

The content analysis of the computer-assisted studies in mathematics education between the years 2009-2014/April

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Abstract

In this study, the examination of the trends regarding the used methods and methods through the content analysis of the published articles and dissertations in the field of Computer-Assisted Mathematics Education is aimed. Within the scope of the research, the articles published in the database of ISI Web of Science and the dissertations published in the thesis centre of Turkish Council of Higher Education (YOK) were scanned and 7 master's theses, 5 doctoral theses, and 43 articles were analysed. In this study, the distribution of articles and theses by years, the number of authors and by subjects and the used research methods and data collection methods were identified. After the percentages and the frequencies of the findings had been calculated, they were presented in the form of charts.

Keywords: computer-assisted mathematics education, computer-based education, mathematics instruction, mathematics, computer, content analysis.

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1. Introduction

Mathematics is a global language, global culture and a software technology which enables us to express our abstract ideas in a systematic way. The things expressed in a mathematical language end up having the same meaning for everyone. Mathematics is the expression language of variables which has a language and symbols in itself, and which can express, assess, calculate something, and afterwards which can make different calculations with the new transactions (Cekici & Yildirim, 2011). The knowledge, ability, behaviour and attitudes acquired through education were transferred from generation to generation. Being always discussed and being of utmost importance on human life, education has attained a place as indispensable elements of the computers and daily life today (Kacar & Dogan, 2007).

As a result of the constant improvements in the computer technology; the quality and quantity of educational software and designs have enhanced and alternatives are constantly increasing. For example while in the past calculators used to be very expensive, today they are cheaper and the use of calculators increased. While many calculations which were needed throughout the daily life and had to be made with paper and pencil in the past, they can be made with the calculators more easily today. As a naturel results of these changes, whereas pencil-paper calculations in mathematics education lost its importance, the abilities like making predictions and problem-solving have become more significant (MEB, 2005). For this reason, in order to keep up with the rapid technological advancements and complicated society life, individuals are required to be qualified with modern knowledge, ability and attitudes. This is possible through the education where each individual is able to gain the competencies specified by the technological advancements (Ulug, 2000).

With the aim of making education more productive and effective, computer-based education is an education practice that left its mark on the twentieth century thanks to the proliferation and personalization efforts (Tankut, 2008). Due the fact that education is getting more complicated day by day, and the amount of knowledge that will be learned has risen and for the purpose of achieving the quality and modern education, the computer usage as an instrument in education became an obligation (Arslan, 2003; Ozkan & Yalcinkaya, 2012). Computer-based education is teaching any subject to students by using a computer or in a general meaning it means teaching to students and helping them to acquire the knowledge more easily by conducting learning-teaching activities with the help of a computer (Baki,2001).

Computer-based education is not about using computers as an alternative but using them as the complementary and booster element for the system (Usun, 2004). It is an education method that strengthens the educational process where learning takes place and learning motivation, as well as enabling students to benefit from according to their learning pace, to create learning on one's own principles with the computer technology (Usun, 2000). In other words, computer-assisted instruction is the method of taking advantage of computers in the education and training process with the aim of allowing students to know about their weak points and performances through the mutual interaction, to take the control of their own learning process by taking feedbacks; to take their attention through the help of graphics, sounds, animations, and shapes. It is abbreviated as CAI (Cheney & Okwumabua, 2013).

Computer-assisted mathematics instruction (CAMI), is a type of instruction done by in general terms using cognitive tools based on cognitive technology, particularly based on computers (Yenilmez & Karakus, 2007). Following the scientific researches it was revealed that computers which left their marks on the education process and for which big projects and studies were undertaken in the field of extending them has made significant contributions to the teaching-learning process specially through the preparation of effective educational software (Halis, 2001). After the literature review it was seen that there were many different studies in which the articles published in the field of Computer-Based Education were analysed. Between the years 2009-2014/ April the articles from the database of the ISI Web of Science (WOS), the master's and doctoral theses from the Higher Education Council's database (YOK) were analysed. Between the years 2000-2011, in an effort to analyse the scientific studies published in Turkey, 126 articles were examined with respect to the computer-assisted mathematics

education. As a result of the analysis of the acquired data it was detected that the key words “mathematics education and training”, “prospective teacher” and “attitude” were the most used key words in the subject area of mathematics education. In these studies it was found that the mathematics software was considerably underused and undergraduates were selected as sample by the researchers (Tatar, Kagizmanli & Akkaya, 2013). Educational surveys play an important role in the developments of the countries’ education systems. Educational surveys made in this field are the most effective resources for the researchers (Okita, 2014). Being aware of what kind of studies were done in the field of Computer-Assisted Mathematics Instruction and updating the data regularly that will be acquired by the new studies will provide an insight to the researchers and the upcoming studies in the future.

The content analysis is a research method that can be applied without affecting the social behaviour. In other words, it is a research method aiming at objective, systematic and quantitative description of the clear and explicit content of communication. It is a method used for collecting the text content and analysing it (Gokce, 2006).

Therefore, the purpose of the research is to analyse the studies in the thesis database of ISI Web of Science (WOS) and YOK concerning Computer-Assisted Mathematics Education in many respects between the years 2009-2014/ April and attempt to guide the scientific researches that is to be made in the future. In line with this purpose, the following questions were asked:

1. How does the distribution of the number of the articles and dissertations regarding the Computer-Assisted Mathematics Education change by years?
2. What kind of data collection methods were used in the studies within the scope of the research?
3. What is the distribution of the studies taken into the research by the data collection methods?
4. What is the distribution of the studies taken into the research by the sampling type?
5. What is the distribution of the studies within the scope of the research by the number of authors?

2. Method

This study is based on the content analysis of the acquired data through the examination of documents. The approach of examining documents is assessed within the scope of quantitative research. In this respect, this research is a qualitative research. The method of document analysis is used for reaching to the resources regarding the purpose of the research and for identifying the data that will be acquired (Cepni, 2007).

The data acquired from the literature review was analysed and divided into meaningful units and it was targeted to express each unit in terms of its conceptual meaning. Within the scope of this research 99 articles regarding the Computer-Based Education were found in the database of WOS and it was seen that only 43 % of them were the studies made in the field of Computer-Assisted Mathematics Education. In the thesis database of YOK 7 masters and 5 doctoral theses were accessed. The articles and theses were analysed one to one and presented by creating tables according to the year of their publication (2009-2014/April), data collection methods, adopted methods, the number of authors and the sampling type.

3. Findings and Comments

3.1. The distribution of the number of the articles and theses regarding the Computer-Assisted Mathematics Education by years

As it can be seen in the Figure 1, in the field of Computer-Assisted Mathematics Education (CAME) the number of the master's and doctoral theses were equal in 2009, while there was an increase in the number of the master's theses in 2010, no doctoral thesis was published in that year. In 2013, the number of doctoral theses reached the peak. Between the years 2011-2013 there was not any change in the number of master's dissertations. As a result of this analysis, the number of the articles analysed in the field of CAME has increased significantly between the years 2009-2010, whereas it experienced a decline between the years 2010-2012. There was another rise in the number of the articles between the years 2012-2013.

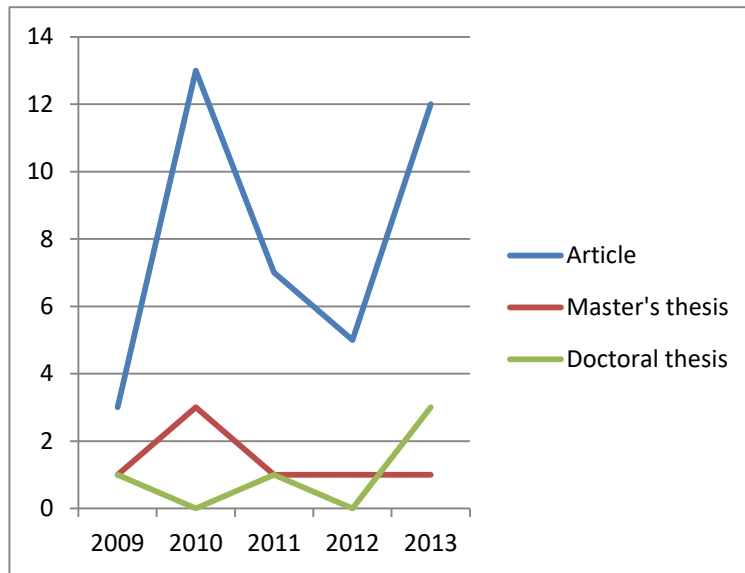


Figure 1. The distribution of the number of articles and theses by years

4. Data Collection Instrument in Research Articles and Theses

As it is indicated in Figure 2, when the theses were analysed it can be seen that experimental studies were predominantly used. Afterwards follow the method and descriptive study with the body of literature studies.

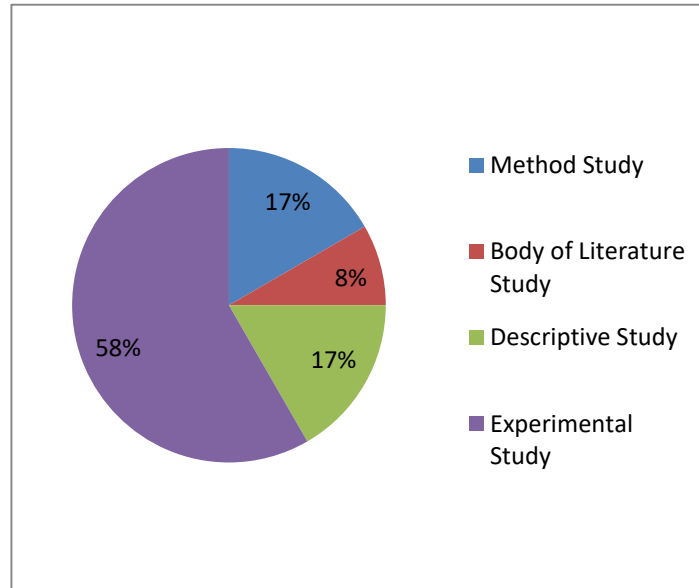


Figure 2. The distribution of the theses by the data collection instrument

In the research articles, as it is shown in Figure 3, method studies were predominantly used as the data collection instrument, afterwards body of literature studies, experimental studies and descriptive studies follow.

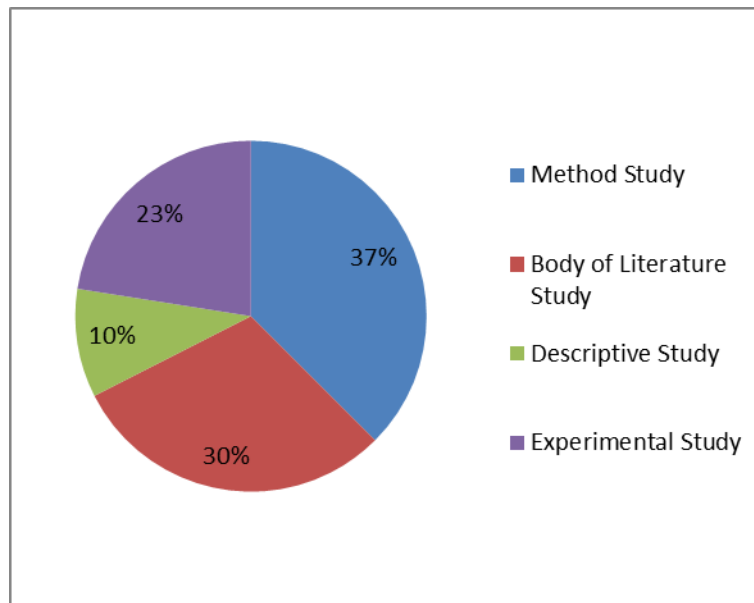


Figure 3. The distribution of the research articles by the data collection instrument

5. The distribution of the data collection methods used in the research articles and theses

The utilised data collection methods in the analysed texts and researches are given in the Figure 4. According to the pie chart in Figure 4, the research methods like scale, questionnaire, performance test, interview and observation, documentary were used in the researches. While the personal information form comprised the smallest proportion of the data collection methods, it was determined that the performance test and scale were commonly used. Due to this fact, it is seen that in the researches, test, scale and questionnaire methods were predominantly used.

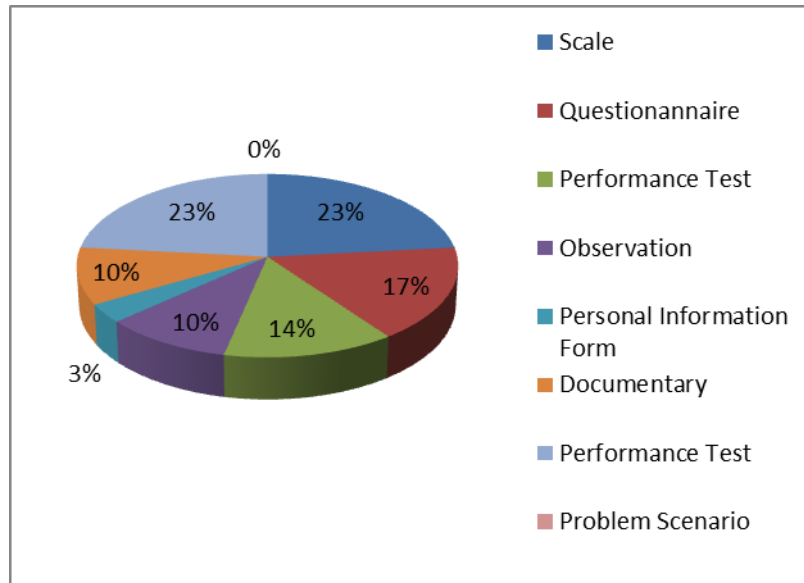


Figure 4. The distribution of the theses by the data collection methods

The data collection methods used in the analysed articles and the researches are illustrated in the figure 5. According to the pie chart in Figure 5, it is seen that in the researches many research methods such as scale, questionnaire, interview, observation, documentary, personal information form and performance test were used. Out of the data collection methods the problem scenario and personal information form were the least used, on the other hand performance test was the most widely used. In line with this fact, it can be inferred that in the researches; test, observation and interview methods were predominantly used.

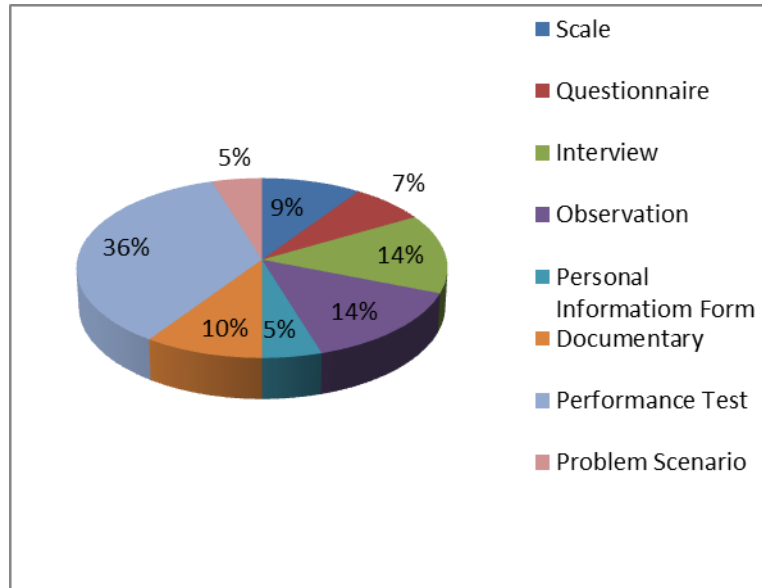


Figure 5. The distribution of the research articles by the data collection methods

6. The distribution by the sampling type used in the research articles and theses

The type of sampling in the thesis database of YOK; students constitute the sampling in 7 of these whereas teachers constitute another sampling type in 5 of theses. Exceptionally, vocational high school students were chosen for the sampling of a doctoral thesis. Only one thesis out of 12 theses used a sampling type composed of student and teacher. Out of 5 sampling models composed of teachers, 3 of them were determined for prospective teachers (teacher candidates). 6 of the theses (master's and doctoral) were prepared at the Department of Computer Education and Instructional Technology.

3 of them were prepared at the Department of Science and Mathematics Education, 1 of them at the Department of Elementary Mathematics and 1 of them was prepared by the students studying at the Institute of Social Sciences. When the articles were analysed by the sampling type we found out that 11 of them were chosen as secondary school students, 6 of them as elementary school students, 13 of them as university students and 10 of them as teachers (most of which are elementary school teachers). We see that 50% of the articles analysed was prepared at the Faculty of Education and the majority of the remaining articles mainly at the Department of Mathematics and also at the Teachers College and at the Department of Computer and Technology.

7. The distribution of the research articles by the number of authors

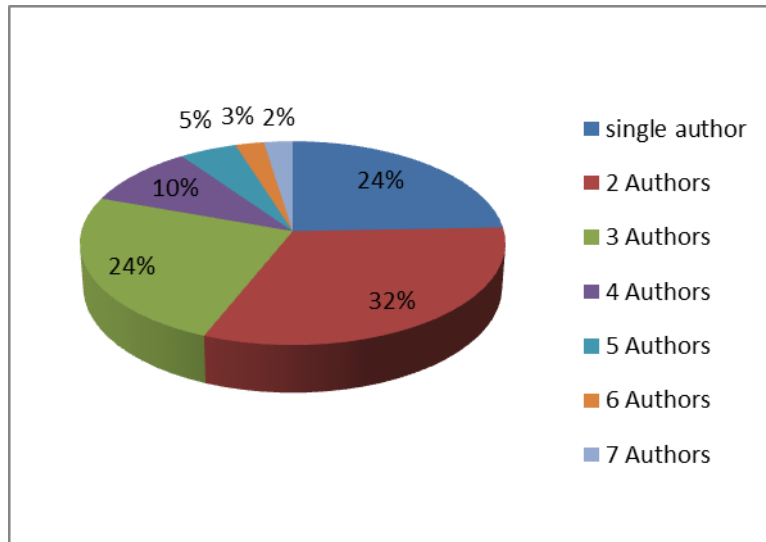


Figure 6. The distribution of the research articles by the number of authors

As it is shown in the Figure 6, it can be seen that the number of the authors of the analysed articles in WOS in the field of CAME is generally two. In the second place, articles with a single author and 5 authors come. We saw that the number of authors would rise up to 7.

8. Discussion

As the importance of the knowledge is increasing in the world day by day, the concepts of “knowledge” and “science” have been shifting. Technology is progressing rapidly and the abilities expected from individuals by the societies in order to keep pace with these changes are changing as well. Like all other fields change is required in the field of education too. Using and understanding mathematics in the daily life has been gaining importance, and this importance is constantly increasing. Among the analysed theses and articles vocational high school students were chosen as a sample group only in one of the theses, unlike to this particular thesis, in the articles vocational high school students are not present. This fact is saddening and should be pointed out. If the mathematical education concerning their vocational field needed by student studying at vocational high schools is provided in a technological environment with the assistance of computers it is inevitably will end up making positive contributions to the success of the students (Ersoy, 2003).

The decline in the number of master’s and doctoral theses between the years 2010-2012 indicated us that studies regarding Computer-Assisted Mathematics Education (CAME) were not done adequately and was about to lose its influence. It is known that experimental studies in the field of CAME have a crucial role. However in the analysed articles, the proportion of the experimental studies remained in the third place. This shows us that during the article writing saving time was desired by the writer. Experimental studies require time, effort and an appropriate setting. Body of Literature study and method study were primarily chosen as data collection instruments.

In the examined theses and articles it was seen that the questionnaire method was underused. The questionnaire technique is a time-consuming and an expensive method based on volunteering. For this reason there is a downward trend in this technique. Increasing the frequency of the usage of this technique will enable us to reveal the benefits and handicaps of the Computer-Assisted Mathematics Education in a detailed and objective way. Studies analysed

in the research, research results reflecting the experimental studies showed that computer-based education method which is one of the individualized education technologies in mathematics instruction helped the students to achieve success compared to the traditional instruction method. It is also identified that this method would be useful in mathematics instruction under these circumstances. Nevertheless, concordantly, it is thought that the number of activities which can be regarded as useful in terms of bringing teacher and student together success should be increased and directive activities should be included in the curriculum for the prospective teachers. Especially for the prospective mathematics teachers, it is considered that this would have an important role in the training of field knowledge.

In the analysed articles, the sampling was composed of both the student and the teacher in the two studies conducted. In other studies only the teacher or the student was included in the sample. It is considered that including both a teacher and a student in the sample of the upcoming studies would improve the quality of education and light the way for the many prospective teachers. Apart from this, in the studies of articles it was figured out that, the majority of the authors was academics working at universities. So, the contributions of the classes and teachers applying computer-assisted mathematics education into the studies regarding this field that would be conducted, would pave the way for the next generations.

9. Conclusion and Recommendations

In this study, 43 articles regarding the computer-assisted mathematics education, published in the database of WOS between the years 2009-2014/April, 7 master's theses, 5 doctoral thesis studies published in the database of YOK thesis centre; were analysed in terms of variables like the distribution of the published articles and theses by years, the type of method examined in these articles and theses, the type of sampling used and data collection methods and the number of authors of articles. It was determined that the number of the published articles reached the maximum amount in 2010. It was seen that the half of the studies was prepared at the Faculties of Education. It was found out that the majority of these studies utilised the achievement test as the data collection method.

When the theses found in the database of YOK's thesis centre were analysed, it was revealed that the 6 of them (master's and doctoral) were prepared at the Department of Computer Education and Instructional Technology. 3 of them were prepared at the Department of Science and Mathematics Education, 1 of them was prepared at the Department of Elementary Mathematics and 1 of them was prepared by the students studying at the Institute of Social Sciences. With this study, it was determined that the studies conducted through the computer-assisted mathematics education are inadequate.

In addition to this, it was concluded that alternative methods in the computer-assisted mathematics education need to be searched, the content analysis of the articles and theses concerning the Computer-Assisted Mathematics Education published between the years 2009-2014/April and prepared by the students need to be more efficient and productive, and studies aiming at improving new learning approaches and instruments need to be conducted for enabling students to learn technology-assisted mathematics.

In the studies examined, it was seen that the mathematical software was used very limitedly and mostly elementary students and undergraduate students were selected as the sample groups. Besides these studies conducted with the elementary and undergraduate students, if the researchers do research with the students and teachers from vocational high schools, it would be very beneficial in terms of providing information regarding the practices of mathematics education at schools. This result shows parallelism with the results achieved by Tatar, Kagizmanli and Akkaya (2013) in their studies concerning computer-assisted mathematics education.

The whole power and the potential of the computer in learning mathematics and teaching mathematics depend on us. In other words, the power and the potential of the computer in

mathematics education is a process linked to the software we produced by using information technology and the users of these software (Gurbuz & Birgin, 2012). In this study of content analysis, we aimed at exemplifying what we are able to do in the field of Computer-Assisted Mathematics Education. Taking everything into consideration it can be concluded that understanding mathematics means doing; being a step ahead in shaping the future. As a result of the alterations in the world, mathematics and education of mathematics gained importance through the assistance of the computer and the ability of using the computer has become an indispensable element of the education life.

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