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Research Article

A Descriptive Content Analysis of the Articles Published in Turkey on Numbers and the Operations Learning Area

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Abstract – Numbers have found a wide place in many studies and curricula from the past to the present. Within the scope of the research, which was designed with the descriptive content analysis method, a total of 5021 volumes of the 124 journals in our country were reviewed, 301 articles were determined, and the data obtained were analyzed with the content. The results are as follows: It was determined that the number of articles first published in Turkey in 1986 on numbers and operations learning area began to increase from 2013. The reviewed articles were designed mostly with the case study method, and the secondary school level was mostly used as the sample in the articles. Besides, addition and subtraction with natural numbers were mainly studied at the primary school level, and at the secondary school level, respectively fractions, operations with natural numbers and fractions were studied in sub-learning areas.

Key words: Arithmetic operations, content analysis, Curriculum, Numbers.

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Introduction

Today's developing and changing world brings forward individuals with the characteristics such as those who can produce knowledge and use it functionally, think critically, are entrepreneurs, problem solvers, etc. (Ministry of National Education [MoNE], 2018). Individuals with these characteristics keeping up with the dynamism in science and technology can be achieved by understanding and doing mathematics (National Council of

[*] This study was produced from the master's thesis prepared by the first author under the supervision of the second author.

Teachers of Mathematics (NTCM), 2000). And this case directs us to the educational perspective in which the mathematical thinking style that integrates with our values and competencies beyond mere achievements is discussed to achieve and understand mathematics and be successful (MoNE, 2018).

In a mathematics education, which is integrated with values and competencies, it is stressed that the numbers that constitute the fundamentals of mathematics should primarily be handled before teaching the abstract and upper-level concepts to the individuals to achieve success and gain high-level mathematical skills (Christou & Vosniadou, 2012; Vlassis, 2004). It is known that a similar situation is valid even for calculation skills (four operations) such as counting, addition, subtraction, multiplication and division (McCallum & Schmitt, 2011; Stein et al., 1997). For instance, it is observed that children cannot achieve upper-level calculation operations and fractions when the basic skills related to counting and numbers are not gained (National Mathematics Advisory Panel, 2008; Waltemire, 2018). This case directs us to the critical concept of numbers that should be learned at earlier ages (Sullivan et al., 2017).

When the literature related to the concept of numbers is reviewed, it is seen that the numbers have three different uses cardinal, ordinal and nominal numbers (Montague-Smith et al., 2018). For instance, the numbers are applied in determining the number of objects in groups such as five cars, ten apples, eight people … (cardinal number); defining the location of the objects as first, second and third (ordinal number) or describing something as just labelling or naming (nominal number) (Haylock & Manning, 2019). When the skill of counting that includes a one-to-one relationship between the counted object and numbers is considered (Blenkin & Kelly, 1996), it is seen that the amount of counting skill is gathered under six developmental headings as recognition-detection, audible-acoustic counting, asynchronous counting, simultaneous counting, consequential counting and abbreviation counting (Ruijssenaars et al., 2006). Pre-school students use their fingers to count within the scope of these six developmental stages (Van De Walle et al., 2012). Besides, they demonstrate that they have the first understanding related to the counting and number concepts by making comparisons between sets by using the concepts of more or less (Baroody & Wilkins, 1999; Fuson, 1988; Gelman & Meck, 1986; NRC, 2001). In addition, between the pre-school period and second grade, children are expected to acquire the concept of amount related to the concept of counting, understand the relationship between ordinal and cardinal numbers and represent numbers differently (Charlesworth & Lind, 2010; NCTM, 2000).

These significance and necessity, which numbers have provided the numbers and operations to be included in the curricula and studies from the past till now. In this scope, when the curricula applied by the MoNE were analyzed, the students between 36 and 72 months are expected to make addition and subtraction operations with the numbers from 1 to 10 in addition to counting from 1 to 20 rhythmically, arraying, matching the numbers and object groups, creating simple patterns, showing half and whole objects (MoNE, 2013). Similarly, When the mathematics course curricula applied by MoNE between 2005 and 2018 were analyzed, it was noticed that the primary school curricula consisted of learning areas such as Numbers (and Operations), Geometry, Measurement and Data Processing, the secondary school curricula consisted of Numbers (and Operations), Geometry (and Measurement), Measurement (Data Process), probability (and Statistics) and Algebra and the most gains and course time was given to the Numbers and Operations learning areas among these learning areas (İlhan & Aslaner, 2019; MoNE, 2005, 2009, 2013, 2015, 2018). In the numbers and operations learning area, the students are expected to develop their number concepts, learn the relationship between numbers and develop their basic arithmetic skills in primary school to form the basis for different sub-learning areas and achievements at the secondary school level (MoNE, 2018). Accordingly, the secondary school consists of various sub-learning areas such as numbers and operations learning area sets of numbers and numbers, relationships between numbers and operations, ratios and fractions, and multipliers and multiples (MoNE, 2018). Within the scope of all these sub-learning areas, it was observed that several studies were conducted on various topics such as natural numbers and operations with natural numbers (Albayrak et al., 2019; Ercive & Narlı, 2019; Paydar & Doğan, 2021; Tuluk & Akyüz, 2019), fractions and operations with fractions (Altıparmak & Palabıyık, 2019; Topçu & Gürefe 2020; Özer et al., 2020), decimal notations (Işık et al., 2012; Karataş et al., 2021), rates (Erdem et al., 2018; Yapıcı & Altay, 2017), multipliers and multiples (Karakuş & Yeşilpınar, 2018), sets (Biber & Tuna, 2016; Yücesan, 2011), integers and operations with integers (Berkant & Yaren, 2020; Bozkurt & Polat, 2011; Erdem et al., 2015; Kiraz & Cemalettin, 2020; Şengül & Zengin, 2015), rational numbers and operations with rational numbers (Altun & Çelik, 2018; Gürbüz & Birgin, 2008; Macit & Nacar, 2019; Yenilmez & Yıldız, 2018), ratio and proportion (Deveci, 2021; Güler & Didiş Kabar, 2017; Şengül & Erdoğan, 2017), exponential expressions (Eymen & Duatepe Paksu, 2015; Eymen İkizoğlu & Duatepe Paksu, 2016; Güzel & Yılmaz, 2020) and rooted expressions (Aksu et al., 2013; Aydoğdu, 2020; Toluk Uçar, 2015). In these studies, it was found that the students had

deficiencies in reading and writing the numbers, grouping numbers and writing the groups according to their digits after grouping the numbers or they over and under-used the 0 concepts (Albayrak et al., 2019), tended to do different types of errors such as not being able to establish the part-whole relationship in problem posing for operations with fractions, attribute natural number meaning to fraction dimensions, have an inability to attribute meaning to integer parts of integer fractions, lack of expression in the problem, and lack of data (Işık, 2011; Işık & Kar, 2012; Özer et al., 2020), their images of a rational number and fraction concept were not clear enough (Berkant & Yaren, 2020), pre-service teachers had problems or were insufficient in deciding the size of the given rooted numbers (Aksu et al., 2013).In addition to considering several studies conducted within the scope of any topic as a source of wealth for literature, it has been claimed that this situation made it difficult to follow the literature (Ertane Baş, 2019; Özturan Sağırlı & Baş, 2020). Handling the general tendencies related to a topic in certain periods is crucial in terms of shedding light on new studies and realizing the trends of the studies (Cohen et al., 2007; Erdem, 2011). From this point, the investigation of the researchers' knowledge related to the trends and current situation of the studies related to their fields with content analysis is thought to contribute to the literature (Falkingham & Reeves, 1998). Accordingly, it is noticed that there are studies in which the general trends related to mathematics education in the literature (Arı & Demir, 2020; Kutluca et al., 2018; Ulutaş & Ubuz, 2008; Yaşar & Papatğa, 2015; Yıldız Altan et al., 2021). In addition, it has been realized that there are researches in which the tendencies related to a certain topic such as metacognition (Baş & Özturan Sağırlı, 2017; Kandal & Baş, 2022), technology-supported education (Bayram, 2019; Tatar et al., 2013; Kutluca et al., 2016), mathematical model and modelling (Albayrak & Çiltaş, 2017; Birgin & Öztürk, 2021; Yenilmez & Yıldız, 2019), mathematics anxiety (Toptaş & Gazel, 2018), realistic mathematics education (Tabak, 2019), problem-solving (Coşkun & Soylu, 2021) and problem-themed (Özturan Sağırlı & Baş, 2020).

In light of these studies, no studies have been encountered in which numbers and operations learning areas in mathematics education are analyzed and evaluated. Considering all this information, it has been aimed to present the trends of articles by investigating the articles conducted related to numbers and operations learning area and contribute to mathematics education by creating a background to new research with this study in Turkey. For this purpose, these research questions were asked.

1. How is the distribution of the articles conducted with the participants at pre-school, primary school and secondary school level in Turkey on the numbers and operations learning area in mathematics education and published in Turkey according to their publication years?

2. How is the distribution of the articles conducted at pre-school, primary school and secondary school levels in Turkey on the numbers and operations learning area in mathematics education and published in Turkey according to their methods?

3. How is the distribution of the articles conducted at pre-school, primary school and secondary school levels in Turkey on the numbers and operations learning area in mathematics education and published in Turkey according to their samples?

4. How is the distribution of the articles conducted with pre-school, primary school and secondary school levels in Turkey on the numbers and operations learning area in mathematics education and published in Turkey according to their data collection tools?

5. How is the distribution of the articles conducted at pre-school, primary school and secondary school levels in Turkey on the numbers and operations learning area in mathematics education and published in Turkey according to their data analysis methods?

6. How is the distribution of the articles conducted at pre-school, primary school and secondary school levels in Turkey on the numbers and operations learning area in mathematics education and published in Turkey according to their publication languages?

7. How is the distribution of the articles conducted at pre-school, primary school and secondary school levels in Turkey on the numbers and operations learning area in mathematics education and published in Turkey according to their sub-learning areas?

Method

Research Design

This research aimed to review the structures and trends of the articles conducted on mathematics education and published within the scope of the topic of numbers and operations sub-learning in Turkey. Accordingly, the research was designed with a descriptive content analysis method which is one of the content analysis methods in which a general trend is determined by reviewing and arranging the quantitative and qualitative research which are put forth differently (Cohen et al., 2007; Çalık & Sözbilir, 2014; Selçuk et al., 2014).

Data collection

In the first stage of the data collection process, 124 journals of faculty of education, institutes of social sciences journals and journals of private institutions and organizations in Tukey were determined. Only the volumes of the journals presented to the readers only online were handled; a total of 1617 volumes and 5021 issues, by taking all of the issues of 2020 into consideration, were included in the process and analyzed. In the second stage of the data collection process, each issue of the journals reached was analyzed individually. The articles were reviewed within the scope of the learning areas and gains in the curriculum with the keywords as numbers, natural numbers, integers, four operations and/or skills, arithmetic, arithmetic operations, ratio proportion, sets, factors and multiples, proportional reasoning, fractions, operations with fractions, rational numbers, operations with rational numbers, exponential expressions and square root expressions. In addition, the articles, including words such as verbal problems, problem-solving and problem-posing, were also reviewed considering the acquisitions within the scope of numbers and operations learning area. In this stage, articles whose samples were foreigners were excluded from the research. In the third stage of the data collection process, the articles were aimed to be classified considering the numbers and operations and sub-learning areas within the scope of the 2013 pre-school curriculum and primary and secondary school 2018 Mathematics Course Curriculum. For this purpose, it was noticed that the articles consisted of even the high school curriculum among the recorded articles. Since secondary school and high school gains are different learning contexts and the numbers and algebra in the high school curriculum take place together in the same learning area, the articles that took place in the high school curriculum were excluded from the research. At the end of this stage, a total of 301 articles were recorded and prepared to be ready for data analysis.

Analysis of the Data

A descriptive analysis method was employed in the analysis of the data. The data obtained in the descriptive analysis are summarized and interpreted according to the theme determined earlier, and obtained results are presented to the reader (Yıldırım & Şimşek, 2018, p. 239, 242). The researcher carried out the analysis process in line with the codes and categories draft prepared by Baş and Özturan Sağırlı (2017) and listed in Figure 1.

The Codes and Categories

- **Study Group**
  - Pre-school
  - Primary School; 1, 2, 3, 4, not specified
  - Secondary School; 5, 6, 7, 8, not specified
  - Pre-service Teacher
  - Teacher
  - Supervisor
- **Method**
  - **Quantitative Approach**
    - Descriptive
    - Experimental
    - Correlational
    - Scale Development
    - Design/activity development
  - **Qualitative Approach**
    - Case study
    - Phenomenology
    - Action research
    - Teaching experiment
    - Review
    - Phenomographic research
  - **Mixed Approach**
- **Data Collection Tools**
  - Achievement test
  - Questionnaire/open-ended questionnaire/scale/test
  - Problem-posing test
  - Problem-solving inventory/test
  - Activity development form
  - Interview
  - Observation
  - Document review
  - Video
  - Other(game/reward/Graphic/instruction/notebook)
  - Mat Diaries
  - Table of specifications
  - Scale of rating
  - Tape recorder
  - Study paper/activity
  - Scale classification form
  - Evaluation inventory
- **Analysis of the Data**
  - **Analysis of the Qualitative Data**
    - Content analysis
    - Descriptive analysis
    - Constant comparative analysis
    - Discriminant analysis
    - Discourse analysis
    - Document analysis
    - Visual analysis
    - Phenomenological analysis
  - **Analysis of the Quantitative Data**
    - Descriptive statistics
    - Independent samples t-test
    - Paired samples t-test
    - Single sample t-test
    - One way ANOVA
    - Two way ANOVA
    - One way MANOVA
    - Kruskal Wallis H test
    - Mann Whitney U
    - ANCOVA
    - Factor analysis
    - Wilcoxon signed-row test
    - Path analysis
    - Implied growth model
    - Item analysis
    - Covariance analysis
    - Chi-square
    - Cochran Q test
    - McNemar test
    - Graphical analysis
- **Sub-learning Area**
  - **Primary School**
    - Natural Numbers
    - Addition with Natural Numbers
    - Subtraction with Natural Numbers
    - Multiplication with Natural Numbers
    - Division with Natural Numbers
    - Fractions
    - Operations with Fractions
  - **Secondary School**
    - Natural Numbers
    - Operations with Natural numbers
    - Fractions
    - Operations with fractions
    - Decimal notations
    - Rates
    - Multipliers and Multiples
    - Sets
    - Integers
    - operations with integers
    - Rational numbers
    - Operations with rational numbers
    - Ratio
    - Ratio and Proportions
    - Exponential Expressions
    - Rooted Expressions
- **Publication Language**
  - Turkish
  - English
  - Turkish-English

Figure 1 The list of codes and categories used in data analysis

The list in Figure 1 consists of 6 categories comprising 88 codes as the sample, method, data collection tools, data analysis methods, sub-learning area and language. The coding process within the scope of categories was realized as follows:

Method; The analysis of this category was realized with the method names expressed by the researchers in the method sections of the articles. In the cases when the methods of the articles were not stated, the methods of the articles were specified by considering the topic, study group, data collection tool and data analysis method in line with the expert opinions.

Sample; In the analysis of this category, it was tried to determine the level among all the levels of pre-school, primary school and secondary school and pre-service teachers. While coding was performed in the primary and secondary samples, the class level was determined based on the 4+4+4 system. In addition, frequencies were recorded for each class level in the sample of each article reviewed during coding. If the class level was not stated, although the article was carried out with secondary school students, it was coded in the section of secondary school not specified. For instance, in the S275 coded article, which consisted of the special education students, since the class levels of the students were not specified despite claiming that they were at the ages of 11, 12 and 14, it was coded in the secondary school, not specified section.

Data Collection Tools; In the analysis of this category, the tools, which were applied to collect only the data related to numbers and operations learning areas among the articles, were subjected to the analysis. For instance, while coding was done to the data collection tool which was used to determine the number senses of students in the S267 coded article, in which the effects of number sense-based teaching on the students' self-efficacy and performance in mathematics were investigated, the coding was done to the data collection tool applied to determine the students' self-efficacy perceptions to mathematics.

Data Analysis Method; In the analysis of this data, in coding, only the analyses related to the measurements related to the numbers and operations learning area were considered in the relevant articles.

Language; In the analysis of this category, the articles were included in the analysis process according to their language by coding as English, Turkish or both English and Turkish.

Sub-learning Area; In the analysis of this category, the data related to which sub-learning area between the primary and secondary school numbers and operations learning area were analyzed. In addition, if the reviewed article consisted of more than one sub-learning area, one frequency was coded for each sub-learning area. In addition, the unit contents that took place in the curriculum of 1997 and earlier were coded within the basis of the sub-learning areas within the scope of the current mathematics curriculum.

Validity and reliability

During the process of collecting, examining and analyzing the process of the data related to each sub-problem that took place in the study, cooperation was carried out with an academician who was an expert in the field of qualitative methods, and arrangements were made within the scope of the processes in line with the feedback and suggestions from him. For instance, in the S90 coded research, whose method was not stated, the proportional reasoning skills and the solution strategies of the pre-service secondary school mathematics teachers brought to the problems involving ratio-proportion were subjected to content analysis after the data were collected with the help of semi-structured interviews prepared by the researcher. A consensus was reached by taking the topic, problem, data collection tools and data analysis of this study, and the research was analyzed in the qualitative category with the case study code.

In the analyses, the coding and analysis process was carried out twice, eight weeks apart, by the researcher for the reliability of the coding process. The consistency of the results and coding was calculated as 93%. The parts, coded separately, were specified by taking the expert opinion, and the findings were prepared to be reported.

Findings and Discussions

Findings related to the sub-problems in the study are presented in the order in this section.

Findings related to the publication years of the articles published in Turkey on the numbers and operations learning area-themed articles in Turkey

Findings related to the distribution of the reviewed articles by year are presented in Figure 2.

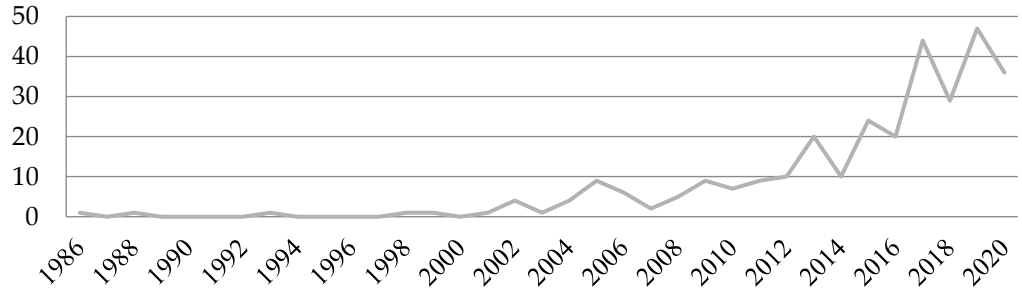

Figure 2 Distribution of the reviewed articles by years

As it was presented in Figure 2, it is seen that the articles on the topic of numbers and operations themed were first published in 1986. In the reviewed articles, it was observed that there had been no regular publications until 2004; however, an increase in the number of articles occurred until recent years. The highest numbers of articles which have been reviewed belonged to 2019 and 2017 in order.

Findings related to the methods of the articles published in Turkey on the numbers and operations learning area-themed articles in Turkey

The findings of the reviewed articles related to their methods are presented in Figure 3.

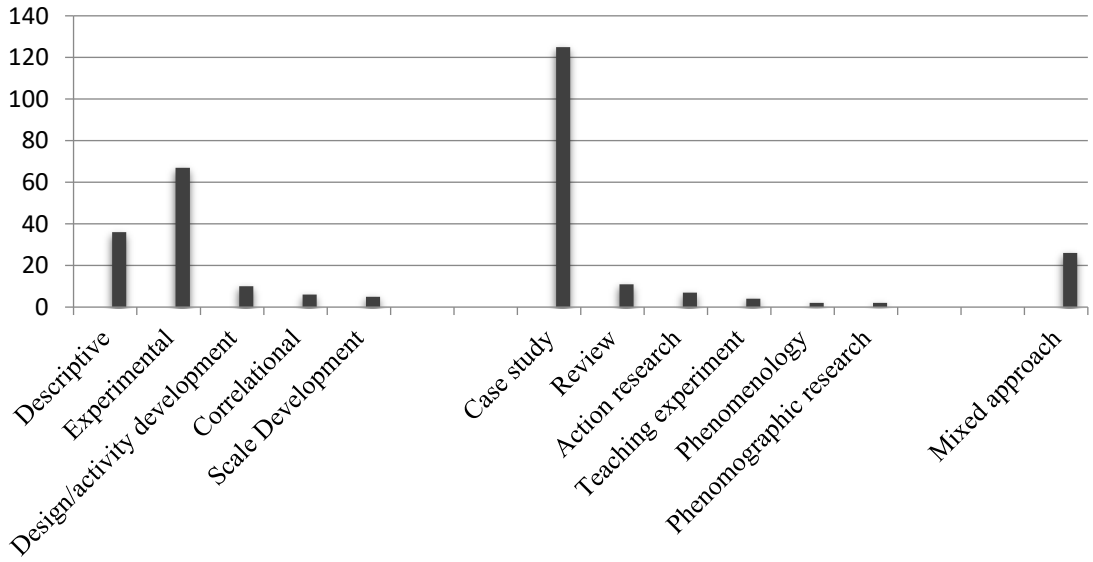

Figure 3 Distribution of the reviewed articles related to their methods

As presented in Figure 3, the numbers and operations learning area-themed articles which have been reviewed were designed with the case study method (125; 42%), experimental (67; 22%) and experimental (36; 12%) methods. In order these methods were

followed by the mixed method (26; 9%) and review (11:4%). The least preferred methods in the articles were phenomenology (2; 0.7%) and phenomographic research (2; 0.7%).

Findings related to the samples of the articles published in Turkey on the numbers and operations learning area-themed articles in Turkey

The findings of the reviewed articles related to their samples are presented in Figure 4.

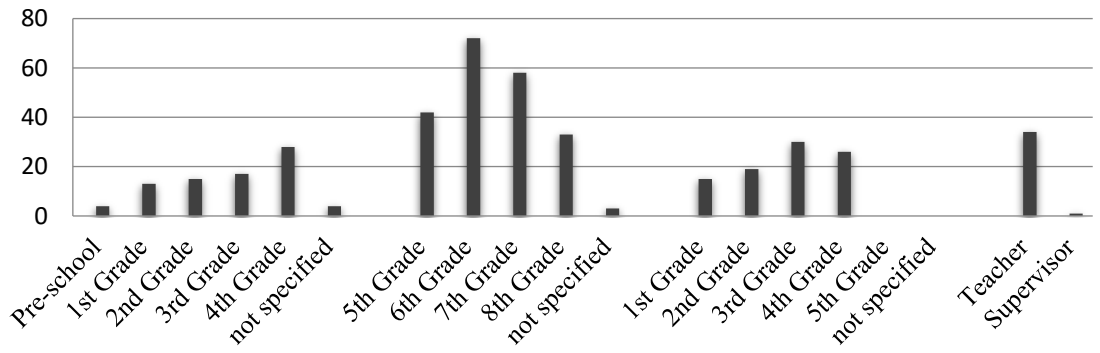

Figure 4 Distribution of the reviewed articles related to their samples

As presented in Figure 4, the secondary school level was the most preferred sample group applied as samples in the numbers and operations learning area-themed articles (208). This sample was orderly, followed by the primary school level (91), the pre-service teachers (90) and the teachers (34). In addition, when the class level which was a study on most was taken into consideration, it was noticed that there were (29) at the 4th class level of the scope of primary school, (72; 58) at the 6th and 7th class levels of the secondary school level and (30) at the 3rd class level of the university. The students in the pre-school level (10) and supervisors (1) were the samples included in the articles least. In addition, no studies were encountered related to the postgraduate level, manager, parents and academicians.

Findings related to the data collection tools of the articles published in Turkey on the numbers and operations learning area-themed articles in Turkey

The findings of the reviewed articles related to their data collection tools are presented in Figure 5.

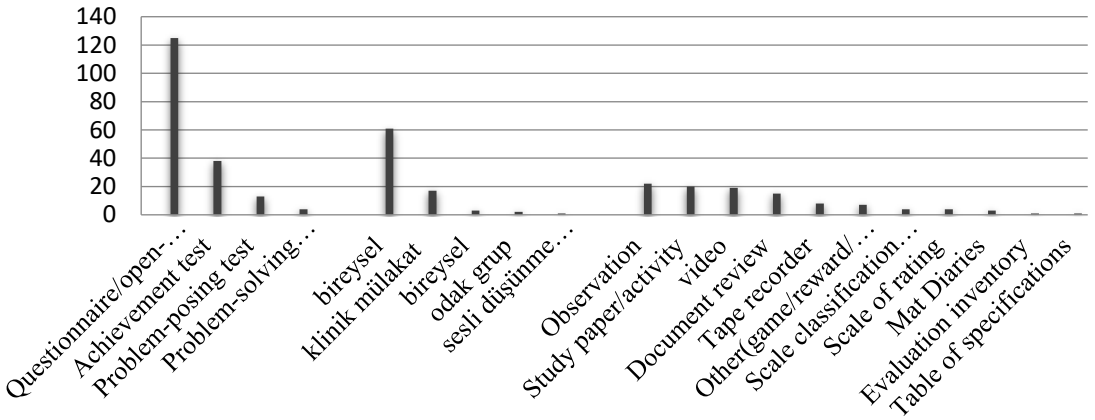

Figure 5 Distribution of the reviewed articles related to their data collection tools

As presented in Figure 5, the most preferred data collection tool in the numbers and operations learning area-themed articles were questionnaires/open-ended questionnaires/scales/tests (125). This was followed by individual interviews (61) and achievement tests (38). The least applied data collection tools in the articles were evaluation inventory (1), table of specifications (1) and activity development form (1).

Findings related to the data analysis methods of the articles published in Turkey on the numbers and operations learning area-themed articles in Turkey

The findings of the reviewed articles related to their data analysis methods are presented in Figure 6.

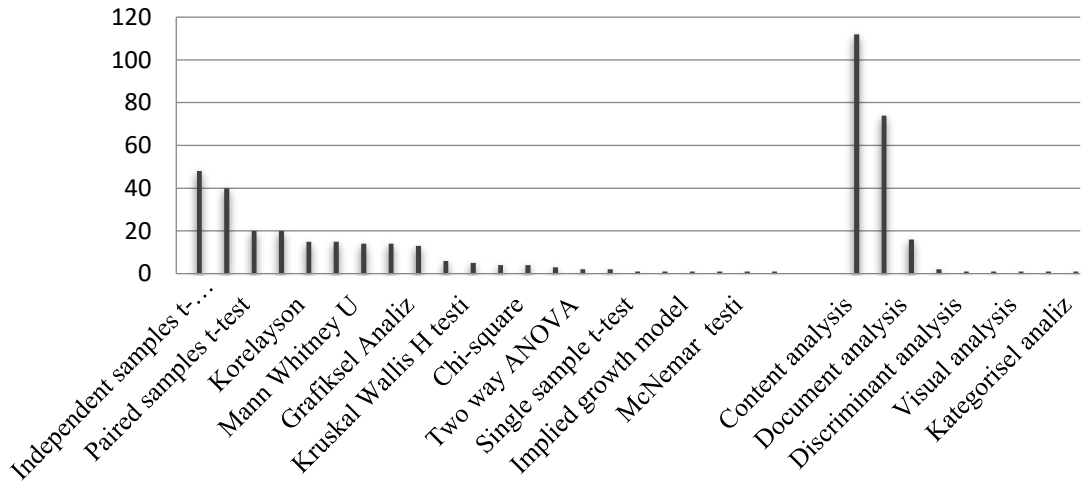

Figure 6 Distribution of the reviewed articles related to their data analysis methods

As presented in Figure 6, the content analysis (112) and descriptive analysis (74) were the methods which were mostly applied in the analysis of the qualitative data in the numbers

and operations learning area-themed articles. In the qualitative data analysis, it can be claimed that the predictive methods were mainly used, and the correlational and hypothesis tests were applied most in these methods. In the analysis of the quantitative data, the independent samples t-test (48) and the descriptive statistics (40), paired-samples t-test (20), and one-way variance analysis (ANOVA) (20) were preferred most in order. Besides, it was determined that the non-parametric tests were also applied in the data analysis.

Findings related to the publication languages of the articles published in Turkey on the numbers and operations learning area-themed articles in Turkey

The findings of the reviewed articles related to their publication languages are presented in Figure 7.

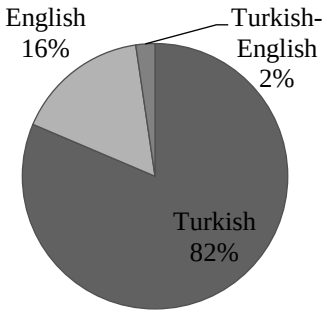

Figure 7 Distribution of the reviewed articles related to their publication language

As presented in Figure 7, approximately 81% (245) of the reviewed articles were published in Turkish, 17% (49) in English and 2% (7) both in Turkish and English.

Findings related to the sub-learning areas of the articles published in Turkey on the numbers and operations learning area-themed articles in Turkey

The findings of the reviewed articles related to their sub-learning areas are presented in Figure 8.

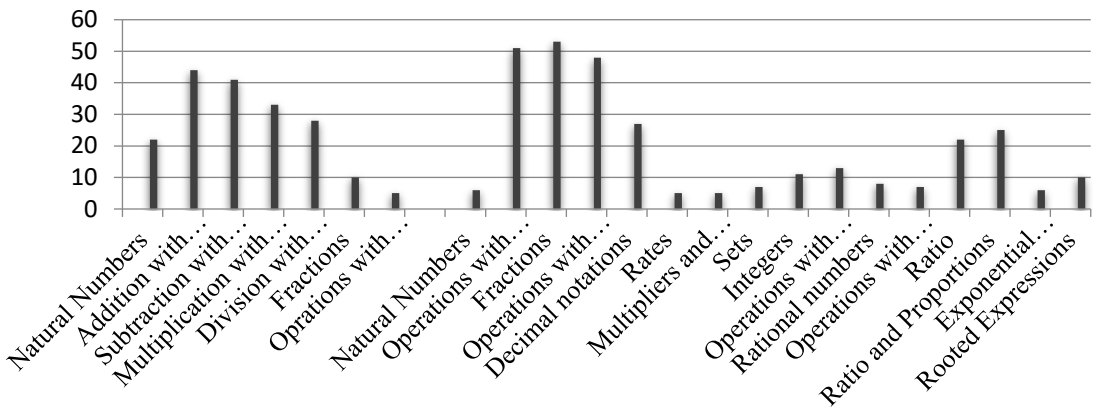

Figure 8 Distribution of the reviewed articles related to their sub-learning areas

As presented in Figure 8, the sub-learning areas of the numbers and operations learning area-themed articles at the secondary school level were fractions (53), operations with natural numbers (51) and operations with fractions (48). The most applied sub-learning areas in the articles at the primary school level were addition operations with natural numbers (44) and subtraction with natural numbers (41). In addition, the least applied learning areas at the secondary school level were exponential expressions (6), rates (5), multipliers and multiples (5); at the primary school level were fractions (10) and operations with fractions (5). In addition, it was determined in the reviewed articles that the researchers had conducted for each sub-learning area.

Conclusion, Discussion and Suggestions

The results related to the publication years, methods, samples, data collection tools, data analysis methods, publication languages and bub-learning areas of the articles published in the journals of Turkey and conducted in Turkey on the numbers and operations learning area-themed articles can be summarized as follows.

It was determined that the articles on numbers and operations learning area-themed articles had been published in 1986 first. It was also observed that they were hardly any research from 1986 till 2004, and the number of published articles from this date has continued to increase until recently. It was noticed that the most published articles in number were in 2019 and 2017. It is thought that the various revisions carried out in the learning area and subject content in the curriculum, especially between 2005 and 2018, have affected the increase in the number of the numbers and operations themed articles in recent years. Accordingly, when the mathematics curricula between 2005-2018 are examined, adding or

omitting the periods or contents of gains of the subjects such as fractions, ratios, proportion, natural numbers, and square root expressions in the scope of learning numbers and operations at some grade levels increases the number of articles covered in this context can be seen as a reason for this increase (MoNE, 2005; 2009; 2013; 2018).

When the articles were analyzed according to their methods, it was determined that the researchers preferred to research with the qualitative approach and case study in their articles most; this was followed by the articles designed with the quantitative and mixed approaches. This may indicate that the researchers wished to explore the topics related to numbers and operations in depth. It was seen in different studies examining various trends in mathematics education that the case study pattern was preferred more than other patterns in qualitative studies (Albayrak & Çiltaş, 2017; Kutluca et al., 2018; Özturan Sağırlı & Baş 2020; Yıldız & Yenilmez, 2019). Besides, it was observed that the experimental and descriptive methods came forward in the qualitative studies. On the other hand, in experimental studies, the number of articles in which the achievement and skill concepts related to the topics, particularly fractions/ operations with fractions and natural numbers/ operations with natural numbers, can be regarded as a result of this case. In addition, the scale development, design and activity development patterns were preferred less in the articles in which the quantitative design was employed can be seen as a deficiency. Similarly, it was determined that the action research, teaching experiment, phenomenology and phenomenological research patterns were preferred relatively less, even in the articles in which the qualitative design was employed.

When the articles were examined according to their sample groups, the most studied group was the secondary school level. This was followed by the articles carried out with primary school level, pre-service teachers and teachers. It was noticed that the secondary school level was studied more in the studies in the various trends examined in mathematics education (Arı & Demir, 2020; Birgin & Öztürk, 2021; Kandal & Baş, 2022; Özturan Sağırlı & Baş, 2020; Toptaş & Gözel, 2018; Yıldız & Yenilmez, 2019). Besides, as the class levels studied most in the articles were analyzed, it was determined that 4th class levels in primary school, 6th and 7th class levels in secondary school, and 3rd class levels in undergraduate level were studied most. That the 4th class level was the level which was studied more within the scope of primary school is thought to be originated from the fact that students' literacy and basic processing skills are provided up to this class level and that comprehensive topic such as fractions and problems are handled at this class level. In addition, the students at the last class levels at the secondary school and undergraduate levels study for the exams, which

can be a reason the students in this group were less preferred by the researchers. In addition, it was noticed that very few studies were carried out with pre-school students. This result of the research demonstrates similarity with the study conducted by Özturan Sağırlı and Baş (2020). In addition, it was seen that there was no study carried out with the postgraduate level, academicians and parents.

When the articles were analyzed with their data collection tools, it was determined that the most preferred data collection tools were questionnaires/ open-ended questionnaires/ tests/ scales and interviews. Achievement tests followed this. That the misconceptions of the participants were dealt with more in the topics such as fractions/ operations with fractions, natural numbers/ problem-posing related to operations with natural numbers (Arıkan & Ünal, 2013; Biber et al., 2013; Işık, 2011; Işık & Kar, 2012; Kılıç, 2013; Soylu & Soylu, 2005) can be presented as a result of this situation. In addition, this situation can be evaluated as a result of the articles being designed with case patterns in qualitative research and experimental and descriptive designs in quantitative research.

The articles' most preferred data analysis methods in qualitative data analysis are the content analysis method and the descriptive analysis method. A similar result was presented in various research (Özturan Sağırlı & Baş, 2020; Yıldız & Yenilmez, 2019). Accordingly, it can be claimed that the case study pattern used more in the qualitative studies was influential. The quantitative data analysis preferred the independent samples t-test, descriptive statistics, paired-samples t-test, and one-way variance analysis. This situation can indicate that comparative analyses were made several times in the quantitative research. It is thought that the researchers prefer these analysis methods because the investigated features are relatively interpreted easier, and the transfer of the relationship between the variables to the reader can be realized by fictionalizing more easily (Selçuk et al., 2014).

When the articles were reviewed in terms of their publication languages, it was realized that most of the reviewed articles were published in Turkish (81%). This was orderly followed by the articles published in English with approximately 17% and both in Turkish and in English with approximately 2%. It can be claimed that selecting only the articles conducted in Turkey and published in educational journals in Turkey in the study sample is effective in the high number of articles published in Turkish. A similar situation was observed to be expressed in the content analysis studies in which the general trend in mathematics education was investigated (Baş & Özturan Sağırlı, 2017; Ulutaş & Ubuz, 2008; Özturan Sağırlı & Baş, 2020).

When the articles were analyzed according to their sub-learning areas, it was noticed that while mostly the addition and subtraction with natural numbers of operations were studied at the primary school level, the sub-learning areas orderly as fractions, operations with natural numbers and operations with fractions were studied at the secondary school level. That the addition and subtraction operations were performed from the 1st class at the primary school level; examining the relationship between these operations, determining their essential characteristics, developing the problem-posing, and solving skills related to these operations are among the targets that should be carried out in the curriculum (MoNE, 2018). This situation, without doubt, is seen as a reason the addition and subtraction of natural numbers are more emphasized in the articles at the primary school level. That the inclusion of numbers and operations as a prerequisite in teaching abstract and advanced mathematical concepts (Christou & Vosniadou, 2012; Vlassis, 2004), that fractions are one of the most difficult concepts encountered by primary school children (Charalambous & Pinta-Pantazi, 2005; Hansen, 2014) and that it forms the basic building block of many topics such as decimals, percentages, and rational numbers within the scope of secondary school (NTCM, 2000) can be seen among the reasons why researchers have focused on these issues.

Some recommendations below are thought to contribute to the literature from this research results.

- ✓ It was noticed that there was no study with the postgraduate, academicians and parents among the reviewed studies on numbers and operations. From this point, these sample groups can be included in future research.
- ✓ In the reviewed research, it was seen that the researchers focused on certain research patterns, such as mostly experimental, descriptive or case studies. From this point, the number of studies related to phenomenology, design, and scale development patterns can be increased or considering the research results, a meta-analysis study can be conducted.

Compliance with Ethical Standards

Disclosure of potential conflicts of interest

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CRediT author statement

The study was conducted and reported with equal collaboration of the researchers.

Research involving Human Participants and/or Animals

Ethics Committee Approval for this research was obtained from the Human Research Committee on Ethics at Erzincan Binali Yıldırım University (Reference number: E-85748827-050.06.04-57538; Date: 28/01/2021).

Türkiye'de Yayımlanan Sayılar ve İşlemler Öğrenme Alanı Temalı Makalelere İlişkin Betimsel İçerik Analizi

Özet: Sayılar, geçmişten günümüze birçok çalışmada ve müfredatta geniş yer bulmuştur. Betimsel içerik analizi yöntemiyle tasarlanan araştırma kapsamında ülkemizde yer alan 124 dergiye ait toplam 5021 sayı incelenerek 301 makale belirlenmiş ve ulaşılan veriler betimsel analiz yöntemiyle analiz edilmiştir. Analiz sonucunda elde edilen sonuçlar şu şekildedir: Türkiye'de sayılar ve işlemler öğrenme alanında ilk olarak 1986 yılında yayınlanan makale sayılarının 2013 yılından itibaren genel olarak artış göstermeye başladığı belirlenmiştir. İncelenen makaleler daha çok durum çalışması deseniyle tasarlanmış ve makalelerde en fazla ortaokul örneklemi üzerinde çalışılmıştır. Ayrıca ilkokul düzeyinde; en fazla doğal sayılarla toplama ve çıkarma işlemi, ortaokul düzeyinde ise sırasıyla kesirler, doğal sayılarla ve kesirlerle işlemler alt öğrenme alanları üzerinde çalışılmıştır.

Anahtar kelimeler: Aritmetik işlemler, İçerik analizi, Öğretim programı, Sayılar

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