Mathematics Education Studies in Turkey between 2009 and 2014: A Descriptive Study

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Abstract

This is a descriptive study on mathematics education studies in Turkey between 2009 and 2014. The study is a review of 580 articles published in mathematics education sections of 32 different journals fully accessible by Ulakbim Social Sciences Database (USSD) by method of purposeful sampling during the 2009-2014 period. "Publication Classification Form" was used for the review of articles. Descriptive survey study was performed on each article and the article was reviewed in article details, discipline, article subject, data collection tools, sampling, data analysis method categories. SPSS 16.0 and Excel software was used for data analysis. The results were interpreted with graphics, frequency and percentage tables and presented in descriptive form. The results show that majority of mathematics education studies published in Turkey are done by Turkish authors, and the language of publication is mostly Turkish. With regards to research subjects, there are more learning studies, quantitative research methods are used more, attitude, perception, character, ability and anxiety tests are preferred as data collection tools, and a single data collection tool is used in most of the studies. It is found that groups of 31-100 people at the level of bachelor degree constitute the sample and content analysis method is frequently used as the data analysis method.

Keywords

Mathematics education, research subjects, trends in mathematics education

Introduction

Recent developments in science and technology have influenced mathematics education as in all other fields, and countries of the world have embarked on a quest to carry mathematics education further under the light of these developments. As the dominant force of this century, technology brought more studies, reviews and questioning of mathematics and sciences (Yücedağ and Erdoğan, 2001). The worldwide movement in sciences and mathematics education studies during the second half of the 20th century also showed itself in Turkey during the last decade of the century and 2000s with an increasing impact (Tatar and Tatar, 2008). Moreover, national and international studies in mathematics education played an important role in the realization and implementation of related policies. Serious discussions started particularly in 70s about the qualities of mathematics education

studies in USA, and with the voicing of the fact that mathematics education studies fall short of responding to real problems, significant changes were demanded both in terms of scope and methods used in mathematics education studies (Baki et al., 2011). These changes took shape with the document of School Mathematics Standards and Principles published in 1989 by the National Council of Teachers of Mathematics (NCTM), which was founded thanks to studies performed by mathematics educators and teachers of mathematics. In a similar way, mathematics education studies in our country have introduced new mathematics teaching curricula (primary and secondary education) in the 2005-2006 year, and secondary education geometry curriculum has been introduced to whole country for first-grade classes of the respective level as of 2009-2010 year (Aktaş, 2013). Moreover, secondary education mathematics curriculum was revised in 2013 in the light of recent developments in the field of mathematics education.

Recently, in the academic world, there is a massive increase in education studies which play a significant role in providing theoretical bases, policies and applications for the education system (Selçuk, Palancı, Kandemir and Dündar, 2014). This also brought a significant increase and dynamism to academic studies on mathematics education in Turkey. In this regard, analyzing the recent trends in mathematics education studies will guide researchers, educators, teachers and students in scientific discussions and queries regarding the nature of mathematics education studies in Turkey (Baki et al., 2011; Çiltaş, Güler and Sözbilir, 2012). On the other hand, people intending to do research on a subject in the field of education have difficulty in accessing all related studies or spend so much time with a literature review (Göktaş et al., 2012). Today, the contribution of studies on educational sciences to the field and researchers is a significant aspect, while classification of studies, trends and assessments based on study results are of no lower importance (Selçuk, Palancı, Kandemir and Dündar, 2014). Because, it is already stated that a study on the review and arrangement of educational studies will be helpful to researchers in the field (Cohen, Manion and Morrison, 2007). At this point, content and meta-analysis results of mathematical education studies provide great convenience for researchers. Recently, this type of content and meta-analysis studies have been drawing the attention of many researchers (Selçuk, Palancı, Kandemir and Dündar, 2014). For this purpose, national and international mathematics education studies have been classified according to various parameters in different time periods, and it is recommended to repeat such classifications at certain intervals.

A related study by Lubiensky and Bowen (2000) reviewed 3011 mathematics education research subjects accessible on ERIC database during 1982-1998 according to titles, subjects and sampling details. According to the study results, the most studied subjects are gender, ethnic groups, social classes and lack of opportunities. Moreover, most studies are done at primary education level, while the least number of studies are performed on pre-school and adult education. The most common subjects of the reviewed articles are scientific learning and teaching, student success, teacher behaviors, curriculum, technology, and student characteristics; while there are less studies on teacher training, student assessment, and educational environment. Hart, Smith, Swars and Smith, (2009), classified a total of 710 articles in 6 mathematics education journals published between 1995 and 2005, namely Journal for Research in Mathematics Education (JRME), Educational Studies in Mathematics (ESM), The Journal of Mathematics Teacher Education (JMTE), Elementary School Journal (ESJ), Early Childhood Research Quarterly (ECRQ), American Educational Research Journal (AERJ)), using the specified methods. 50% of reviewed articles were written with qualitative methods, 21% with quantitative methods and 29% with mixed methods. In a similar vein, Hannula (2009) reviewed the subjects of mathematics education congress statements published by the International Group for the Psychology of Mathematics Education (PME) during the 1997-2007

period. And the study shows that most common subjects are teacher training and development, attitude-perception-belief and improvement of mathematical thinking. Garfield and Ahlgren (1988) reviewed only the studies on the concept of statistics and probability under the categories of teaching, misconceptions and correction of misconceptions. And study results show that there are a limited number of probability and statistics studies in the literature.

Similar studies have become more popular in our country in recent years. Kayhan and Koca (2004) reviewed study articles in CIJE (Current Index to Journals in Education) database, postgraduate theses and dissertations in Dissertation Abstracts database and theses in YÖK (The Council of Higher Education) database to analyze the subjects of mathematics education studies between 2000 and 2002. The findings of the study revealed that most common subjects in mathematics education studies are cognitive aspect, mathematics subjects (curriculum) and teaching methods. Ulutaş and Ubuz (2008) aimed to review 129 articles published between 2000 and 2006 according to sampling, subject, field of research, method, data collection tools and research region criteria. The study results show that most of the studies take primary education students and prospective teachers as the sampling; a big majority of the studies take cognitive, affective aspects and teaching methods as the subject; experimental studies are frequently employed as research methods, and tests and surveys are developed as quantitative methods. By mathematics subject, the largest number of publications are in numbers and geometry subjects, by region, the highest number of researchers are the faculty of education staff of universities in the Central Anatolia region. Yücedağ and Erdoğan (2011), reviewed 153 articles published on Hacettepe University Faculty of Education (HUEFD), The Turkish Online Journal of Educational Technology (TOJET), Educational Sciences in Theory and Practice (KUYEB) and Eurasian Journal of Educational Research (EJER) journals according to research subjects, sampling and types of study. The results reveal that attitude is the common sub title of studies, geometry and algebra are the common subjects, prospective teachers constitute the sampling, experimental and literature review studies are commonly used methods. Baki et al, (2011) reviewed 284 postgraduate theses and dissertations accessible on YÖK National Thesis Center, Proquest database and university libraries according to research problem, research method, data collection tools and sampling in order to find out the trend in mathematics education postgraduate theses and dissertations completed in Turkey. The study results show that learning and teaching are common research problems; experimental and review are common research methods; achievement test and surveys are frequently used data collection tools, and prospective teachers constitute the sampling to a great extent. Similarly, Çiltaş (2012) analyzed 150 postgraduate theses and dissertations published between 2005 and 2010 in Turkey with regards to field of research, subject, method, data collection tools, sampling size and data analysis methods. The study shows that quantitative studies are preferred more, teaching studies are prominent, achievement tests are frequently used, primary education second level (6th to 8th grade) students are preferred as the sample, the sampling size is within range of 31 to 100 people and percentage-frequency and t-tests are majorly used as the data analysis method. A study by Çiltaş, Güler and Sözbilir (2012) analyzed 359 mathematics education articles published in 32 journals during the 1989-2009 period according to field of research, subject, method, data collection tools, sampling size and data analysis methods. The study concludes that there is a sharp increase in mathematics education since as of 2002, quantitative studies are preferred more, learning studies are common as the research subject, achievement tests are preferred as the data collection tool, percentage and frequency tables are significantly used as the data analysis method. A study by Tatar, Kağızmanlı and Akkaya (2013) to review technology-assisted mathematics education scientific studies published in Turkey during 2000-2011 period in terms of demographics, keywords and methodology reviewed over 126 articles

in 32 Turkish journals. The study concluded that majority of the studies have one or two authors; mathematics education-teaching is the favorite subject; prospective teachers and attitude are the most common keywords; undergraduate students constitute the sampling; surveys are frequently used as data collection tools. Qualitative and quantitative research methods are equally frequent; average, standard deviation, and t-test methods are frequently used as data analysis methods in quantitative studies, while descriptive analysis is heavily favored in qualitative studies.

Studies carried out to reveal the recent research trends in mathematics education provide us with a framework about the studies in the field (Çiltaş, Güler and Sözbilir, 2012). However, NCTM (2000) asserts that as in many fields, mathematics education is or should be in a period of change. In this context, researchers (Çiltaş, Güler and Sözbilir, 2012) suggest that similar studies should be carried out in certain intervals in order to find out the state of mathematics education studies in our country. For this reason, this study aims to make a descriptive analysis of mathematics education studies published in Turkey. An in-depth analysis of mathematics education studies took place by use of the publication classification form. Articles were reviewed according to the categories of descriptive info, discipline, article subject, method, data collection tools, sampling and data analysis methods and the following research questions were addressed:

1. What is the distribution of mathematics education studies during the 2009–2014 period by publication language?

2. What is the distribution of mathematics education studies during the 2009-20014 period by nationality of authors?

3. What is the distribution of mathematics education studies during the 2009-20014 period by year?

4. What is the distribution of mathematics education studies during the 2009-20014 period by field frequency?

5. What is the distribution of mathematics education studies during the 2009-20014 period by subject frequency?

6. What are the commonly used research methods employed in mathematics education studies during the 2009-20014 period?

7. What are the common data collection tools used in mathematics education studies during the 2009-20014 period?

8. What is the common sampling and sampling size used in mathematics education studies during the 2009-2014 period?

9. What are the common data analysis methods used in mathematics education studies during the 2009-2014 period?

Method

This study employs descriptive survey model. Survey models aim to describe a past or present condition as it is (Karasar, 2012).

Scope and Process of Study

Studies on mathematics education were reviewed in the first stage of the study. This process revealed that a study by Çiltaş, Güler and Sözbilir (2012) reviewed 359 articles on mathematics

education published in 32 journals between 1987 and 2009. Then, articles to be reviewed within the scope of the study were limited to the years 2009-2014. And 580 articles in 32 journals published in 2009-2014 and fully accessible by web on Ulakbim Social Sciences Database (USSD) were analyzed. 4 of these journals are in Web of Science SSCI index, and 28 in Ulakbim index. Names of the journals and publication dates of articles are given in Appendix 1. The full text of journals and articles were accessed through the web.

Data Collection Tool

Publication classification form developed by Sözbilir, Kutu and Yaşar (2012) and revised by Çiltaş, Güler and Sözbilir (2012) for mathematics education studies is used after another revision for mathematics education studies during 2009-2014. Publication classification form comprises of seven sections; namely, descriptive info about the article, discipline, research subject, method, data collection tools, sampling and data analysis methods. The final revised form of the publication classification form is presented in Appendix 2.

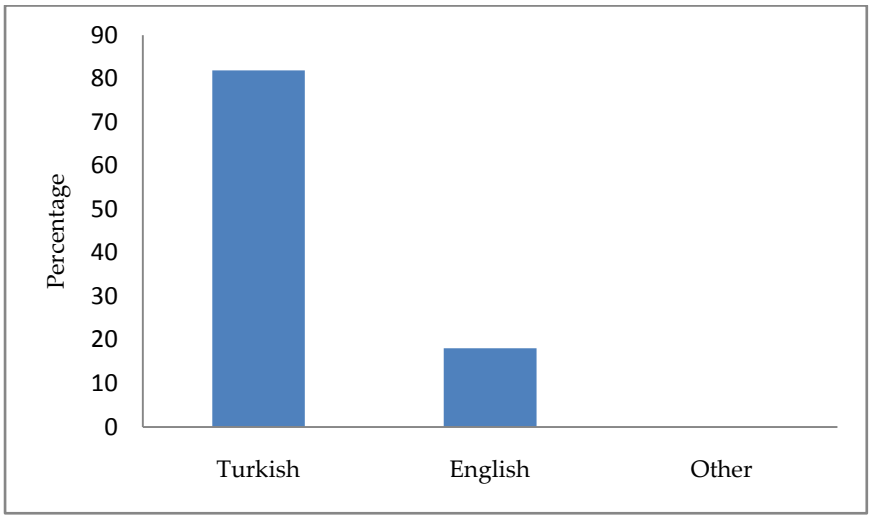
Data Analysis

This study employs a descriptive analysis method for data analysis. 20 randomly selected articles were classified by the researcher according to the publication classification form. 20 classified articles were re-classified with the help of two researchers working on the field, and differences of opinion about the articles were put forward. Researchers arrived at a consensus following discussions to solve differences of opinion regarding the classification of articles. Then, remaining articles were classified by the researcher. Articles classified by the researcher were checked by two researchers in defined intervals in order to improve reliability. This method helped in correcting any potential mistakes in classification. Then, data coded by the publication classification form which was adapted for mathematics education studies during 2009-201, and comprised of 7 sections, were saved in an Excel worksheet. Lastly, data analysis took place with use of SPSS 16.0 and Excel. Gathered results were converted into graphics, frequency and percentage tables and presented in a descriptive form.

Findings

Study findings are presented based on the research questions. Publication language of studies by mathematic educators was reviewed according to the first research question, and the related findings are given in Figure 1. Figure 1 shows that a big majority of articles are published in Turkish (81,89%), with only 18,1% published in English.

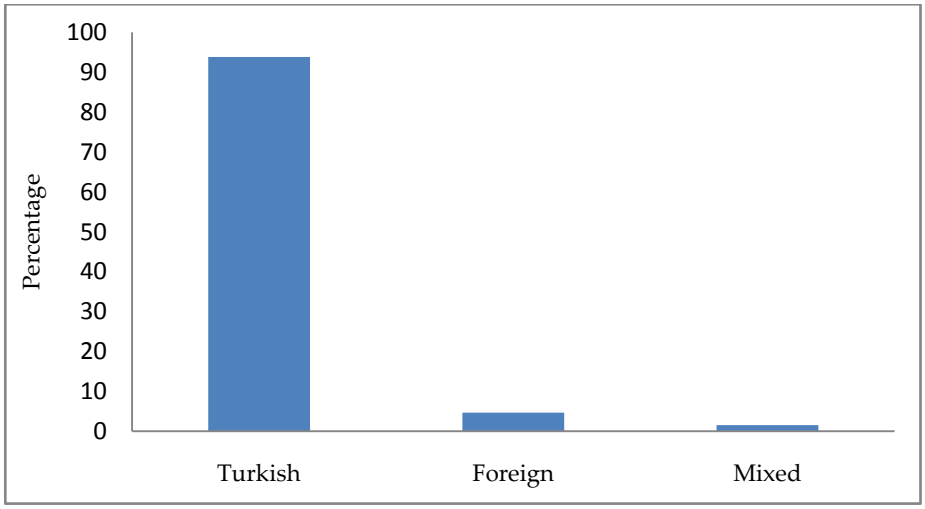
Fig. 1. Distribution of mathematics educators' publication languages



Distribution of mathematics education authors publishing between the years 2009 and 2014 by nationality

The second research question reviews show that most of the studies in the country are carried out by Turkish authors (93,79%), with foreign authors publishing in national journals as 4,65% and mixed (Turkish-Foreign) studies having 1,55%.

Fig. 2. Distribution of mathematics education authors by nationality



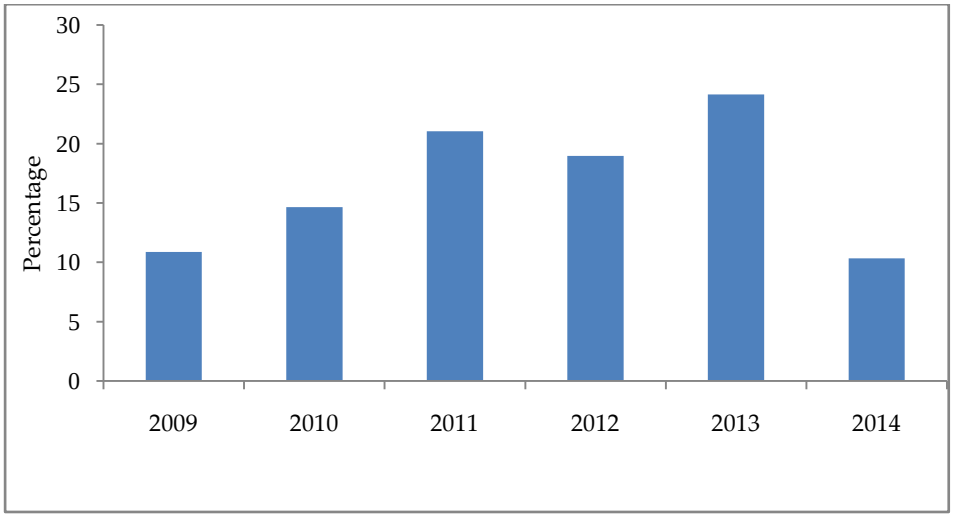
Distribution of mathematics education studies between the years 2009 and 2014 by year

Despite being a quite new area of research in our country with the first mathematics education study dating back to 1987, there is a noticeable increase in mathematics education studies from 2002 onwards (Çiltaş, Güler and Sözbilir, 2012). Table 1 and Figure 3 shows the distribution of studies published between the years 2009 and 2014 by year. According to Figure-3, there is a considerable increase in the number of publications particularly in the year 2013 (24,13%) and 2011 (21,03%). However, there is a decrease in the number of publications in the years 2009 (10,86%) and 2014 (10,34%).

Table 1. Total number of articles reviewed during the 2009-2014 period

Years	Frequency (f)	Percentage (%)
2009	63	10,86
2010	85	14,65
2011	122	21,03
2012	110	18,96
2013	140	24,13
2014	60	10,34
Total	580	100

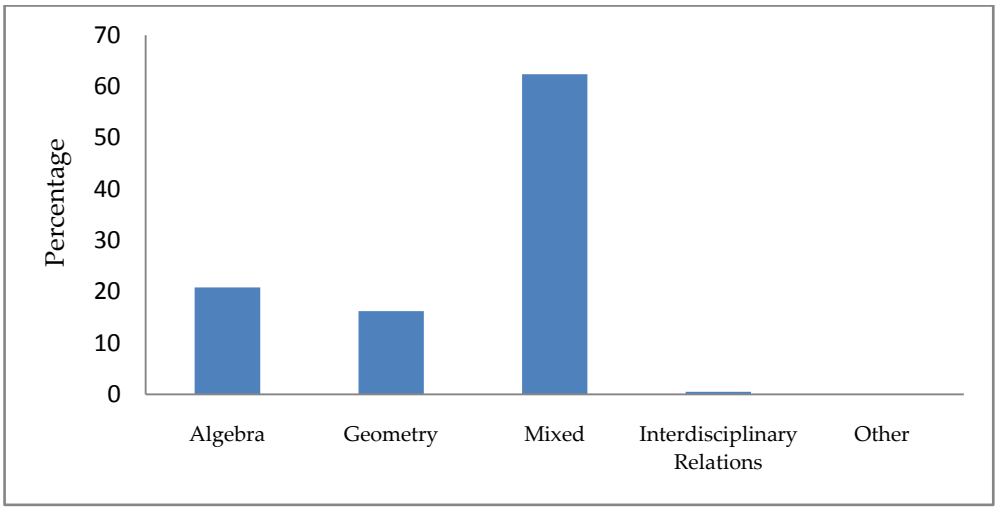
Fig. 3. Distribution of Mathematics Education Studies by Year



Subject Areas Frequently Addressed in Mathematics Education Studies between the Years 2009 and 2014

Distribution of articles by field of study is given in Figure 4 as reviewed according to the fourth research question. Accordingly, 62,41% of reviewed articles take mixed studies as the subject (studies taking algebra and geometry fields as a whole in mathematics education). As seen in the figure, researchers focused on mixed-subject studies. Moreover, 20,86% of studies are carried out on algebra subjects, 16,20% on geometry subjects, and 0,51% on interdisciplinary relations of mathematics. According to these findings, we can say that mathematics education studies are addressed in a more general way rather than specific subjects.

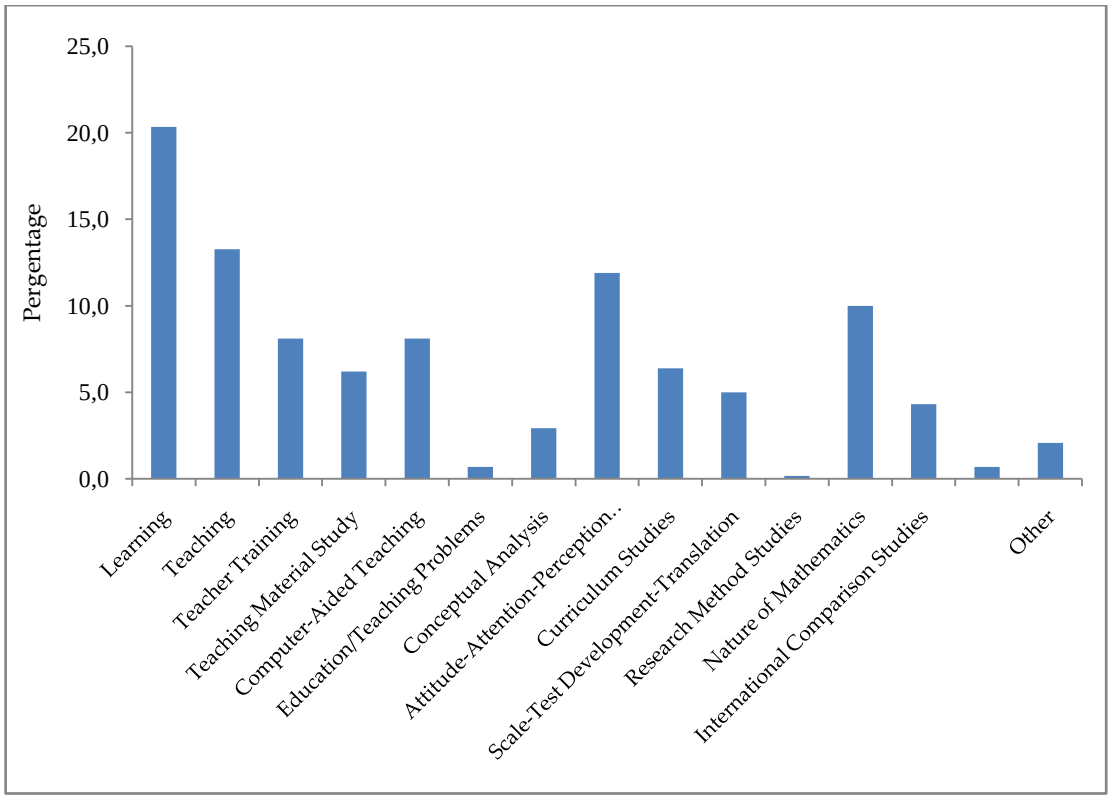
Fig. 4. Distribution of reviewed articles by subject areas



Subjects Frequently Addressed in Mathematics Education Studies between the Years 2009 and 2014

Distribution of common subjects addressed by researchers is given in Figure 5. Researchers typically study learning (20,3%), teaching (13,3%) and attitude-attention-perception-anxiety (11,9%) subjects. Moreover, there are far less studies on concept analysis (2,9%), test/scale development-translation (5,0%), international comparison studies (4,3%), education-teaching problems (0,7%) and research method (0,2%) subjects. There are also studies under the other (2,1%) category not falling into the specified codes and typically with 1 (one) frequency value.

Fig. 5. Distribution of frequently addressed subjects in mathematics education studies



As frequently studied mathematics subjects, learning and teaching categories are analyzed and divided into sub-categories as shown in Table 2. Accordingly, learning studies focus heavily on achievement level assessment (10%) and misconception (3,6%). Similarly, influence of teaching on success (7,1%) and influence of teaching on attitude (3,4%) are the prominent subjects in teaching studies.

Table 2. Distribution of the content of reviewed articles by subject

		Frequency (f)	Percentage (%)
Learning		118	20,3
	Misconception	21	3,6
	Learning Disability	7	1,2
	Achievement Level Assessment	58	10
	Learning Styles	12	2,1
	Conceptual Knowledge	20	3,4
	Other Learning Studies	0	0
Teaching		77	13,3
	Method Comparison	6	1,03
	Influence of Teaching on Success	41	7,1
	Influence of Teaching on Attitude	20	3,4
	Influence of Teaching on Scientific Process Skills	10	1,7

Research Methods Frequently Employed in Mathematics Education Studies between the Years 2009 and 2014

Fig. 6. Research methods frequently used by mathematics educators

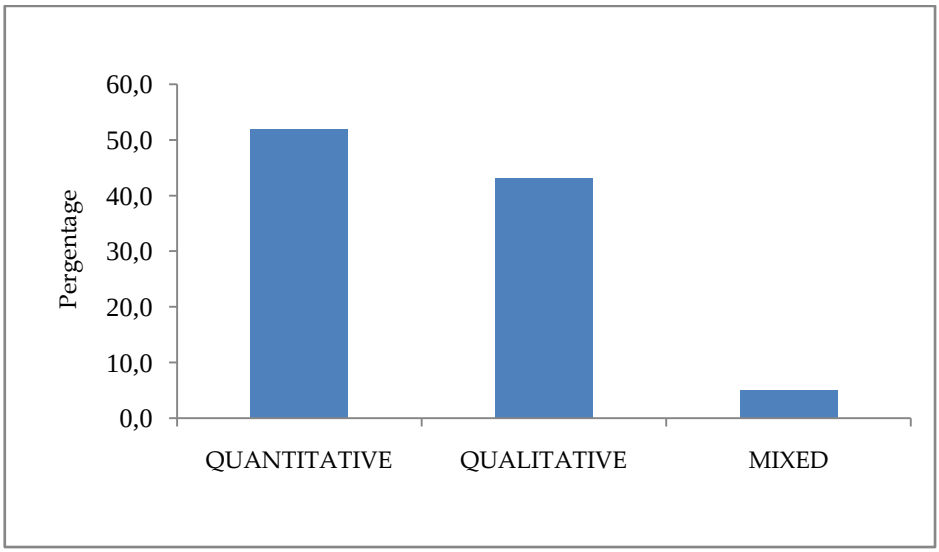
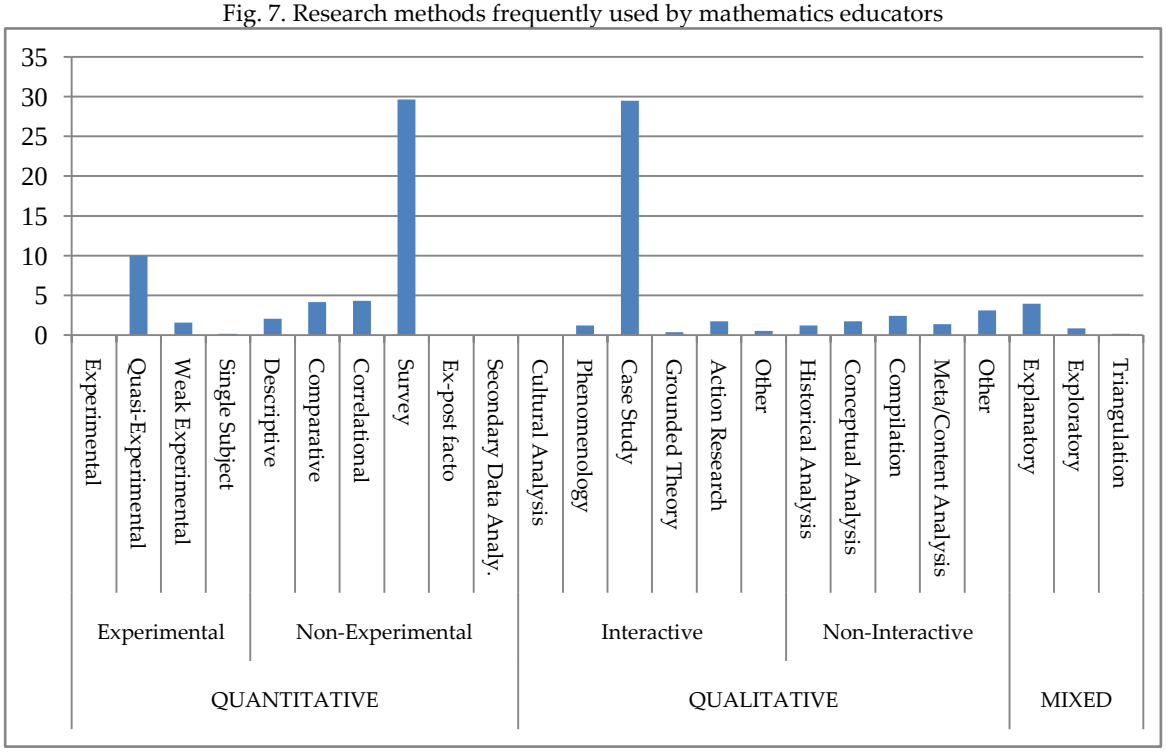


Fig. 7. Research methods frequently used by mathematics educators



Research methods frequently used by mathematics educators are given in Figure 6 and 7. According to Figure 6, researchers use quantitative design by 51,9%, qualitative design by 43,1% and mixed designs by 5%. According to Figure 7, quasi-experimental design is at the forefront with 10% in experimental research designs, and survey studies take the lead with 29,7% in non-experimental research designs. In qualitative research methods, the focus is on case study (29,5%) in interactive studies, and on compilation (2,4%) in non-interactive studies. Explanatory (qualitative-quantitative) design studies take 4% of the mixed method.

Fig. 8. Research designs frequently used by mathematics educators

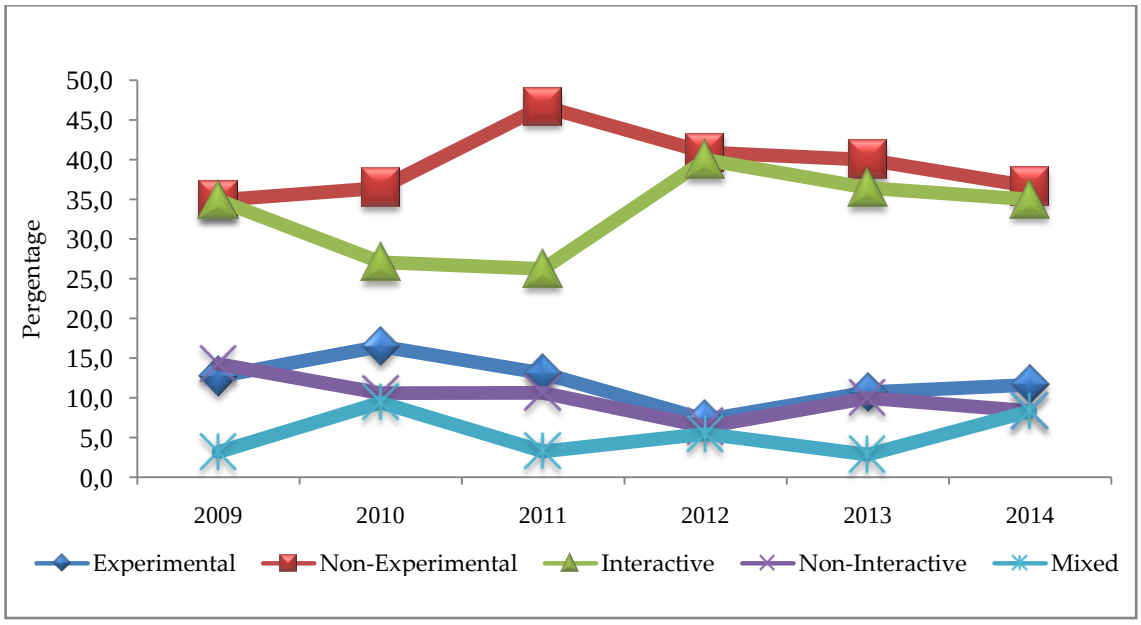


Figure 8 shows the distribution of methods used by year. There is not a considerable amount of change in experimental, non-interactive and mixed research methods between the years 2009 and 2014. Moreover, there is a sharp decrease in interactive research method in the year 2011, and non-

experimental research studies showed an increase trend in the year 2011. In the year 2014, both research methods showed a level close to that of the year 2009.

Frequently Used Data Collection Tools in Mathematics Education Studies between the Years 2009 and 2014

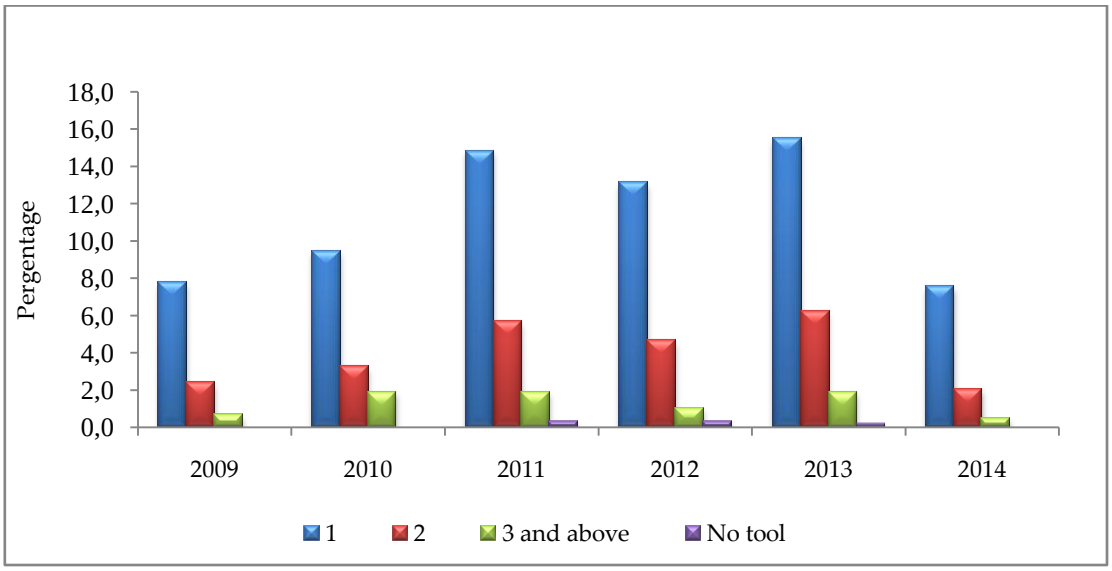
Findings about the data collection tools frequently used by mathematics education researchers are given in Table 3. According to the table, researches frequently use attention-attitude-character-ability etc. tests (37,6%), interview (31,6%) and surveys (20,7%). Moreover, researchers preferred alternative measurement-assessment tools (0,9%) and observation (10%) data collection methods less.

Table 3. Data collection tools frequently used by mathematics education researchers

Data Collection Tools		f	%
Achievement Tests		115	19,8
	Multiple-Choice	88	15,2
	Open-Ended	27	4,7
	Other	0	0
Surveys		120	20,7
	Likert-Type	62	10,7
	Open-Ended	58	10
	Other	0	0
Attention, attitude, character, ability etc. tests		218	37,6
Interview		183	31,6
	Structured	30	5,2
	Semi-Structured	141	24,3
	Unstructured	2	0,3
	Focus Group	10	1,7
Alternative Measurement-Assessment Tools		5	0,9
Documents		99	17,1
Observation		58	10
Other Data Collection Tools		30	5,2

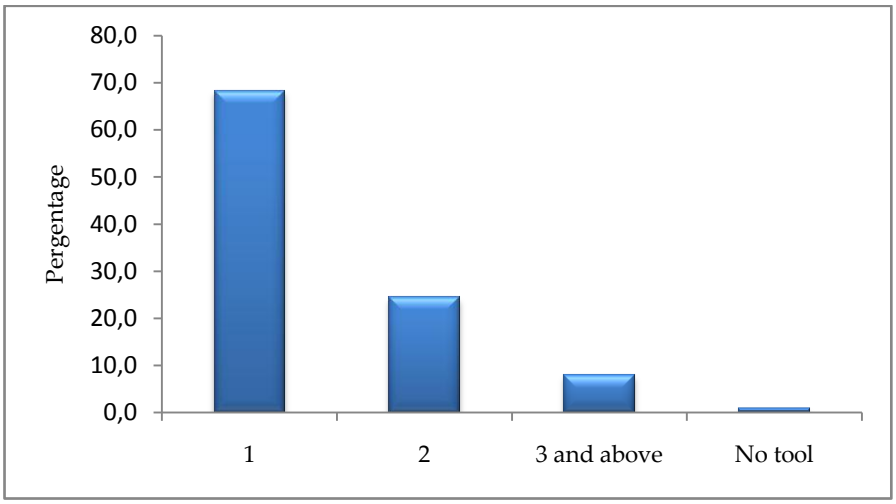
Distribution of the number of data collection tools by year is given in Figure 9. When taken as a whole, the number of studies conducted with a single data collection tool is higher compared to studies conducted with multiple data collection tools for the studies carried out between the years 2009 and 2014. Moreover, there is a significant increase in the number of studies carried out both with a single data collection tool and multiple data collection tools during the years 2011 and 2013. Similarly, we can speak about an increase in the number of studies carried out with 3 data collection tools for the years 2011 and 2013.

Fig. 9. Distribution of data collection tools used by mathematics educators by year



General percentage values of data collection tools used by mathematics educators are given in Figure 10. Accordingly, single data collection tool use in studies have 68,5%, two data collection tools 24,3%, 3 and above data collection tools 7,9% and no tool studies make up 0,9%.

Fig. 10. Number of data collection tools used by mathematics educators



Sampling and Sampling Size Frequently Used in Mathematics Education Studies between the Years 2009 and 2014

Sampling and sampling sizes frequently used by mathematics educators are given in Figure 11 and 12. Figure 11 shows that researchers preferred undergraduate level (32,6%) in their sampling. And they did not specifically prefer pre-school (0,8%), graduate (0,5%), managers (0%) and families (0,5%) as sample groups.

Fig. 11. Types of samples frequently used by mathematics educators

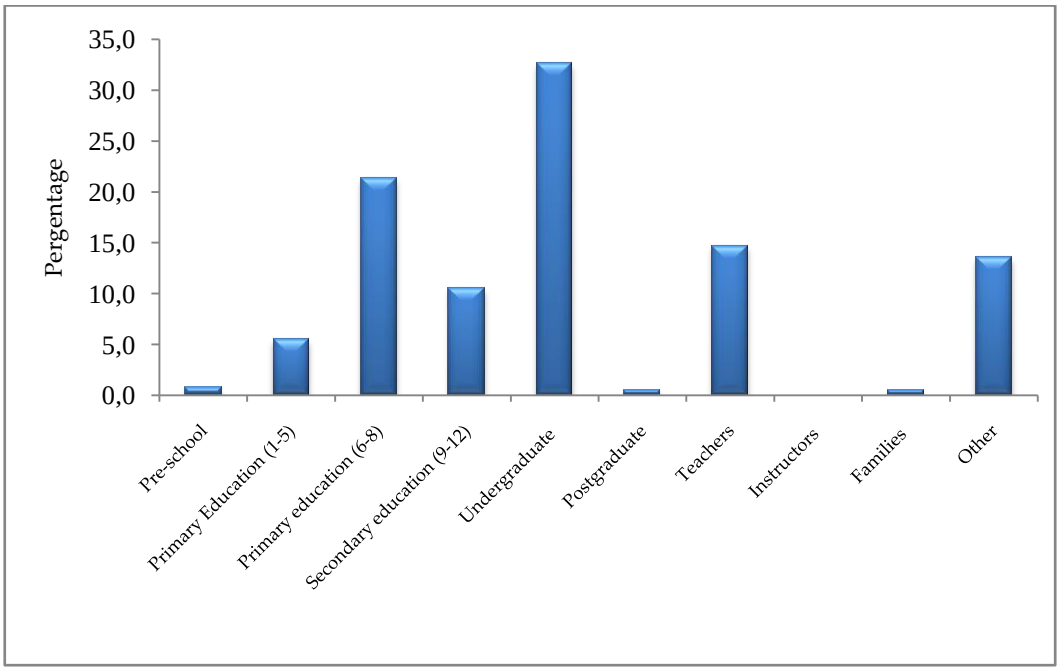
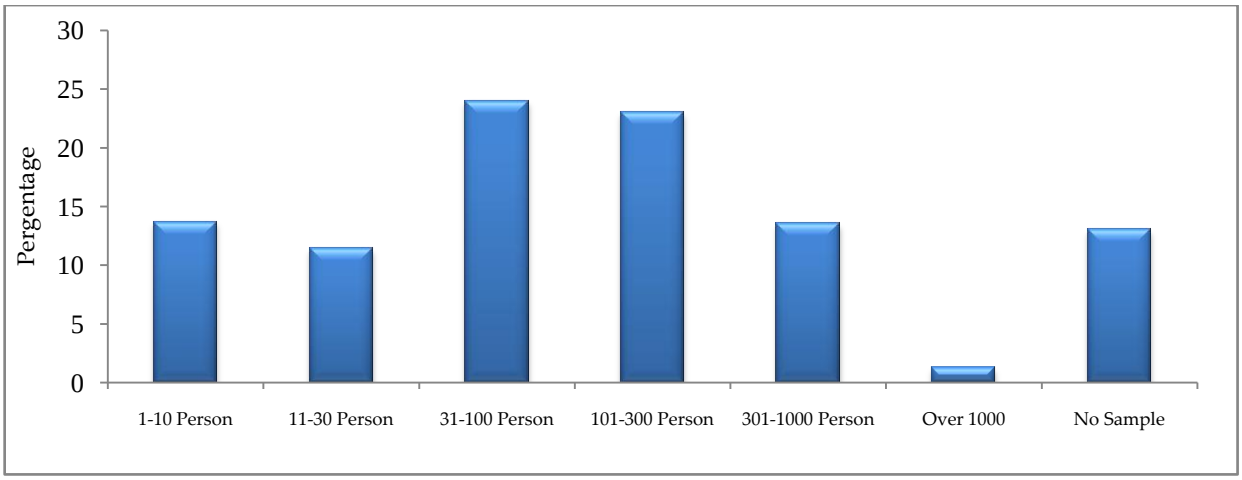


Figure 12 gives the sampling sizes of mathematics educators, and researchers prefer to work with sample groups consisting of 31-100 people (24%) and 101-300 people (23%). Moreover, researchers didn't specifically prefer working with sample groups consisting of over 1000 people (1,3%). Besides, document-review studies with no sampling have high percentage (13%).

Fig. 12. Sampling sizes frequently used by mathematics educators



Data Analysis Methods Frequently Used in Mathematics Education Studies between the Years 2009 and 2014

Different data analysis methods used by mathematics educators are given in Figure 13. Researchers prefer percentage-frequency (26,9%) from descriptive statistics methods, t-test (20%) from predictive statistics methods, and content analysis (29,3%) from qualitative statistics methods. Moreover, studies in the other category (2,8%) of predictive statistics methods are attributable to Lisrel software, and the studies in the other category (6,2%) of qualitative statistics methods are attributable to complication, document reviews etc. studies of mathematics educators.

Fig. 13. Data analysis methods frequently used by mathematics educators

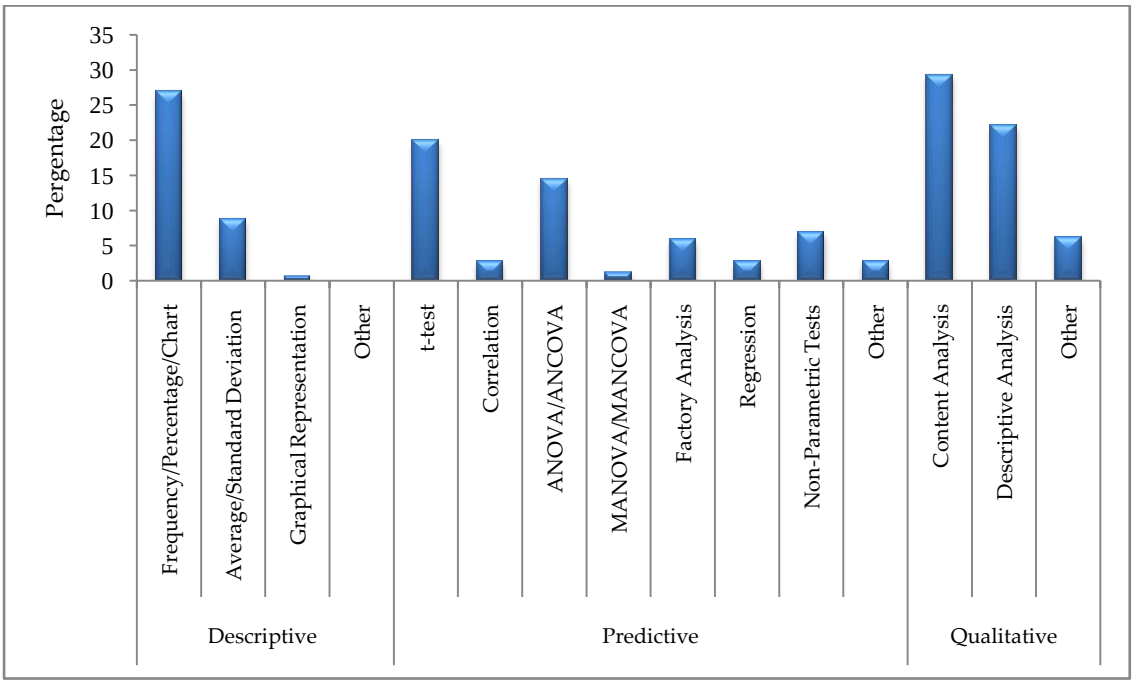
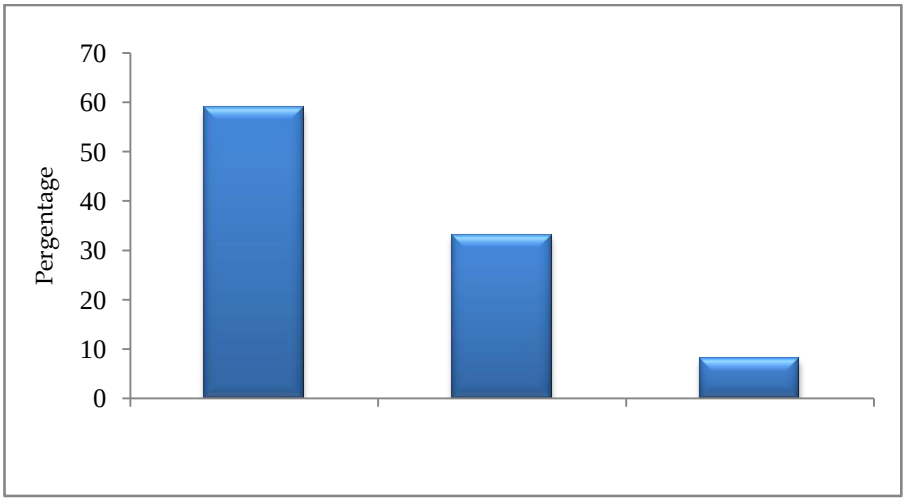


Figure 14 shows that mathematics educators heavily used a single data analysis method (58,8%) in their publications. 33,1% of researchers employed two data analysis methods, and 8,1% of researchers used three data analysis methods.

Fig. 14. Number of data analysis methods frequently used by mathematics educators



Discussion, Conclusion and Recommendations

This study aims to review national studies by mathematics educators by publication languages, nationality of researchers, number by year, research areas, research methods, research subjects, data collection tools, sampling and sampling sizes and data analysis methods; and the study findings are discussed in parallel with research questions.

Great majority of the journals published in our country provide opportunities to Turkish publications and most journals appeal to Turkish authors (93,79%) in a national level, and this leads to the fact that most of the publications by mathematics educators are published in Turkish (81,89%).

These results show parallelism with the results of a study by Selçuk, Palancı, Kandemir and Dündar, (2014) which concludes that the publication language of studies published in an international education journal is 65%. One of the main reasons for the rare use of foreign languages in publications is that a great majority of journals are national, and foreign (4,65%) and mixed-author (1,55%) publications are scarce in international journals. So, it is suggested that academicians should be sent abroad and supported to learn a foreign language for academic writing purposes. Thus, interaction can be improved with foreign researchers, and foreign and mixed-author publications can be increased.

The first mathematics education study in Turkey was carried out two decades ago (Çiltaş, Güler and Sözbilir, 2012). From this perspective, mathematics education is a brand new field in our country. However, findings of study on mathematics education studies between the years 2009 and 2014 show that mathematics education reached a certain maturity in terms of number of publications. Table 1 and Figure 3 shows that the number of publications between the years 2009 and 2011 has increased every passing year. The number of publications reached the peak in 2013 (24,13%). Therefore, research findings support the conclusion that (Baki et al., 2011) mathematics education is becoming established in Turkey as an area of research, and is well beyond its infancy with the increase in the number of mathematics educators and mathematics education institutions.

A review of mathematics education studies by area of research concluded that mixed (62,41%) category studies are predominant. But, algebra and geometry studies are preferred less by researchers. This shows that researchers focus more on studies that take mathematics as a whole, rather than specific subjects. Especially studies on interdisciplinary relations of geometry and mathematics with other disciplines is preferred less than studies on mixed and algebra subjects. This points to the fact mathematics educators turns towards studies which take mathematics as a whole with superficial interview rather than making an in-depth analysis of specific subjects. However, studies on algebra and geometry concepts should be increased in particular. Because, improvement of conceptual knowledge and deeper understanding of mathematics is only possible through increasing studies that feature concepts. These findings show parallelism with the findings of the study by Çiltaş, Güler and Sözbilir (2012). However, these findings do no match the study by Çiltaş (2012), Yücedağ and Erdoğan (2011) concluding that algebra and geometry studies are frequently done, and the study by Ulutaş and Ubuz (2008) which points that there are various studies on numbers and geometry subjects.

Reviewed articles show that researchers frequently studied the learning (20,3%), teaching (13,3%) and attitude-attention-perception-anxiety (11,9%) subjects. This result supports the findings of studies by Baki et al., (2011), Çiltaş (2012), Çiltaş, Güler and Sözbilir (2012) and Lubiensky and Bowen (2000). A thorough review of the frequently addressed learning and teaching categories reveal that achievement level assessment and misconceptions are prominent in the learning category, while the influence of teaching on success and attitude come to the fore in the teaching category. Mathematics educators' trend towards mixed studies can be explained by the heavy focus on studies on achievement level assessment and attitude-attention-perception-anxiety subjects in the learning category. Because, studies on these subjects typically consider mathematics as a whole and are not in-depth studies. Conceptual knowledge studies (3,4%) within the learning category feature conceptual understanding and such studies have recently increased. We can say that encouraging researchers for studies on this subject is significant in terms of conceptual improvements.

Most of the methods employed in mathematics education studies are quantitative methods (51,9%), while qualitative methods are 43,1% and mixed methods fill only 5%. This result is in parallel with

the studies carried out in our country (Baki et al., 2011; Çiltaş, 2012; Çiltaş, Güler and Sözbilir, 2012; Selçuk, Palancı, Kandemir and Dündar, 2014; Ulutaş and Ubuz, 2008; Yücedağ and Erdoğan, 2011). However, the results are at variance with the results (50% qualitative, %21 quantitative, %29 mixed) of the study on methods employed in mathematics education studies carried out by Hart, Smith, Swars and Smith, (2009). These results clearly mark that research methods vary by country. While studies performed between the years 1987 and 2009 employed qualitative methods at the rate of 35,1% and mixed methods at the rate of 5,3% (Çiltaş, Güler and Sözbilir, 2012), research results point to a huge increase in qualitative studies recently in our country, but there is no significant difference in use of mixed research methods. The recent increase in qualitative mathematics education studies can be attributed to the heavy focus on studying the learning subject category which enables in-depth review of conceptual knowledge. However, the frequent use of quantitative studies and particularly survey studies (29,5%) explains the common use of mixed studies which deal with mathematics as a whole and pave the way for superficial reviews. The increase in qualitative mathematics education studies in our country is a positive development, and mixed studies are preferred less. Qualitative and mixed research methods enable more thorough review of underlying problems, thereby bringing a new depth to mathematics education studies in our country; so, it is suggested to give priority to mixed studies to interpret data in multiple ways (Çiltaş, Güler and Sözbilir, 2012).

Reviewed articles show that researchers frequently used attention-attitude-character-ability tests (37,6%), interview (31,6%) and surveys (20,7%) as data collection tools. This result shows parallelism with the results of similar studies in our country (Baki et al., 2011; Selçuk, Palancı, Kandemir and Dündar, 2014; Ulutaş and Ubuz, 2008). Moreover, in parallel with the results of the research by Çiltaş, Güler and Sözbilir (2012), use of a single data collection tool (68,5%) is predominant. Researchers preferred mixed research methods less, and this influenced the number of data collection tools used. Because, in mixed methods, different data collection tools should be used to gather supporting data. In this regard, we can say that results are consistent with one another. More data collection tools should be used to enrich the data set and improve the consistency between data.

Most of the samples used by researchers are at undergraduate level (32,6%), and sample size is between 31 and 100 people (24%). This result supports the findings of similar studies in our country (Baki et al., 2011; Çiltaş, Güler and Sözbilir, 2012; Ulutaş and Ubuz, 2008; Yücedağ and Erdoğan, 2011). But, there is a discrepancy with studies (Çiltaş, 2012; Lubiensky and Bowen, 2000) concluding that the commonly used sample is at primary education level. Moreover, mathematics educators do not prefer working with pre-school (0,8%) and postgraduate (0,5%) sample groups. Similar results are achieved by Çiltaş, Güler and Sözbilir (2012), and mathematics educators are advised to carry out studies with both sample groups. However, mathematics education studies between the years 2009 and 2014 demonstrate that studies with both sample groups are fairly insufficient. Many similar studies show that mathematics educators typically prefer undergraduate students as the sample group. This can be attributed to the fact that it is easy to reach undergraduate students compared to other sample groups. For this reason, we can suggest encouraging researchers to projects involving each sample group from pre-school to postgraduate level, and solve any problems they may encounter.

The study also revealed that mathematics educators frequently use quantitative research methods, but content analysis method (29,3%) is heavily favored in the analysis section. This result falls into disparity with similar studies in our country (Çiltaş, 2012; Çiltaş, Güler and Sözbilir, 2012; Ulutaş

and Ubuz, 2008; Yücedağ and Erdoğan, 2011) concluding that mathematics educators prefer descriptive data analysis methods more as the data analysis method. With that said, researchers frequently used descriptive statistics methods (26,9%) and t-test (20%) as the data analysis method. Moreover, in parallel with the findings of similar studies in the literature (Baki et al., 2012; Çiltaş, Güler and Sözbilir, 2012; Tatar, Kağızmanlı and Akkaya, 2013), single data analysis method (58,8%) was frequently used in the studies. Therefore, we can attribute the predominance of single data analysis method to minor involvement of mixed research methods and frequent use of a single data collection tool. However, it is important to use multiple variables in education studies to make a clear review of the influence of variables, reduce the limits of studies and improve the consistency between variables. For this reason, it is suggested to multiple supporting data analysis methods while doing analysis on data gathered using various data collection tools.

In general, study results show parallel preferences of mathematics educators regarding subject areas, subjects, methods, number of data collection tools, sampling and sampling size to results of similar studies carried out in the past (Baki et al., 2011; Çiltaş, 2012; Çiltaş, Güler and Sözbilir, 2012). Nevertheless, we can speak about a radical change in data collection tool and data analysis method preferences. In mathematics education studies between the years 2009 and 2014, attitude-attention-perception-character-ability etc. tests stand out in data collection tools, and content analysis method stands out in data analysis methods. Moreover, results demonstrate that studies between the years 2009 and 2014 also neglect pre-school, postgraduate and family sample groups just like previous years. For this reason, it is suggested to attach more importance to studies with such sample groups in the future mathematics education studies. Because, involvement of pre-school children in mathematics education studies will contribute to their mathematical development. Similarly, it will help postgraduate students or academicians of the future to shape their professional lives and create an academic culture with their involvement in mathematics education studies. It is also found that there is a massive increase in the number of qualitative research methods in studies conducted between the years 2009 and 2014. Hence, we can say that there is a growing interest in qualitative research methods and data analysis methods regarding mathematics education studies in our country. These findings will hopefully offer an insight to mathematics education researchers, teachers and particularly fresh academicians. Identification of mathematics education study trends at certain intervals will help researchers to carry out studies focusing on the field requirements. Moreover, reviewing content analyses within the scope of creating and implementing mathematics education policies will facilitate analysis of research results in the field. Thus, we can clearly point out that doing similar studies with different databases and resources (proceedings, articles, thesis etc.) at certain intervals will help all researchers to find out new approaches, extend the scope of their future academic studies and give the right decisions.

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Appendix 1. The distrubition of the journals examined in research

Journals	Year Range	Frequency-Percent f(%)
Journal of Abant İzzet Baysal University	2009-2014	8(1,37)
Ahi Evran University Journal of Faculty of Education	2009-2014	23(3,96)
Ankara University Journal of Faculty of Educational Sciences	2009-2014	13(2,24)
Cumhuriyet International Journal of Education	2012-2013	8(1,37)
Çukurova University Journal of Faculty of Education	2012-2014	5(0,86)
Dicle University Journal of Faculty of Ziya Gökalp Education	2009-2014	23(3,96)
Dokuz Eylül University Journal of Faculty of Buca Education	2010-2013	10(1,72)
Ege University Journal of Faculty of Education	2010-2013	2(0,34)
Education and Science Journal	2009-2014	55(9,48)
Erzincan University Journal of Faculty of Education	2009-2014	17(2,93)
Gazi University Journal of Faculty of Education	2010-2013	6(1,03)
Gaziantep University Journal Social Sciences	2009-2014	15(2,58)
Hacettepe University Journal of Faculty of Education	2009-2014	35(6,03)
International Journal of Education in Mathematics, Science and Technology	2013-2014	9(1,55)
Elementary Education Online	2009-2014	51(8,79)
İnönü University Journal of Faculty of Education	2009-2013	7(1,20)
Kastamonu University Journal of Faculty of Education	2009-2014	41(7,06)
Educational Sciences: Theory & Practice	2009-2014	43(7,41)
M. U. Journal of Faculty of Atatürk Educational Sciences	2009-2012	8(1,37)
Mehmet Akif Ersoy University Journal of Faculty of Education	2010-2014	11(1,89)
Mersin University Journal of Faculty of Education	2009-2013	11(1,89)
Journal of National Education	2009-2014	15(2,24)
N. E. F. Electronic Journal of Science and Mathematics Education	2009-2014	28(4,82)
Ondokuz Mayıs University Journal of Faculty of Education	2012-2013	4(0,69)
Pamukkale University Journal of Faculty of Education	2009-2014	26(4,48)
The International Journal of Educational Researchers	2010-2014	2(0,34)
The International Journal of Research in Teacher Education	2010-2012	8(1,37)
Turkish Online Journal of Educational Technology	2009-2014	27(4,65)
Turkish Journal of Computer and Mathematics Education	2009-2014	56(9,65)
Uludağ University Journal of Faculty of Education	2009-2013	10(1,72)
International Journal of Turkish Educational Sciences	2013	1(0,17)
Yüzüncü Yıl University Journal of Faculty of Education	2009	2(0,34)
Total	548	100

Appendix 2. Mathematics education publication classification form

A-ARTICLE DETAILS

1. Article Name:…… **2.** Author(s) ……**3.** Journal Name :……..
4. University of Author(s):…… ……**5.** Year:……**6.** Volume:……**7.** Number:……**8.** Page:……
9. Reference No: ……**10.** Research Question/Number of Hypotheses:……**11.** Number of Charts (Tables):……**12.** Number of Figures: ……
13. Number of Graphics:……**14.** Authors: Turkish ( ) Foreign ( ) Mixed ( ) **15.** Publication Language: Turkish ( ) English ( ) Other ( )……

B-AREA OF ARTICLE

1. Algebra ( ) **2.** Geometry ( ) **3.** Mixed ( ) **4.** Interdisciplinary Relations ( ) **5.** Other ( )

C-SUBJECT OF ARTICLE

1. Learning ( )
MS ( ) LD ( ) LS ( ) ALA ( ) CK ( ) Other ( )
2. Teaching ( )
MC ( ) ITA ( ) ITS ( ) ITSBS ( )
3. Teacher Training ( )
PTT ( ) IST ( ) Other ( )
4. Teaching Material Study ( )
MD ( ) MU ( )
5. Computer-Aided Teaching ( )
6. Education/Teaching Problems ( )
7. Conceptual Analysis
8. Attitude-Attention-Perception Assessment
9. Curriculum Studies ( )
10. Scale-Test Development-Translation ( )
11. Research Method Studies ( )
12. Nature of Mathematics ( )
ML ( ) PMDL ( )
13. International Comparison Studies ( )
PISA ( ) TIMSS ( ) CURRI-BOOK ( )
14. New Trends in Mathematics Education ( )
15. Diğer ……

D- RESEARCH METHOD

1. QUANTITATIVE		**2. QUALITATIVE**		**3. MIXED**
		Interactive	**Non-interactive**	
11.Experimental	**12.Non-experimental**	**21.** Cultural Analysis ( )	**28.** Historical A. **( )**	**31.** Explanatory ( ) (quantitative➔qualitative) ( )
111. Experimental ( )	**121.**Descriptive ( )	**22.** Phenomenology **( )**	**29.** Conceptual A. **( )**	**32.** Exploratory (qualitative➔quantitative ( ))
112. Quasi-experimen. ( )	**122.**Comparative ( )	**23.** Grounded Theory **( )**	**30.** Compilation A. ( )	**33.**Triangulation (quantitative+qualitative)
113. Weak experiment. ( )	**123.**Correlational ( )	**24.** Critical Study **( )**	**31.** Meta Ana. **( )**	
114. Single Subject ( )	**124.**Survey ( )	**25.** Case Study **( )**	**32.** Other **( )**	
	125. Ex post facto ( )	**26.** Action Research **( )**		
	126. Secondary Data Ana. ( )	**27.** Other **( )**		

E- DATA COLLECTION TOOLS

1.Survey ( )
Open-ended ( ) Likert ( ) Other ( )
2.Achievement Test ( )
Open-ended ( ) Multiple-Choice ( ) Other ( )
3.Perception/Attention/Attitude/Ability/Character etc. Tests ( )
Please specify……
4.Interview ( )
Structured ( ) Semi-structured ( ) Unstructured ( ) Focus group ( )
5.Observation ( )
Participant ( ) Non-participant ( )
6. Alternative Assessment Tools ( )
(Diagnostic test, Conceptual map, Portfolio etc.)
7.Documents ( )
8. Other(please specify) ( ) ……..

F- SAMPLING

a. Sampling	**b. Sampling Size**
1. Pre-school ( )	**1.** Between 1-10 **( )**
2. Primary education (1-5) ( )	**2.** 11-30 **( )**
3. Primary education (6-8) ( )	**3.** 31-100 **( )**
4. Secondary education (9-12) ( )	**4.** 101-300 **( )**
5. Undergraduate (Fac. of Education) ( )	**5.** 301-1000 **( )**
6. Postgraduate (Master-Doctorate) ( )	**6.** Over 1000 **( )**
7. Teachers ( )	
8. Instructors ( )	
9. Families ( )	
10. Managers ( )	
11. Other…… ( )	

G-DATA ANALYSIS METHOD

1. QUANTITATIVE DATA ANALYSES			**2. QUALITATIVE DATA ANALYSES**	
1. Descriptive		**2. Predictive**	**3. Qualitative**	
11. Frequency/percentage/chart	( )	**21.** Correlation ( )	**31.** Content analysis	( )
12. Average/standard deviation	( )	**22.** t-test ( )	**32.** Descriptive analysis	( )
13. Graphical representation	( )	**23.** ANOVA/ANCOVA ( )	**33.** Other ……	( )
14. Other……	( )	**24.** MANOVA/MANCOVA ( )		
		25. Factory analysis ( )		
		26. Regression ( )		
		27. Non-parametric tests ( )		
		28. Other…… ( )		

MS: Misconception, **LD:** Learning Difficulty, **LS:** Learning Styles, **ALA:** Achievement Level Assessment, **CK:** Conceptual Knowledge, **MC:** Method Comparison Studies, **ITA:** Influence of Teaching on Attitude, **ITS:** Influence of Teaching on Success, **ITSBS:** Influence of Teaching on Scientific Process Skills, **PTT:** Prospective Teacher Training, **IST:** In-service Training, **MD:** Material Design, **MU:** Material Usage, **ML:** Mathematical Literacy, **PMDL:** The Place of Mathematics in Daily Life, **PISA:** International PISA Comparisons, **TIMSS:** International TIMSS Comparisons, **CURRI-BOOK:** International Curriculum-Book Comparisons