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Mathematics Education Research in Turkey: A Content Analysis Study*

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Abstract

In this study, a content analysis of research is aimed in the field of mathematics education of Turkish researchers. To this aim, the investigation of 359 article were made which were accessed from web in full text between 1987 and 2009 years and which were published in the field of mathematics education from 32 different journals. 27 of these journals were national and 5 of them were indexed in Web of Science (SSCI). For this particular aim, a paper classification form, developed by Sozbilir, Kutu and Yasar was revised and used for research in mathematics education. Each publication has been subjected to content analysis through this form and the data were recorded in a database. The data were analyzed using SPSS 16.0 software. The results chart, frequency, and percentage table is presented as a descriptive manner. As a result, a large increase in mathematics education since 2002 is concerning studies, quantitative research is more preferred, as the subject of research is in the forefront of learning activities, studies, using more than one data collection tool and as a method of data analysis are in the forefront of the use and frequency were determined .

Key Words

Mathematics Education, Research Titles, Scientific Research, Papers, Content Analysis.

In the last century, great developments in science and technology have resulted in nations' increasing tendency to science and mathematics, therefore more attention focused on studies in curriculum development in science rather than mathematics. The most important reforms in mathematics education occured during the transition period to modern mathematics from 1960's to 1980's (Sztajn, 1995). As a result after this transition, CCCP, with the previous name of Union of Soviet Socialist Republics (USSR), launched the first artificial satellite, Sputnik I, into Earth's orbit in 1957. Then, all of the world nations started to give more attention to science and mathematics (Sözbilir & Canpolat, 2006; Sztajn, 1995). Parallel to these developments taken place around the world, Turkey gave also more importance to science and mathematics education by opening the first science high school in 1964 in Ankara (Selvi, 1996). 1980's is the period of the realization of the need for a reform in mathematics education (Savaş, 1999). In Turkey, the real shift towards educational research, particularly in science and mathematics education, was observed after a reform movement which was under the National Education Development Project initiated by Higher Education Council [YÖK] and financed by World Bank during 1990's. This project resulted with re-structuring schools of educations at tertiary

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level in 1997 to be more educational research oriented schools which resulted in increase of educational research papers in science and mathematics education both at national and international level. In Turkey, this process gained more acceleration during the last 10 years starting from 2000's (Tatar & Tatar, 2008). This study is focused on illuminating how this research in mathematics education is improving in Turkey. The investigation of the research approaches in mathematics education performed in the recent years will set a light to researchers, educators, teachers, and students in order to perform scientific discussion and questionings. This is because the investigation of educational studies and their proper organization will help the other researchers who want to conduct related studies (Cohen, Manion, & Morrison, 2007).

Few studies so far have focused on how mathematics education research is developing in Turkey. Among them Kayhan and Koca (2004) conducted a small scale study in order to investigate the frequently studied subjects in the mathematics education research papers and thesis between 2000 and 2002. The results of this study showed that most of the studies in mathematics education were dominated by study on learning 'cognitive dimensions' of mathematics, 'curriculum studies" and 'teaching methods'. In another study by Ulutaş and Ubuz (2008) a total of 129 papers published between 2000 and 2006 subjected to a content analysis indicated most of the studies conducted in mathematics education in seven years were performed at primary level and at tertiary level with prospective teachers based on the sampling and they were focused on about cognitive, sensorial dimensions of mathematics and teaching methods. In addition, most of the studies were quantitative experimental studies. The tests and questionnaires were chosen as the data collection tools. Based on the titles of the studies numbers and geometry subjects were the widely studied subjects in mathematics education. On the other hand, while the geographic areas were considered, it was determined that majority of studies were performed by researchers in the universities located around the Central Anatolia Region.

On the other hand, international studies focused on the content analysis of mathematical education researches had greatly helped to understand the development and importance of mathematics education research. Hart, Smith, Swars, and Smith, (2009) classified the research in mathematics education conducted between 1995 and 2005 according to methods employed in the studies. 710 articles from 6 journals with the domain of mathematics education were investigated. According to the results, half of the all articles investigated employed qualitative method while 21% of them used quantitative and 29% used mixed methods.

Garfield and Ahlgren (1988) conducted a survey which searched for the studies focused on statistics and probability concepts. They discussed the misconceptions related to teaching statistics and probability, statistical reasoning and how to resolve these misconceptions. As a result, the research literature on this subject was found to be very limited. Finally, ERIC provided a series of extensive summaries on mathematics education research published between 1994 and 1998 entitled 'Research in Mathematics Education' (Owens, 1996; Owens & Reed, 1998). Each year, mathematics education studies were collected and summarized according to the content and standards.

Content analysis studies focused on investigating the content of the researches done in a specific discipline and identify the trends play important role in understanding the development of the particular discipline (Apaydın, 2009). Studies investigate the trends of the research conducted in mathematics education in recent years both provide a perspective to researchers. This content analysis study aimed to identify the trends in mathematics education research papers published by the Turkish researchers in the last quarter. For this particular aim, paper classification form, developed by Sozbilir, Kutu and Yaşar (in press), was revised for mathematics education studies in order to answer research questions listed below. In Turkey;

1- How the distribution of studies in mathematics education published by Turkish researchers between 1987 and 2009 changes through years?

2- What are the frequently studied domains in mathematics education published by Turkish researchers between 1987 and 2009?

3- What are the frequently studied subjects (titles) in mathematics education published by Turkish researchers between 1987 and 2009?

4- What are the frequently used research methods in mathematics education research published by Turkish researchers between 1987 and 2009?

5- What are the frequently used data collection tools in mathematics education research published by Turkish researchers between 1987 and 2009?

6- What are the frequently used sampling methods and sample sizes in mathematics education research published by Turkish researchers between 1987 and 2009?

7- What are the frequently used data analysis methods in mathematics education research published by Turkish researchers between 1987 and 2009?

Method

Content analysis is employed as the research method in this study. Content analysis brings the similar data together under specific concepts and themes. It is an organized interpretation of such concepts and themes that help readers to understand better (Yıldırım & Şimşek, 2006). Content analysis is a systematic and renewable technique that summarizes a text's words into smaller content categories with respect to codes based on specific rules (Büyüköztürk, Çakmak, Akgün, Karadeniz, & Demirel, 2009).

Data Collection Tool

Each paper is subjected to a content analysis by using the '*Papers Classification Form* (PCF)'. PCF is a modified version of the "Paper Classification Form (PCF)," which was developed by Sozbilir, Kutu and Yasar (in press). The form is composed of seven components which provide descriptive information for the identification of the paper, subdisciplinary area of the paper, subject (title) of the paper, methods employed in the study, data collection tools used, sampling and sample sizes, and data analysis methods.

Sample

Since the first study published in the field of mathematics education by Turkish researchers were seen in 1987, the data in this study were gathered from the investigation of 359 articles, which the were accessed from web in full text between 1987 and 2009 years and which were published in the field of mathematics education from 32 different journals. 27 of these journals were national and 5 of them were indexed in Web of Science (SSCI). The names of the journals and the publication dates of the articles were presented in Appendix 1. Majority of the journals were accessed via web and the journal which were not accessed via web were provided from the library of Ataturk University.

Data Analysis

At the initial stages of the study, the researchers studied together under the guidance of third author. To achieve the reliability, randomly selected 15 papers were subjected to content analysis by the authors independently and then authors came together, compared the results, the differences were discussed, disagreements about the classifications were discussed and common meanings were set. The rest of the papers were divided and classified by the first and second authors. With regular periods, third author checked the classification of the papers. All data, collected by means of publication classification form were recorded to an electronic database and then transferred to SPSS 16.0 and were analyzed. The results were descriptively presented in the forms of charts and frequencies tables.

Result and Discussion

Majority (85%) of the studies conducted by mathematics educators were published in Turkish language and the rest of them were in English. Research in mathematics education is a newly developing area in Turkey. Throughout last 20 years, the number of the mathematics education researches has increased sharply and reached a peak in 2005. This increase is due to the restructuring made in the organization of education faculties as a part of national educational reform movement in 1990's by the Higher Education Council (YÖK) (Türkmen, 2007). This reform movement encouraged researchers in educational faculties to focus on educational research more than pure scientific research. Therefore, educational researches have started to increase gradually in the last 20 years. In recent years the researchers in Turkish universities are forced to publish at international level for academic advancement. Therefore mathematics educators are inclined to publish in abroad and this has caused a slight increase in the number of international papers. Moreover, national journals have also increased the quality of the papers they have published in recent years. This has caused a little bit decrease at the number of papers published in national journals.

The content analysis results also showed that mathematics education papers fell in four general areas as algebra, geometry, mixed and relationship of mathematics with other disciplines. The majority of the papers were classified as mixed indicating that studies focused on different aspects of mathematics rather than a single area such as algebra, geometry. There

were studies that focused on investigation of students' attitudes towards mathematics, determination of their interest and anxiety, their self-efficacy. In addition 73.5 percent of the studies used only one data collection tool. This is because trends among mathematics education researchers were doing descriptive studies in which they tried to present a general situation. However, mathematics education research should give more importance to studies focused on teaching that reveal the essence of the concepts and for more understandable learning. Therefore, in general, it is thought that tendency of researchers' studies to specific research areas such as algebra and geometry helps students to learn mathematics' specific subjects.

According to the results of the analysis, most frequently studied areas in mathematics education included learning, teaching, and teacher education. This finding supported the findings of the study by Lubiensky and Bowen (2000). Misconceptions and determination of achievement level on the basis of learning, effects of teaching on achievement and attitude towards mathematics on the basis of teaching were common. Lastly, pre-service teacher education studies attracted more attention. The finding of this study is parallel to the other studies (Kayhan & Koca, 2004; Ulutaş & Ubuz, 2008; Tatar & Tatar, 2006). However, since in-service teacher education studies are quite few, it could be suggested that more research attention may be given to this area.

Regarding the research methods used, it was found that the use of quantitative methods were dominant (~60 %), this was followed by qualitative methods (~35 %), and use of mixed methods (~ 5%) were quite uncommon. The results of this study show parallelism with the other studies carried out in Turkey (Ulutaş & Ubuz, 2008), while there is a discrepancy with the studies conducted abroad (Hart et al., 2009).

The fundamental principle of quantitative research is to present and evaluate the gathered data by descriptive and statistical manners. On the other hand, the qualitative research takes place in natural settings and is interpreted in a holistic way. Therefore, the results of the study are discussed more fully and in multiple ways (Creswell, 2003). Therefore, this study suggests that there is a need to do more qualitative research in mathematics education that investigates the concepts and research areas more deeply. On the other hand, mixed methods handle the qualitative and quantitative data by transforming different data sources from one to another in order to verify each other (Creswell, 2003). However, it was found that there were few studies in mathematics education with mixed methods in Turkey. It may also be suggested that researchers should give priority to do more mixed method approaches to enrich the data collected and to increase the quality and the reliability of studies.

According to the data collection tools, the results showed that data were more frequently collected by questionnaires and achievement tests and 73.5 percent of quantitative studies relayed only on one data collection tool at the end of this study. This result was also apparent in Ulutaş and Ubuz (2008). To increase the validity of the studies and to reach more reliable results, it is suggested that researchers need to use more than one data collection tool.

In terms of samples and the sample sizes, the results indicated that majority of the samples involved in the studies were undergraduate students and the sample size ranged from 31 to 100 individuals. These findings were supported by Tatar and Tatar (2006) and Ulutaş and Ubuz (2008) studies. However, Lubiensky and Bowen (2000) found that the majority of the studies were conducted with the sample of elementary level students. According to this result, it is reasonable to suggest that mathematics educators' should also focus teaching and learning mathematics at lower levels such as preschool and early years in primary as well as postgraduate levels.

The data analysis approaches employed in the mathematics education research papers published in Turkey, quantitative data analysis methods such as descriptive statistics and inferential statistics were frequently used. This finding is reasonable as quantitative research methods were quite common. Moreover, it is also important to note that 78 percent of the studies used only single data analysis method. This is due to the fact that majority of the studies intended to investigate only effect of one or two variables.

During recent years, it was argued that teaching mathematics should be in a process of change as those in the other disciplines (National Council of Teachers of Mathematics [NCTM], 2000). From this perspective, it is recommended that similar studies should be periodically conducted to determine the development of research in mathematics education periodically. This would help researchers to see the current trends and shifts to envisage the future research areas. In addition, it is recommended to represent the results of meta-analysis of similar studies to see the contribution of a specific research area to the mathematics education in Turkey.

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Ek 1.

Taranan Dergiler ve Yıllar

No	Dergiler	Yıl Aralığı	f(%)
1	Ahi Evran Üniversitesi Eğitim Fakültesi Dergisi	2006–2008	3(0,8)
2	Ankara Üniversitesi Eğitim Bilimleri Fakültesi Dergisi	2005–2008	3(0,8)
3	Atatürk Üniversitesi Kazım Karabekir Eğitim Fakültesi Dergisi	2005–2008	16(4,4)
4	Çağdaş Eğitim Dergisi	2005–2008	5(1,4)
5	Çukurova Üniversitesi Eğitim Fakültesi Dergisi	2006–2009	6(1,6)
6	Dicle Üniversitesi Ziya Gökalp Eğitim Fakültesi Dergisi	2006–2009	7(1,9)
7	Dokuz Eylül Üniversitesi Buca Eğitim Fakültesi Dergisi	2006–2009	1(0,3)
8	Ege Üniversitesi Eğitim Fakültesi Dergisi	2004–2006	5(1,4)
9	Eğitim ve Bilim Dergisi	2002–2009	9(2,5)
10	Eğitimde Kuram ve Uygulama	2007–2009	6(1,6)
11	Eurasia Journal of Educational Research	2000–2009	27(7,6)
12	Erzincan Üniversitesi Eğitim Fakültesi Dergisi	2004–2007	9(2,5)
13	Eurasia Journal of Mathematics, Science and Technology Education	2005–2009	7(1,9)
14	Gazi Üniversitesi Eğitim Fakültesi Dergisi	2003–2008	19(5,4)
15	Hacettepe Üniversitesi Eğitim Fakültesi Dergisi	1987–2009	82(23,1)
16	International Journal of Environment & Science Education	2006–2008	3(0,8)
17	İlköğretim Online Dergisi	2002–2009	22(6,2)
18	İnönü Üniversitesi Eğitim Fakültesi Dergisi	2006–2009	9(2,5)
19	Kastamonu Eğitim Dergisi	2003–2008	29(8,2)
20	Kırşehir Eğitim Fakültesi Dergisi	1996–2008	8(2,2)
21	Kuram ve Uygulamada Eğitim Bilimleri	2001–2009	12(3,4)
22	Marmara Üniversitesi Atatürk Eğitim Fakültesi Eğitim Bilimleri Dergisi	2000–2004	3(0,8)
23	Mehmet Akif Ersoy Eğitim Dergisi	2006–2009	7(1,9)
24	Mersin Üniversitesi Eğitim Fakültesi Dergisi	2005–2008	3(0,8)
25	Milli Eğitim Dergisi	2004–2008	10(2,9)
26	Necatibey Eğitim Fakültesi Elektronik Fen ve Matematik Eğitimi Dergisi	2008–2009	4(1,1)
27	Pamukkale Üniversitesi Eğitim Fakültesi Dergisi	1998–2005	6(1,6)
28	Turkish Online Journal of Educational Technology	2003–2008	15(4,2)
29	Türk Fen Eğitimi Dergisi	2004–2005	1(0,3)
30	Uludağ Üniversitesi Eğitim Fakültesi Dergisi	2001–2008	13(3,7)
31	Yedi Tepe Eğitim Fakültesi Dergisi	2006–2007	5(1,4)
32	Yüzüncü Yıl Üniversitesi Eğitim Fakültesi Dergisi	2006–2008	4(1,1)

Ek 2.
Matematik Eğitimi Yayın Sınıflama Formu

A. MAKALENİN KÜNYESİ

1.Makale Adı:

2.Yazar/ları: **3.Yazarlar:** a.Türk ☐ b.Yabancı ☐ c.Karma ☐
4.Yayımlandığı Dergi: **5.Dergi türü:** a.Uluslararası ☐ b.Ulusal ☐
a.Yıl: b.Cilt: c.Sayı: d. Sayfa: **6.Yayın Dili** a.İng. ☐ b.Türkçe ☐ c.Diğer ☐
7. Dergi Sınıfı a.SCI/SSCI: ☐ b.ERIC-BEI-EI-AEI: ☐ c. ULAKBİM SBVT ☐ d.Sınıfsız ☐ e.Diğer ☐

B. MAKALENİN ALANI

☐ 1.Cebir ☐ 2. Geometri ☐ 3. Karma ☐ 4. Diğer alanlar ile ilişkisi ☐ 5. Diğer

C. MAKALENİN KONUSU

1.	☐	Öğrenme						**4.**	☐	Öğretim materyali çalış.	**10.**	☐	Ölçek-Test geliştirme-çeviri		
	6	KY	6	ÖS	6	BDB	6	Diğer	**5.**	☐	Bilgisayar destekli öğretim	**11.**	☐	Araştırma yöntemi çalışmaları	
2.	☐	Öğretim							**6.**	☐	Eğitim/öğretim sorunları	**12.**	☐	Matematiğin doğası	
	6	YK	6	ÖTE	6	ÖBE	6	ÖBSBE	**7.**	☐	Kavram analizi		6	MOY	6	BGYY
3.	☐	Öğretmen eğitimi							**8.**	☐	Tutum-ilgi belirleme-algı				
	6	ÖAE	6	HİE		6	Diğer		**9.**	☐	Müfredat çalışmaları	**13.**	☐	Diğer.....	

D. ARAŞTIRMA YÖNTEMİ

*2610				*2510				%+3/+	
1.	**Deneysel**	**2.**	**Deneysel Olmayan**	**3.**	**Etkileşimli**	**4.**	**Etkileşimsiz**	**5.**	**Karma**
11. ☐	Tam Deneysel	**21.** ☐	Betimsel	**31.** ☐	Kültür analizi	**41.** ☐	Tarihsel anlz.	**51.** ☐	Açıklayıcı
12. ☐	Yarı Deneysel	6	Longitudinal	**32.** ☐	Olgubilim	**42.** ☐	Kavram anlz.		(Nicel➔Nitel)
13. ☐	Zayıf Deneysel	6	Cross-age	**33.** ☐	Örnek olay	**43.** ☐	Derleme	**52.** ☐	Keşfedici
14. ☐	Tek Denekli	**22.** ☐	Karşılaştırmalı	**34.** ☐	Teori oluşturma	**44.** ☐	Meta Analiz		(Nitel➔Nicel)
		23. ☐	Korelasyonel	**35.** ☐	Eleştirel çalışmal	**45.** ☐	Diğer.....	**53.** ☐	Çeşitleme
		24. ☐	Tarama	**36.** ☐	Diğer.....				(Nitel+Nicel)
		25. ☐	Ex-post Facto						
		26. ☐	İkincil veri anlz.						

E. VERİ TOPLAMA ARAÇLARI

1.	☐	Anket						
	6	Açık uçlu	6	Likert		6	Diğer	
2.	☐	Başarı testi						
	6	Açık uçlu	6	Ç.Seçmeli		6	Diğer	
3.	☐	Algı/İlgi/Tutum/Yetenek/Kişilik vb testler						
		Adını yazınız						
4.	☐	Görüşme (mülakat)#::::::::						
	6	Yapıland.	6	Yarı-yap	6	Yap/mamış	6	Odak gr.
5.	☐	Gözlem						
	6	Katılımcı	6	Katılımcı olmayan				
6.	☐	Alternatif değerlendirme araçları						
		(Diagnostik test, Kavram hart., Portfolyo vb)						
7.	☐	Dokümanlar						
8.	☐	Diğer (adını yazınız)						

F. ÖRNEKLEM

	a. Örneklem	**b. Örneklem Büyüklüğü**
1. ☐	Okulöncesi	**1.** ☐ 1-10 arası
2. ☐	İlköğretim (1-5)	**2.** ☐ 11-30 arası
3. ☐	İlköğretim (6-8)	**3.** ☐ 31-100 arası
4. ☐	Ortaöğretim (9-12)	**4.** ☐ 101-300 arası
5. ☐	Lisans	**5.** ☐ 301-1000 arası
6. ☐	Lisansüstü	**6.** ☐ 1000'den fazla
7. ☐	Öğretmen	
8. ☐	Yöneticiler	
9. ☐	Veliler	
10. ☐	Diğer	

G. VERİ ANALİZ YÖNTEMİ

NİCEL VERİ ANALİZİ				NİTEL VERİ ANALİZİ	
1.	**Betimsel (Descriptive)**	**2.**	**Kestirimsel (Infrential)**	**3.**	**Nitel Analiz**
11. ☐	Frekans/Yüzde tabloları	**21.** ☐	t-testi	**31.** ☐	İçerik Analizi
12. ☐	Ortalama/Standart sapma	**22.** ☐	Korelasyon	**32.** ☐	Nitel Betimsel Analiz
13. ☐	Grafikle gösterim	**23.** ☐	ANOVA/ANCOVA	**33.** ☐	Diğer .....
14. ☐	Diğer.....	**24.** ☐	MANOVA/MANCOVA		
		25. ☐	Faktör Analizi		
		26. ☐	Regresyon		
		27. ☐	Non-Parametrik testler		
		28. ☐	Diğer.....		

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KY: Kavram Yanılgısı, **ÖS:** Öğrenme Stilleri, **BDB:** Başarı Düzeyi Belirleme, **YK:** Yöntem Karşılaştırma Çalışmaları, **ÖTB**: Öğretimin Tutuma Etkisi, **ÖBE:** Öğretimin Başarıya Etkisi, **ÖBSBE:** Öğretimin Bilimsel Süreç Becerilerine Etkisi, **ÖAE:** Öğretmen Adayı Eğitimi, **HİE:** Hizmet İçi Eğitim, **MOY:** Matematik Okur Yazarlık, **MGYY:** Matematiğin Günlük Yaşamdaki Yeri