysis methods are ANOVA, Pearson Product Moment Correlation Analysis, t-Test, Independent Groups T Test, Descriptive Analysis, Mann-Whitney U test, Regression Analysis.

References

1. Sare Sengul, Yasemin Katranci, Metacognitive Aspects of Solving Function Problems,Procedia – Social and Behavioral Sciences,Volume 46, 2012, Pages 2178-2182, ISSN 1877-0428, https://doi.org/10.1016/j.sbspro.2012.05.450.

2. Ozsoy G. Metacognition. Turkish Educational Magazine, 6 (4), 713-740,2008.

3. Turk E.G. Factors predicting adolescents' thinking styles: parents, metacognition and epistemological beliefs. (Doctoral thesis). Ankara University, Institute of Educational Sciences, Ankara, 2011.

4. Bagceci B., Dos B. & Sarıca R. An analysis of metacognitive awareness levels and academic achievement of primary school students. Journal of the Institute of Social Sciences of Mustafa Kemal University, 8 (16), p.551-566, 2011.

5. Akın A. The relationships between achievement goal orientations and cognitive awareness, parental attitudes and academic achievement (Dec. Thesis, Sakarya University (Turkey), 2006.

6. Aydemïr H. & Kubanc Y. Investigation of Metacognitive Behaviors in the Problem Solving Process. Electronic Turkish Studies, 9 (2), 2014.

7. Demir G. The effect of realistic mathematics education approach on mathematics anxiety, mathematics self-efficacy perception and achievement of vocational high school students (Master's thesis, Adnan Menderes University, Institute of Social Sciences), 2017.

8. Canca D. Research of the relationship between university students' cognitive and metacognitive selfregulation strategies and their mathematics achievement according to gender. Master thesis, Yıldız Teknik University, 2005.

9. Saban A.İ. Investigation of cognitive awareness and motives of classroom teaching students according to some socio-demographic variables. Ege journal of Education, 9 (1), p. 35-58, 2008.

10. Memis A. & Arican H. The analysis of 5th grade students' mathematical metacognition levels between the variables gender and achievement. Karaelmas Journal of Educational Sciences, 1(1), p.76-93, 2013.

11. Ozsoy G. & Ataman A. The effect of metacognitive strategy training on mathematical problem solving achievement. International Electronic Journal of Elementary Education, 1(2), p.67-82, 2009.

12. Tok H., Ozgan H. & Dos B. Evaluation of the cognitive awareness strategy and learning strategies as a positive predictor of success in the distance education classroom. Journal of the Institute of Social Sciences of Mustafa Kemal University, 7 (14), p.123-134, 2010.

Yasin GOKBULUT*[1], Esra YENİDUNYA[2], Dilek SAHİNPINAR[3]
[1] Токат Газиосманпаша университеті, Токат, Түркия.
[2] Түркия Білім министрлігі, Түркия.
[3] Агра Ибрахим Шешен университеті, Агра, Түркия.

2008–2023 жылдар аралығында Түркиядағы математика бойынша дипломдық жұмыстардағы метакогнитивті тенденциялар

Аннотация. Бұл зерттеудің мақсаты – кейбір айнымалыларға сәйкес Түркияда 2008-2023 жылдар аралығында жазылған метакогнитивті математика бойынша диссертацияларды талдау. Метакогнитивті математика – бұл математикалық есептерді шешу процестерін түсіну, оқыту стратегияларын қолдану және математика туралы метакогнитивті хабардарлықты дамыту сияқты жоғары деңгейлі когнитивті дағдыларды қамтитын маңызды сала. Бұл зерттеу Түркиядағы осы саладағы диссертациялардың санын, олардың жыл бойынша таралуын және олардың өсу тенденциясын бағалайды. Сонымен қатар ол диссертацияға арналған тақырыптар мен ішкі өрістерді зерттеу арқылы метакогнитивті математикалық зерттеулердің қай салаларда шоғырланғанын анықтауға бағытталған. Деректер Йока Ұлттық диссертациялық орталығынан алынды. 3 түйінді сөзден (математикалық метатану, metacognition, метакогнитивтік математика) әдебиеттерді іздеу нәтижесінде 2008–2023 жылдар аралығында пәнге қатысты 4 докторлық және 17 магистрлік диссертация алынды. Талдау үшін сипаттамалық мазмұнды талдау қолданылды. Алынған мәліметтерге сәйкес түйінді сөздер ең көп қолданылған деп айтуға болады метатану, метакогнитивті хабардарлық және проблемаларды шешу, ең көп зерттеулер Чукуров университетінде жүргізілді, соңғы жылдары пәнге деген қызығушылық біртіндеп өсті, ең көп зерттеулер 2019, 2021 және 2022 жылдары жүргізілді, қол жетімділік диссертацияларды қорғау Ашық, магистрлік зерттеулер бұл пән бойынша іріктеу деңгейі әдетте орта мектепке сәйкес келеді, ал орта мектептің 7-сыныптарында жүргізілген зерттеулер жиі кездеседі.

Кілтті сөздер: метакогнитивтік математика, зерттеу бағыттары, метатану, Математиканы оқыту, метакогнитивтік стратегиялар, жоғары білім, кәсіби даму.

Yasin GOKBULUT*[1], Esra YENİDUNYA[2], Dilek SAHİNPINAR[3]
[1] Токатский университет Газиосманпаша, Токат, Турция.
[2] Министерство образования Турции, Турция.
[3] Агры Ибрагим Чечен университет, Агры, Турция.

Метакогнитивные тенденции в дипломных работах по математике в Турции с 2008 по 2023 год

Аннотация. Цель этого исследования – проанализировать диссертации по метакогнитивной математике, написанные в Турции в период с 2008 по 2023 год в соответствии с некоторыми переменными. Метакогнитивная математика – важная область, которая включает в себя когнитивные навыки высокого уровня, такие как понимание процессов решения математических задач, использование стратегий обучения и развитие метакогнитивного осознания математики. В этом исследовании оценивается количество диссертаций в этой области в Турции, их распределение по годам и тенденции их роста. Кроме того, он направлен на определение областей, в которых сосредоточены метакогнитивные математические исследования, путем изучения тем и подполей для диссертации. Данные взяты из Национального диссертационного центра Йока. В результате поиска литературы из 3-х ключевых слов (математическая метапознание, metacognition, метакогнитивная математика) за период 2008–2023 гг. получено 4 докторских и 17 магистерских диссертаций по предмету. Для анализа использовался описательный содержательный анализ. Согласно полученным данным, можно сказать, что ключевые слова наиболее широко используются в метапознание, метакогнитивная осведомленность и решение проблем, наибольшее количество исследований проводилось в Чукуровском университете, в последние годы интерес к этой дисциплине постепенно рос, наибольшее количество исследований проводилось в 2019, 2021 и 2022 годах, доступность защиты диссертаций открыта, магистерские исследования уровня отбора по этой дисциплине обычно подходит для средней школы, и исследования, проведенные в 7-х классах средней школы, являются обычным явлением.

Ключевые слова: метакогнитивная математика, направления исследований, метапознание, преподавание математики, метакогнитивные стратегии, высшее образование, профессиональное развитие.