Mathematics Education Research Trends in Turkey: International Research Context

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Abstract The purpose of this chapter is to reveal trends in mathematics education research in Turkey and to discuss its similarities and differences in comparison with international research. This chapter starts with a section focusing on several challenges facing the education system, and mathematics education research in particular, in Turkey. In the following section, in order to better understand the trends of mathematics education research in Turkey, the trends of Turkish journals are compared with those in the two international journals. Articles published in three journals in Turkey (Educational Sciences-Theory and Practice [ESTP], Education and Science [E&S], and Hacettepe University Journal of Education [HJE]) and two journals that are popular in Europe and Asia (Educational Studies in Mathematics [ESM] and International Journal of Science and Mathematics Education [IJSME]) in terms of mathematics education and indexed in Social Sciences Citation Index (SSCI) were subjected to semantic content analysis in two sub-dimensions: their research content and their methods and techniques of research. Finally, implications for the future of mathematics education research in Turkey are discussed as conclusions.

1 Introduction

Until the second half of the twentieth century, education and culture were thought to be independent of values, as the positivist belief that scientific discovery and technological developments were based on rational, experimental, and objective criteria that

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B. Atweh et al. (eds.), *Asian Research in Mathematics Education*,
Mathematics Education – An Asian Perspective,
https://doi.org/10.1007/978-981-99-0643-7_6

were not tied to any particular social value system (Lee, 2001). On the contrary, nowadays, the view is that education, and mathematics education in particular, reflects the values of the culture it is in and is influenced by these values (see Bishop, 2002; Ernest, 2007). According to this new perspective, it is necessary to interpret the relations between people and the world with scientific knowledge and methods, rather than placing scientific knowledge, and mathematical knowledge in particular, in a field of cognition independent of the world (Tan & Kim, 2012). This new point of view toward mathematics naturally has an impact on the classroom applications of mathematics (Ernest, 1991) and also prompts teachers to review their teaching approaches (see Seah, 2003). It also provides a good basis for students to better appreciate how important mathematics is to understand and interpret the situations in today's complex economies and constantly changing conditions (Van de Walle et al., 2019). Similarly, mathematics education research is necessary to understand what mathematics is for students' lives and the whole society and how to teach it more effectively and meaningfully. In addition, mathematics education research needs to pay more attention to real-life contexts to uncover interdependent relationships between mathematics, people, and society (see Tan & Kim, 2012). In this context, firstly a brief information about mathematics education research in Turkey is given. Then, findings of the content analysis of the articles of International and Turkish journals, indexed in the SSCI in the last five years, are presented. With these findings, the similarities and differences between International and Turkish journals in terms of research contents, methods, and techniques in mathematics education, and thus the research trends of these journals, are revealed. Finally, implications for the future of mathematics education research are discussed in this chapter.

1.1 Mathematics Education Research in Turkey

As of April 2020, there are 203 universities and academies in Turkey, 129 of which are state institutions and 74 private universities (see Higher Education Council of Turkey [in Turkish: YÖK], 2020). These universities have 92 faculties of education and 90 faculties of Science and Literature. In the faculties of science and literature, only pure mathematics content courses are given, and no courses for educational sciences are included in the curricula of these faculties. In education faculties, on the other hand, pedagogical courses are given in addition to pure content courses, but pure content courses are not handled at a deep level as in science and literature faculties. In order for the graduates of the Faculty of Science and Literature to become teachers, they must also take initial teacher training courses (e.g., special teaching methods, introduction to education, assessment, and evaluation). However, the main responsibility for teacher training rests heavily on the Faculties of Education. The student-centered education-based accreditation of Education Faculties, started in 1997 (see Education Information Network in Europe [EURYDICE], 2010; YÖK, 2018). Within the scope of this accreditation process, two different mathematics teacher training programs were implemented: elementary mathematics teaching program (in Turkish: İMÖ)

and secondary mathematics teaching program (in Turkish: MÖ). As of April 2020, there are 107 İMÖ programs in Turkey (at 95 state and 12 private universities) and 13 MÖ programs, all at state universities. Compared to overseas universities, academic research in mathematics education in Turkey started only recently. For example, while elsewhere doctoral studies on mathematics education and the establishment of mathematics education research societies date back to the 1900s, studies on mathematics education in Turkey only started in the early 2000s (see Education Information Network in Europe [EURYDICE], 2010; YÖK, 2018).

With the aforementioned accreditation process, since the beginning of 2000s, Educational Sciences Institutes were established for the first time in addition to the Institutes of Science (mathematics, physics, chemistry, engineering, etc.) and Social Sciences (history, psychology, law, etc.). Educational sciences institutes, unlike education faculties, focus on graduate education rather than undergraduate education. During this period, the number of graduates and doctorates in educational sciences in the educational sciences institutes increased, and educational sciences began to be seen as a separate branch of knowledge from the content areas. Parallel to the establishment of mathematics education as a separate discipline was the rapid increase in the number of educational science journals (e.g., Education and Science, Gazi University Journal of Gazi Educational Faculty, Hacettepe University Journal of Education, Eurasian Journal of Educational Research, Educational Sciences: Theory and Practice), and the inclusion of articles about mathematics education in these journals. In addition, journals that only publish research on mathematics education began to emerge during this period (e.g., Turkish Journal of Computer and Mathematics Education, Necatibey Faculty of Education, and Electronic Journal of Science and Mathematics). Similarly, the projects supported by the Scientific and Technological Research Council of Turkey (in Turkish TÜBİTAK) started to take place in the field of mathematics education for the first time (e.g., Akkoç et al., 2011; Kılıç & Doğan, 2018; Öksüz et al., 2011; Tanışlı et al., 2019). During this period, students were also sent to universities abroad (especially the USA, England, Germany, and France) for master's and doctorate degrees in mathematics education with the cooperation of Ministry of National Education of Turkey (in Turkish MEB) and YÖK. With the return of these students to Turkey at the end of their education, research on mathematics education in the country gained even more traction. In addition, Turkish mathematics education researchers started publishing articles in reputable international journals in the 2000s and continue to do so today.

2 Aims and Importance of the Study

The first of the important tasks of educational research is to conceptualize, observe, and systematically record the events and processes related to learning; the second is to analyze the data recorded in order to accurately determine the conditions and results of these observations, and the third is to contribute to the related subject using various

theories. Furthermore, finding solutions to problems that do not require specialization by their nature, systematically and productively in social and human science research, can be assumed another important task (Yates, 2012). In addition, educational research helps to review and develop educational practices; in other words, they form the basis of educational decision-making (Kida, 1984). For example, conducting research on relevant policies and practices to reveal and prevent the causes of educational inequality will contribute to evaluations by providing new information and insights into these policies and practices (Reid, 2013). In this context, investigating the trends of these research activities will contribute to the improving practice. In the same way, international comparison studies are a prominent phenomenon in policymaking (Adamson, 2012). For these reasons, it is important to examine the researches according to the purpose and content and the methods used, and thus determine the possible trends and direction of these researches over time. In this respect, many studies have been conducted to determine the trends of research in the Turkish context both nationally and in comparison with international mathematics education research. For example, in the context of Turkey, Ulutaş and Ubuz (2008) examined the articles published in four Turkish educational journals between 2000 and 2006 and they found that most of the studies in the articles they examined were quantitative studies and were mainly conducted with preservice teachers that were about cognitive and affective dimensions of teaching and learning. Baki et al. (2011) examined doctorate and master's theses published in Turkey and they found that most of the theses about mathematics education between 1998 and 2007 were conducted using quantitative experimental design, usually in 6th, 7th, and 8th grades. Doğan and Tok (2018) examined articles in the field of educational sciences published in SSCI indexed Turkish journal Education and Science between 2007–2014 and they found that the examined articles were mostly quantitatively conducted with mostly preservice teachers chosen as participants. Selçuk et al. (2014) also examined articles published between 2007 and 2013 in terms of contents in Education and Science and found that the studies were mostly conducted using quantitative methods, especially descriptive survey method and preservice teachers were mostly chosen as participants.

Few studies in mathematics education have published internationally. For example, Inglis and Foster (2018) examined the articles in ESM and JRME journals since the date they first started publishing research. Foster and Inglis (2019) reviewed two of the UK's leading mathematics education journals (Mathematics Teaching and Mathematics in School) since their first publication. However, these studies can be seen as reviews of researches that remain at the national level. There has not been any comparison study between internationally published journals with Turkish journals. In this context, unlike the studies mentioned above, in this chapter we consider trends of articles published between 2009 and 2020 in two mathematics education journals (Educational Studies in Mathematics [ESM], and International Journal of Science and Mathematics Education [IJSME]), that are respected in the field of mathematics at an international level, and Turkish publications that were

indexed in SSCI. In this way, this study aims to compare the trends of Turkish mathematics education researches with international mathematics education researches. Answers to the following questions were sought:

What are the similarities and differences between Turkish journals and international journals in terms of research content in mathematics education?

What are the similarities and differences between Turkish journals and international journals in terms of research methods and techniques in mathematics education?

3 Method

3.1 Research Design

The present study is a descriptive research based on document review (Seixas et al., 2018). Documents determined within the scope of the study were analyzed by content analysis. This analysis was carried out using six steps as follows: Step (1) Preparing data; Step (2) Creating main categories; Step (3) Coding according to main categories; Step (4) Compiling texts according to main categories and creating sub-categories inductively; Step (5) Conducting analysis based on categories and presentation of results; and Step (6) Reporting and documentation (Kuckartz, 2019). Content analysis, sometimes referred to as document analysis, includes methods and techniques that researchers use to examine, analyze and make inferences about their human communications (e.g., printed or written text, photographs, cartoons, illustrations, publications, and verbal interactions) (Julien, 2008).

3.2 Reviewed Documents

This section is limited to a review of articles of five journals which are indexed in SSCI, three of them based in Turkey origin, one in Europe, and one in Asia. The journals considered within this study were determined as follows: (a) Articles published in the Turkish journals, which have been indexed in SSCI in the last five years and (b) Articles published in ESM and IJSME. Within the scope of the research, three education journals originating from Turkey and indexed in SSCI in the last five years were identified as Education and Science (E&S), Educational Sciences-Theory and Practice (ESTP), and Hacettepe University Journal of Education (HJE). Some of the journals examined within the scope of the present study have varied history of publishing (ESM started its publication in 1968, Education and Science in 1976, HJE in 1986, IJSME in 2003, and ESTP in 2001). Brief information about these five journals examined is as follows:

Educational Sciences-Theory and Practice (ESTP) publishes articles in the field of education and educational research. It became one of the SSCI journals in 2007 in Turkey. The impact factor of ESTP is 0.532 in the year 2018, and the impact factor quartile of ESTP was Q4.

Education and Science (E&S) publishes articles in the field of education and educational research. It became one of the SSCI journals in 2007 in Turkey. The impact factor of Education and Science is 0.486 in the year 2020 and the impact factor quartile of Education and Science is Q4.

Hacettepe University Journal of Education (HJE) publishes articles in the field of education and educational research. It became one of the SSCI journals in 2007 in Turkey. The impact factor of Hacettepe University Journal of Education was 0.141 in the year 2015 and the impact factor quartile of Education and Science was Q4.

Educational Studies in Mathematics (ESM): ESM publishes articles in the field of mathematics education. It became one of the SSCI journals in 2009. The impact factor of ESM is 2.402 in the year 2020 and the impact factor quartile of ESM is Q2.

International Journal of Science and Mathematics Education (IJSME): It was launched in 1993 to provide both science and mathematics educators an opportunity to publish their papers in this journal sponsored by the National Science Council in Taiwan. The impact factor 2020 of IJSME is 2.073. The impact factor quartile of IJSME is Q3.

All the articles about mathematics education published by the journals analyzed during the years they were indexed in SSCI were included. In this sense, all articles published on mathematics education were examined during the specified years of the following journals: ESM and IJSME journals between 2009 and 2020 years, ESTP journal between 2007 and 2018 years, E&S journals between 2007 and 2020, and finally HJE journals between 2007 and 2015 years. As the IJSME journal has been indexed in SSCI since 2009, the articles published from 2009–2020 in this journal were examined. As the ESTP journal started to be indexed in SSCI in 2007, 2007 was determined to be the starting year, and 2018 was the ending year since it was not indexed in SSCI after 2018.

3.3 Data Analysis and Process

The process followed while applying descriptive content analysis is explained in detail in this section:

Step (1) Preparing Data: As mentioned above, articles of each journal related to mathematics education were included in the study. For example, since the ESM journal is only on mathematics education, all published articles from 2009, the year it was indexed in the SSCI, to the present day were examined. As IJSME accepts articles from science and mathematics. Only articles related to mathematics education were

Table 1 Number of publications of journals

	ESM Europa 2009–2020	IJSME Asia 2009–2020	E&S Turkey (2007–2020)	ESTP Turkey (2007–2018)	HJE Turkey 2007–2015	Total
Number of published articles	793	926	1131	1080	758	4688
Number of analyzed articles	793	361	105	79	48	1386

chosen for the study. Similarly, since E&S, ESTP, and HJE journals accept articles from all educational research fields, those related to mathematics education were selected from among the articles published in these journals. The articles related to mathematics education in these journals were first selected by two researchers. Then a consensus was reached by checking whether these selected articles were related to mathematics education. In addition, book reviews in journals were not included in this study and a total of 1386 articles were examined (see Table 1).

The full texts of the articles in each issue were obtained online from the web pages of the five journals examined within the scope of the study. Researchers used their own universities' databases to access the articles in the journals examined. Articles in the reviewed journals were coded according to year, volume, number, and order of the article in the web page. For example, an article published in ESM journal in 2018, which was published in the second volume, third issue, and fourth place according to the web page of that issue was coded as ESM-2018-2-3-4. In this way, the articles to be examined were arranged separately for each journal.

Step (2) Creating main categories: Creating main categories is explained in "2.a. Research Contents" and "2.b. Methods and Techniques". The data were analyzed using content analysis. It is the process of creating a category to explore the main subject categories at the core of the data analyzed and the specific sub-categories that these areas contain. In this sense, in this chapter, *research contents, methods, and techniques* were the main categories. The specific sub-categories for the research contents based on the framework of Chiu et al. (2016) were 11 sub-categories: *teacher education, teaching, learning (cognitive), learning (affective), goals, policy and curriculum, evaluation and assessment, cultural, social, and gender issues, history, philosophy, epistemology, and nature of mathematics, educational technology, informal learning, textbook,* and *text analysis.* Similarly, the specific sub-areas for the methods and techniques were four sub-categories: *research design, participants, data collection tools, and data analysis methods.* Table 2 summarizes general categories and sub-categories of mathematics education research.

Brief explanations for each general category and sub-category were given below:

Table 2 General categories and sub-categories of mathematics education research

General categories	Sub-categories
Research content	Teacher education, teaching, learning (cognitive), learning (affective), goals, policy and curriculum, evaluation, and assessment, cultural, social, and gender issues, history, philosophy, epistemology, and nature of mathematics, educational technology, informal learning
Methods and techniques	Research design, data collection tools, data analysis methods, participants

2.a. Research Contents

The 11 sub-categories examined under this category and their short explanations are below:

Teacher education: This sub-category covers prospective teachers and teacher education issues (teacher and prospective teachers' cognitive dimensions, teaching style, subject and pedagogical content knowledge etc.), affective dimensions (i.e., teacher and prospective teacher attitudes, values, beliefs, etc.) and professional development of teachers (e.g., lesson study), etc.

Teaching: This sub-category includes teaching theories, methods, techniques, etc. For example, discovery learning, component display theory, problem solving methods, etc.

Learning cognitive: It focuses on the cognitive dimension of students' learning. For example, concept learning, learning styles, mathematical process skills (problem solving, communication, reasoning, and proof etc.), argumentation, and metacognitive strategies, etc.

Learning affective: It includes the affective dimension of students' learning and classroom atmosphere. For example, values, beliefs, emotion, attitude, peer interactions, individual differences, etc.

Goals, policy, and curriculum: It includes education policies and aims, identifying effective schools, curriculum policy and reform and evaluation, etc.

Evaluation and assessment: It focuses on different evaluation and assessment approaches, development and implementation of questionnaire, educational measurement, etc.

Cultural, social, and gender issues: It includes cultural differences (multiculturalism, international comparative research, bilingualism etc.), socio-economic dimensions, gender differences, etc.

History, philosophy, epistemology, and nature of mathematics: This sub-category deals with the nature, history, philosophy, psychology, moral and ethical issues, literacy, and theory of mathematics, etc.

Educational technology: It comprises information and communication technologies.

Informal learning: This sub-category includes informal contexts such as museums, outdoor settings (e.g., street mathematics), and public awareness of mathematics.

Curriculum, textbook, and text analysis: It includes the analysis of mathematics curriculum, textbooks, and texts etc.

2.b. Methods and Techniques

The four sub-categories examined under this category and their short explanations are below:

Research design: It includes studies using quantitative, qualitative, mixed methods, theoretical and review articles, and documents etc.

Participants: It includes students with grade levels, pre-service teachers, teachers (in-service), parents, and mathematics education experts (having Ph.D. degree).

Data collection tools: It includes surveys, interviews, observations, documents (e.g., textbooks, texts, materials, etc.)

Data analysis methods: It covers quantitative (e.g., descriptive, and inferential statistics), qualitative (e.g., constant comparative analysis, content analysis), and combinations of the two analyzes.

Considering the possibility of missing the meaning of the sentence in the analysis of words and paragraphs (Yıldırım & Şimşek, 2008) in this study paragraphs were chosen as our analysis unit. For example, in some articles, the method is not clearly stated (e.g., case study); if the section/paragraph in which the working process is explained is examined, it is understood that the method used is qualitative or quantitative. Thus, the paragraphs are used as the unit of analysis of this research.

Step (3) Coding according to main categories: After the articles to be examined were determined, each article was coded by two researchers separately. Articles were coded according to the main categories at this stage. Analyzes were done with computer-assisted qualitative data analysis software (e.g., ???).

Step (4) Compiling texts according to main categories and creating sub-categories inductively: In the fourth step, after the data coded according to the main categories were reviewed, they were analyzed more deeply and recoded according to the sub-categories. For example, let's assume that a section in the article was coded as "methods and techniques", which is one of the main categories, in the third step. In this case, in this step, this section, which was coded as the methods and techniques main category, was examined and re-coded as the data collection category under the methods and techniques which is one of the main categories.

Step (5) Conducting analysis based on categories and presentation of results: The data obtained at this stage can be presented quantitatively or qualitatively (Kuckartz, 2019). In this research, the large data obtained were interpreted quantitatively. The data were converted into quantitative data using computer-assisted qualitative data analysis software, and the results were interpreted by the researchers and presented with tables and graphics.

Step (6) Reporting and documentation: The results and comments on the content analysis of the articles of each journal were reported by the researchers in the results section using frequency and percentage tables and graphs according to the main categories and subcategories.

3.4 Data Analysis Process and Trustworthiness of the Study

After determining the articles to be examined, the researchers checked the suitability of the coding scheme by coding 10 articles separately before proceeding to the main coding stage. After the suitability of the coding scheme was decided, the main coding phase was initiated. The coding phase lasted 4 months. The researchers analyzed the articles according to the coding scheme and reviewed these coding every three weeks. The reliability of data was ensured with peer review (Lincoln & Guba, 1985). The coefficient of concordance among the researchers was calculated as 0.93. This value indicates that there is a significant agreement in coding between researchers (see Landis & Koch, 1977). Since articles are complex in terms of *research contents*, *method, and technique*, an article can be coded according to more than one subcategory scheme.

In the case of a disagreement between the coding, the codes in disagreement were reviewed. The categories according to which these disagreed codes should have been recoded were determined by consensus of the two researchers.

4 Results and Discussion

The results of the study are presented in two separate titles according to the research problems: Research contents, methods, and techniques.

(a) **The trend of mathematics education researches according to research contents**

The trends of the journals examined within the scope of the current study for the research contents were examined in 11 sub-categories (see Fig. 1).

As can be seen from Fig. 1, the publications in the journals examined within the scope of this study are mainly for *teacher education* and *learning cognitive* categories. After these two categories, studies are published mainly about *teaching* category. In addition, it is seen that the articles are similar in these aforementioned three categories. On the contrary, very few studies have been published in all journals focusing on *curriculum, textbook,* and *text analysis.* In addition, unlike articles in IJSME and Turkish journals, more studies are published under the category of h*istory, philosophy, epistemology*, and *nature of mathematics* in ESM. Additionally, with respect to *cultural, social, and gender issues; educational technology; goals,*

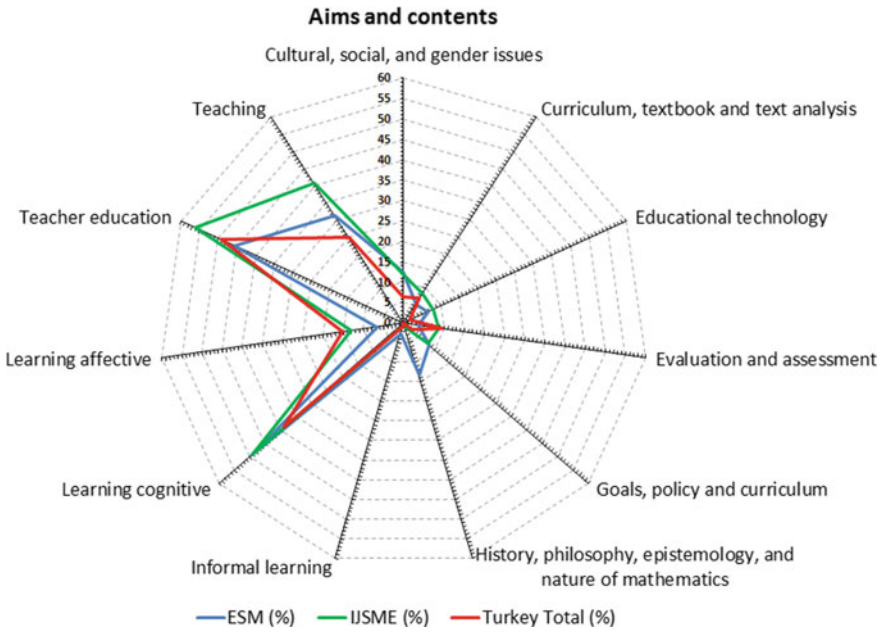

Fig. 1 Trends of mathematics education studies according to subcategories of research contents

policy, and curriculum; and professional development of teachers and *teaching*, it was determined that more articles were published in ESM and IJSME than in Turkish journals. More articles about *evaluation and assessment*, *learning affective* and *affective dimensions of teachers, and preservice teachers* have been published in the Turkish journals than in ESM and IJSME. Finally, it was determined that, in all journals examined within the scope of this study, very few articles about *informal learning* were published.

(b) **Trends of mathematics education research according to Methods and Techniques**

The trends of the journals examined within the scope of the current study for methods and techniques were divided into four sub-categories, and each category was divided into sub-categories.

In this section, articles in journals are analyzed according to sub-categories of *research design, data analysis methods, data collection tools* and *participants.*

As seen in Fig. 2, *quantitative methods* are dominant in Turkish journals in terms of research design, while *qualitative methods* are dominant in ESM and IJSME. The mixed method is preferred in Turkish journals more than in ESM and IJSME. On the other hand, in ESM and IJSME *design-based* researches and *theoretical and review* researches are preferred more than the Turkish journals. As can be seen from Fig. 2, in terms of *data analysis methods*, in accordance with the research design, *quantitative data analysis* is more prominent in Turkish journals, while *qualitative*

data analysis is more prominent in ESM and IJSME. In terms of the articles in which the two types of analyses (Qual and Quan) are used together, it is seen that all journals are similar. As data collection tools depend on the research method chosen, as seen in Fig. 2, in ESM and IJSME journals where *qualitative research methods* are dominant, interview, observation, and videotapes data collection tools are more preferred than in Turkish journals. In Turkey, where *quantitative research methods* are more dominant, it is seen that *questionnaire* and *test* are preferred more than in ESM and IJSME. Finally, in terms of participants, it is seen that there are more studies with *kindergarten, grade 1–5 students, expert, parents'* participant groups in ESM and IJSME compared to journals in Turkey (see Fig. 2). As for the journals in Turkey, it is seen that studies are carried out with *preservice teachers* and *grade 6–8 students* at a higher rate than in ESM and IJSME. It is seen that all the journals in Turkey and the ESM and IJSME journals carried articles about grade 9–12 students at similar rates.

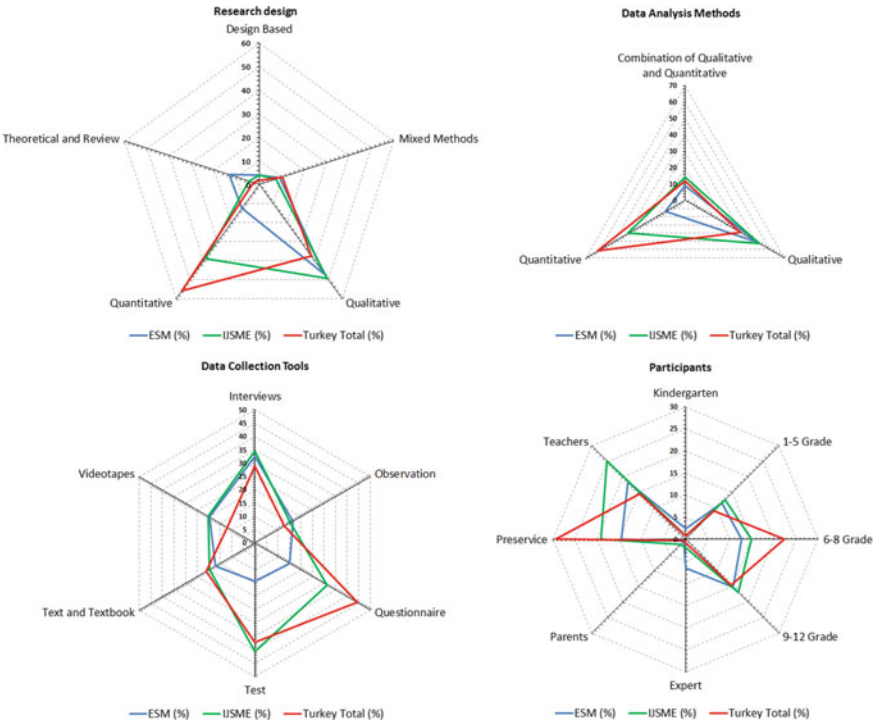

Fig. 2 Trends of mathematics education studies according to sub-categories of methods and techniques

4.1 Results and Discussion About Research Contents

In the context of the current study, it has been determined that more articles about *cultural, social, and gender perspectives* have been published in ESM and IJSME journals compared to Turkish journals (E&S, ESTP, and HJE). This result coincides with the results of studies by Ulutaş and Ubuz (2008). This is because Inglis and Foster (2018) examined the trend of research published in ESM journal in the last 50 years and revealed that the studies on mathematics education in the socio-cultural field have increased considerably. Similarly, in the current study, it has been found that there is a considerable amount of socio-cultural mathematics education studies in ESM and IJSME journals (especially in ESM) compared to the journals in Turkey (E&S, ESTP, and HJE), which are considered within the scope of the study. Also, similar to the results of the present study, Ulutaş and Ubuz (2008) found that very few articles related to the cultural and socio-cultural dimension of mathematics education were published. One reason for this may be that the international recognition of ESM and IJSME journals is much higher than the journals in Turkey (E&S, ESTP, and HJE), and the researchers publishing in ESM and IJSME journals may tend to publish more sociocultural studies. In addition, it is seen that the articles published in this category in the journals in Turkey (E&S, ESTP, and HJE) are mostly gender related.

It is seen that there are more published articles in the field of *educational technology* in the journals of ESM and IJSME than in Turkey. More importantly, in two journals (ESTP and HJE) in Turkey, there were no published articles in the field of *educational technology* in mathematics education in the years when they were indexed in the SSCI, while E&S journal has relatively few articles compared to other categories. This result is consistent with Chiu et al. (2016), Ulutaş and Ubuz (2008), and Baki et al. (2011). In their study, Chiu et al. (2016) found that few articles were published in the field of *educational technology* in the journals they examined. In addition, in the theses which have been examined in the study of Baki et al. (2011), it is seen that the categories that include the use of technology in mathematics education and teaching remain at a minimum rate compared to other categories. Furthermore, Ulutaş and Ubuz (2008) determined that there are very few articles about *educational technology* in the journals they have examined. Despite the huge incentive for the use of technology in education in Turkey (e.g., Movement of Enhancing Opportunities and Improving Technology (in Turkish: FATİH), interactive boards, tablets, etc.), the publishing of a few articles on the use of technology in mathematics education in the Turkish journals when they were indexed in the SSCI may have resulted from the fact that the researchers sent their publications about *educational technology* to journals that were specific only on the field of *educational technology* or the articles submitted in this field did not go through review processes or the journal publishing policies of the relevant years or the editors' preferences. It can be said that this situation may have been reflected in the articles examined in this study, and therefore, few articles have been published in the journals in Turkey about educational *technology category*.

It is seen that more articles about the evaluation and assessment dimensions have been published in the Turkish journals examined within the scope of the current study compared to the ESM and IJSME. This is similar to the results of the study conducted by Doğan and Tok (2018). They examined the articles about educational sciences published in the E&S journal and found that scale development is the third most studied subject in the field of educational sciences. In addition, the results of the present study show that most of the articles published in the examined Turkish journals about *evaluation and assessment* category focus on the scale development about affective dimension rather than using a measurement technique in the field of mathematics education. One consequence of this is that there are more articles about affective dimension in the Turkish journals (E&S, ESTP, and HJE) than ESM and IJSME.

In the category of *goals, policy, curriculum*, it is seen that more articles are published in ESM and IJSME journals. Baki et al. (2011) found that a small number of the thesis were carried out in the field of mathematics education curriculums, and in particular, it is observed that there is almost no thesis about this subject before 2005, when the mathematics curriculum reform has been made in Turkey, and after 2005, there has been a considerable increase in the curriculum area until 2007. In addition to this, as it can be understood from the results of this study, it can be said that although the curriculum updates were made in Turkey repeatedly in 2013 and 2018, the increase that stated in their study and the other updates made in the curriculum were not reflected in the articles published in the Turkish journals (E&S, ESTP, and HJE).

In the category of *history, philosophy, epistemology*, and *nature of mathematics*, no articles have been published in the Turkish journals (E&S, ESTP and HJE), whereas there are a few articles in EJSME and a large number of articles in ESM. This result coincides with the results of studies by Foster and Inglis (2019), Inglis and Foster (2018), and Ulutaş and Ubuz (2008). In the studies of Foster and Inglis (2019) and Inglis and Foster (2018), it is seen that few articles have been published in the journals examined about the category of *history, philosophy, epistemology, and nature of mathematics* compared to other fields. In contrast, similar to the results of this study, Ulutaş and Ubuz (2008) found that no articles were published in the journals they examined in Turkey about the category of history, philosophy, epistemology, and nature of mathematics. The study by Ulutaş and Ubuz (2008) included the years 2000–2006 and the E&S and HJE journals that were also examined in the current study. Although this study is up-to-date, there have been no publications in the categories mentioned above in journals indexed in SSCI in Turkey since 2006. One reason may be that Turkish mathematics education researchers do not pay enough attention to the categories of *history, philosophy, epistemology, and nature of mathematics.*

It is seen that the articles published about *teacher education*, *learning cognitive,* and *teaching* categories in the examined journals are on an equal basis, but in the affective dimension, more articles are published in Turkish journals (E&S, ESTP, and HJE) compared to ESM and IJSME journals. This result is consistent with the results of the studies by Inglis and Foster (2018), Selçuk et al. (2014), and Ulutaş and Ubuz (2008). Inglis and Foster (2018) found that fewer articles about *affective dimension*

were published in ESM journal compared to other research areas. Selçuk et al. (2014) and Ulutaş and Ubuz (2008) determined that the most publications about the *affective dimension* were made in Turkish journals (E&S and HJE) which were also examined within the scope of this study. It may be due to the fact that, as mentioned above, researchers in Turkey are mostly inclined to conduct studies on scale development. Despite the fact that the number of publications about the *teacher education* category is similar, if the participant groups are taken into consideration, the frequent selection of pre-service in the researches in the Turkish journals constitutes evidence that the studies about *teacher education* in Turkey are mostly done with pre-service teachers. Therefore, it can be said that more studies about professional development of in-service teachers are carried out in ESM and IJSME journals than in Turkey journals (E&S, ESTP, and HJE). This result is consistent with the results of Baki et al. (2011), Doğan and Tok (2018), Inglis and Foster (2018), Ulutaş and Ubuz (2008). Ulutaş and Ubuz (2008) found that there are very few publications about in-service *teacher education*. In addition, Baki et al. (2011) found that there is a limited number of thesis about in-service teacher education. As is evident from the results of the current study, publications about *teacher training* in recent years have remained almost similar over the examined years. In the study of Inglis and Foster (2018), it can be seen that there is an increasing number of publications about in-service *teacher education* in the ESM in recent years.

4.2 Results and Discussion About Methods, Techniques, and Participants

In the journals examined in the current study, it is seen that in the Turkish journals (E&S, ESTP, and HJE), researchers tend to use *quantitative methods*, whereas in ESM and IJSME, researchers tend to use *qualitative methods*. This result can be said to be similar to the results in the studies of Inglis and Foster (2018), which reveal that experimental studies have decreased gradually in the ESM journal in the recent years; and Doğan and Tok (2018), Baki et al. (2011), Selçuk et al. (2014), and Ulutaş and Ubuz (2008), who revealed that the *quantitative methods* were dominant in the articles they examined. One of the reasons for the greater preference of *quantitative methods* in Turkish journals as suggested by Selçuk et al. (2014) is that quantitative research is easier and faster than qualitative methods in terms of feasibility and data analysis, and that sampling is easy to reach. Doğan and Tok (2018) stated that this may be because qualitative research requires more time and effort than quantitative research. In addition, some of the reasons why researchers prefer methods that requires less effort and time may be that researchers want academic titles quickly or that their institutions are forcing researchers to do many studies. It can be seen that researchers used the mixed method more frequently in articles published in Turkish journals (E&S, ESTP, and HJE) compared to ESM and IJSME (see Fig. 2). If the results of the current study are compared with the results of Selçuk et al. (2014), and Doğan

and Tok (2018), it is found that there is an increase in the trends of researchers to use *mixed method* in the articles published in Turkish journals. The fact that ESTP has been accepting only *mixed method* researches since 2016 as the publication policy can be considered one of the reasons why mixed methods research appears more in Turkish journals than ESM and IJSME. In addition, *design-based researches* in ESM and IJSME is seen to be higher than the Turkish journals (E&S, ESTP, and HJE). In the *theoretical and review* category, it is seen that the articles about this category in Turkish journals (E&S, ESTP, and HJE) are less than the ESM and IJSME journals; in other words, the trends of the Turkish researchers are not in this direction. This result overlaps with the studies of Doğan and Tok (2018), Selçuk et al. (2014), which reveal that the researchers for the *review* category have very little place in the articles of the journals they examined. For example, as already mentioned, researchers in Turkey tend to use quantitative methods, therefore preferred data analysis methods and data collection tools that are in a way compatible with quantitative methods (see Fig. 2). This also applies to the trends of research, research and data analysis methods and data collection tools in ESM and IJSME. In studies published in the journals of ESM and IJSME, researchers generally tended to use qualitative methods, therefore the data collection tools and data analysis methods they used were in line with this qualitative method they preferred (see Fig. 2). Similar results can be seen in the studies conducted by Chiu et al. (2016), Doğan and Tok (2018), Selçuk et al. (2014), and Ulutaş and Ubuz (2008). Since the quantitative method was more dominant in these studies, data collection tools and data analysis methods were also quantitatively weighted.

As for the participant group, it is observed that researchers who publish articles in Turkish journals (E&S, ESTP, and HJE) tended to work with pre-service teachers. In contrast, the working group of articles in ESM and IJSME are generally teachers. In addition, next to pre-service teachers, in Turkey, studies were mostly carried out with 6-8th grade students as a participant group. These results coincide with the results of studies conducted by Doğan and Tok (2018), Selçuk et al. (2014), and Ulutaş and Ubuz (2008). Doğan and Tok (2018), Selçuk et al. (2014), and Ulutaş and Ubuz (2008) also found that researchers in Turkey generally worked with pre-service teachers and then conducted their studies with 6-8th grade students. The fact that pre-service teachers are easily accessible and the need to reach more sample groups in quantitative researches (e.g. scale development, survey methods, etc.) due to the greater preference of quantitative methods in Turkish studies may have been a factor in selecting more of pre-service teachers as research groups in Turkish studies. This may also be an indication that institutions do not devote much time and resources to researchers to conduct in-depth studies on issues related to primary and secondary school students. This situation is also compatible with the work of Ulutaş and Ubuz (2008). In addition, it was stated above that there are many studies about the professional development of teachers in ESM and IJSME journals. As an expected result of conducting studies about professional development of teachers, more selection of teachers as a study group can be seen as a common occurrence. In Turkey, the number of studies involving families as a participant group remained very limited. While there were no studies in ESTP and HJE in which families were

participants, there were very few studies in E&S. There are more studies in ESM and IJSME where families are included as working group compared to Turkish journals. Although parents in Turkey are very fond of their children and follow their education and training processes very closely, conducting very small number of studies involving parents may be seen as a lack of researches and may be due to the researchers' preference in this direction. In addition, it is seen that kindergarten has very little place as a study group in researches in Turkey. One reason for this can be the small number of researchers with a Ph.D. in mathematics education in kindergarten.

To sum up, it is expected that the contributions of this study for researchers in Turkey may be interesting and relevant in terms of Turkish (local) and to the international context. In this sense, in terms of the local and international context, for mathematics education researchers in Turkey, this study may present a framework specific to Turkey, which will guide future studies on which direction the trends are, which topics need to be emphasized more, or which topics are lacking in mathematics education. In addition, mathematics education researchers can develop their research by comparing them with the trend of international studies; thus, this can increase the international acceptability of researchers' publications in Turkey. In this way, this could contribute significantly to research in mathematics education and thus to practice in teaching settings in Turkey. Eventually, the available results may also provide elements to specific critical and cultural perspectives for environment of mathematics education in Turkey.

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