Computer-Assisted Mathematics Education Research in Turkey: The Content Analysis of 2005-2015 Period Theses

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Abstract

The purpose of this study is to examine the methodological dimensions of theses in the field of computer-assisted mathematics education by researchers in Turkey. For this purpose, a total of 25 theses, 19 of which are master's degree and 6 of which are doctoral thesis, have been examined from the sources available between 2005 and 2015. In order to evaluate the theses, the publication classification form developed by Sözbilir, Kutu and Yasar (2012) has been adapted to analyze theses on computer aided mathematics education. Content analysis of the entire theses was done with the help of this form and the data about the theses were recorded.The data were analyzed using the SPSS 16.0 program. Descriptive results are presented in graphics and tables. Results of the study showed that computer assisted mathematics education thesis research have been increasing since 2005, quantitative researches are preferred but they are used in the mixed method in some research, research topics are the preliminary learning studies and more than one data collection tool is used in the studies. The use of the percentage and frequency tables has been determined to be the foreground.

Keywords: Computer assisted instruction, mathematics education, content analysis, thesis

Introduction

During the time when we have lived that is called information age, the accumulation of knowledge around the world is accelerating. It is known that the technological growth of the last 50 years has not been seen in history. One of the biggest innovations brought by technological growth is the computer. The computer is also accelerating the development of other technological developments and experiments. Computer is seen as one of the means of improving productivity-effectiveness in education and is widely used as an instructional material. The computer is often used by the teacher in the lessons to transfer information to the learners, and to help them get access to knowledge easily.

The ability to provide Internet and dynamic software on computers has allowed computers to take a more active role in schools. Students will be able to learn by means of computerized software and internet tools, digital natives by trial and error methods, and digital immigrants can learn with feedbacks made in interaction with a manual or guide. Different methods and technological tools are used to enrich the learning environment and facilitate learning in different disciplines, especially computers (Baki, 2000). Mathematics is seen as one of the most difficult courses to learn in the society (Ocalan, 2004), and therefore the effect of computer use on learners in mathematics teaching has been explored differently (Bayturan, 2011; Hangül, 2010; İçel, 2011).The use of the computer as a bridge through software and the internet allows the learning individuals to construct their own mathematics by themselves.

In the realization of the changes in mathematics education, it is an important influence that the computer and the technologies it brings with it become a part of our life day by day. The positive effects of computer software developed especially for mathematics education on the learning environment are accepted by many researchers working in this field (Aktumen, 2007; Bulut, 2009). Baki (1996) describes the potential of computer for mathematics education as follows; Abstract mathematical concepts can be made concrete by being carried to the screen and at the same time mathematicians' research methods and the nature of important problems in mathematics can be changed.

Two different studies on computer-aided mathematics education have been reached. One of them is by Çeliköz (1997) He analyzed 26 studies, including doctorate, master's degree and articles in Turkey. It is seen that mostly learning studies are preferred as research topic and more experimental studies are preferred. The other one is conducted by Çiltaş, Güler and Sözbilir (2012). They did the content analysis of a total of 359 articles published in the field of mathematics education in 32 different journals by Turkish researchers between 1987 and 2009. As a result of the study, it is observed that there is an increase in the number of studies conducted in the field of mathematics education, the quantitative research is more preferred since 2002. Mostly learning studies, using single data collection tool and the use of the percentage and frequency tables were forefronted.

When the content analysis studies are examined; It is noteworthy that there are no comprehensive studies on theses accepted at the Turkish universities that review the researches on computer assisted mathematics education and are presented on the national platform. In this context, it is considered that in the field of computer

assisted mathematics education research, in determining the current state of the country doing content and form analysis of the dissertations accepted at the graduate and doctoral levels will contribute to the field. The examination of the research done in terms of different dimensions and the association of the results of these dimensions can give the researcher in mathematics education the opportunity to evaluate different aspects of computer assisted mathematics education. It is believed that the great picture of the synthesis and synthesis of thesis studies on computer-assisted mathematics education at the national level and a researcher who can make scientific generalizations on behalf of our country provide a valuable contribution to the field of mathematics education and a guide for determining existing problems and determining the need for new research problems. It is thought that the examination of computer assisted mathematics education research done in our country will contribute to obtaining more comprehensive results for the studies to be done in our country and to compare the situation in this country with the results of the research in other countries. Taking all these facts into account, this study aims to reveal the descriptive characteristics and methodological dimensions of the master and doctoral thesis researches that were accepted in the universities of our country between 2005 and 2015.

Within the scope of the study, the following research questions were sought:
1) Which learning areas are preferred in computer-assisted mathematics education thesis studies?
2) Which methods are widely used in computer assisted mathematics education thesis studies?
3) In which research designs did computer-assisted mathematics education have been collected widely in thesis researches?
4) Which data collection tools are widely used according to the methods of computer assisted mathematics education thesis research?
5) Which sample features vary widely in computer assisted mathematics education thesis research?
A. Which sample selection methods are commonly used?
B. Which sample levels are commonly preferred?
C. At what intervals are sample sizes commonly used?
6) Which data analysis methods are widely used in computer assisted mathematics education thesis research?

Methodology
This research was carried out on the basis of content analysis, in which 25 computer-assisted mathematics education thesis studies within the scope of master's and doctoral thesis researches accepted at Turkish universities were examined. Cohen, Manion and Morrison (2007) state that content analysis is a research technique that results from the classification of texts, the comparison of texts, and the extraction of theoretical texts.

Universe / Sample
The universe constitutes master's and doctoral dissertations in the field of computer-assisted mathematics education that has been accepted at universities in Turkey. The sample of the research is the 25 thesis accepted by the Turkish universities in the area of computer assiated mathematics education between 2005 and 2015. First of all, research on computer assisted mathematics education thesis studies have been determined by researchers and theses published in the last ten years have been researched. When the theses were determined, they were questioned with "computer assisted" key words and then the theses included in the bibliography sections of these theses were examined and the ones suitable for computer assisted mathematics education field were selected. As a result of the research, the thesis published between the years 2005-2015 have been reached from the universities which included thesis studies in the field of computer assisted mathematics education.

Data Collection Instruments
Computer assisted Mathematics Education Theses Classification Form (BDMETSF) was used as a data collection tool in the study; Research questions have been developed by researchers using Göktaş et al. (2012), Sözbilir and Kutu (2008) and other related studies (Hew et al., 2007; Masood, 2004; Reeves, 1995). In the development process, a draft form was created first, then opinions were taken from different researchers about this form and necessary arrangements were made. In the field of mathematics education, the form has been finalized by three field specialists with a doctorate degree. The first part is the demographic part of the article, which describes the descriptive properties such as the name of the article, the authors, and the journal it is published in. In the other sections, the type of the article, the topic of the article, the method of the article, data collection tools, sampling and data analysis methods are included in order.

Data Analysis
The data obtained from theses examined by content analysis within the scope of the research were analyzed using descriptive statistics (percentage and frequency). Using the data, the data frequencies and percentage ratios were calculated to correspond to the response of each of the research questions. The obtained frequency

distributions and percentage ratios are presented in the form of charts and graphs.

Validity and Reliability
Before and during the examination of the theses, a guiding guidance service was provided to the researchers. In addition, a publication classification form has been provided and controlled. The theses examined within the scope of the research were shared by the researchers in order to ensure the reliability of the research. The classification process has been completed by the researchers in two stages. In the first stage, each researcher entered the data of his / her theses, and the correctness of the data entered in the second stage was checked by another researcher. Differences in views arising from these controls have been researched and tried to be resolved. In the last stage, the deficiencies were eliminated by checking again by the data. Efforts have been made to ensure the internal validity and reliability of the study.

Results
Data collected using computer assisted mathematics education classification form were analyzed based on research questions. The findings of the analyzes are presented below in parallel with the research questions.

Preferred learning areas in computer assisted mathematics education thesis studies
Data collected using computer assisted mathematics education classification form were analyzed based on research questions. The learning areas of computer-assisted thesis based on the first research question were examined. As a result of the examination, two out of 25 theses were not evaluated in the dimension of learning areas because of the meta-analysis work and the other is the detection work. Of the other 22 theses, 13 (59.09%) were working on algebra and 9 (40.9%) were working on geometry. As a result of the investigation; Seven of them were in the field of algebra, four of them were in the field of geometry and the remaining 16 articles were in other fields.

Computer assisted mathematics education methods used in thesis research
The research methods that are frequently used in published theses are seen in Figure-1 and Figure-2. According to Figure-1, the researchers used 52% quantitative, 8% qualitative, 36% mixed and 4% field review methods.
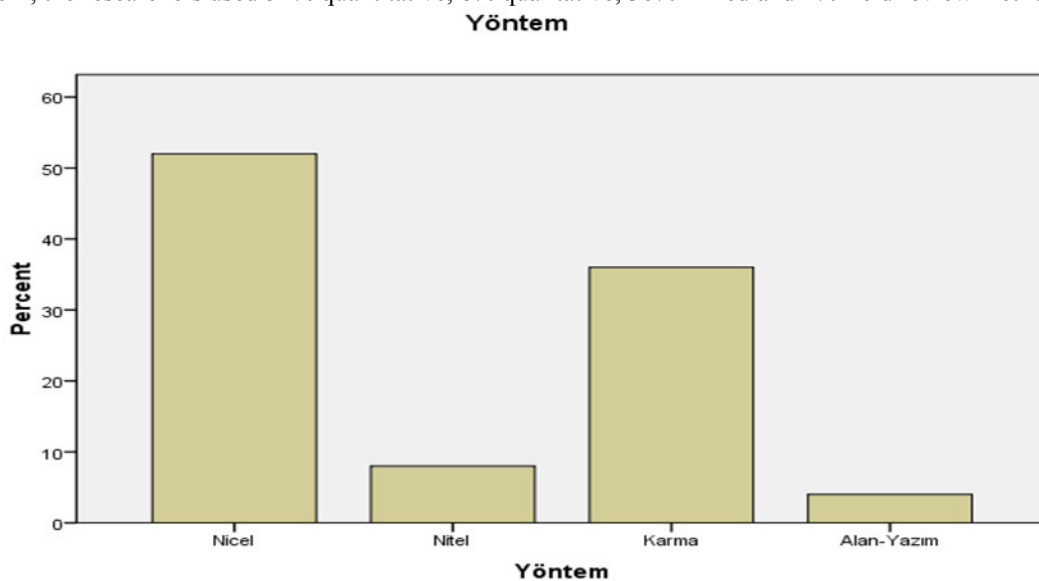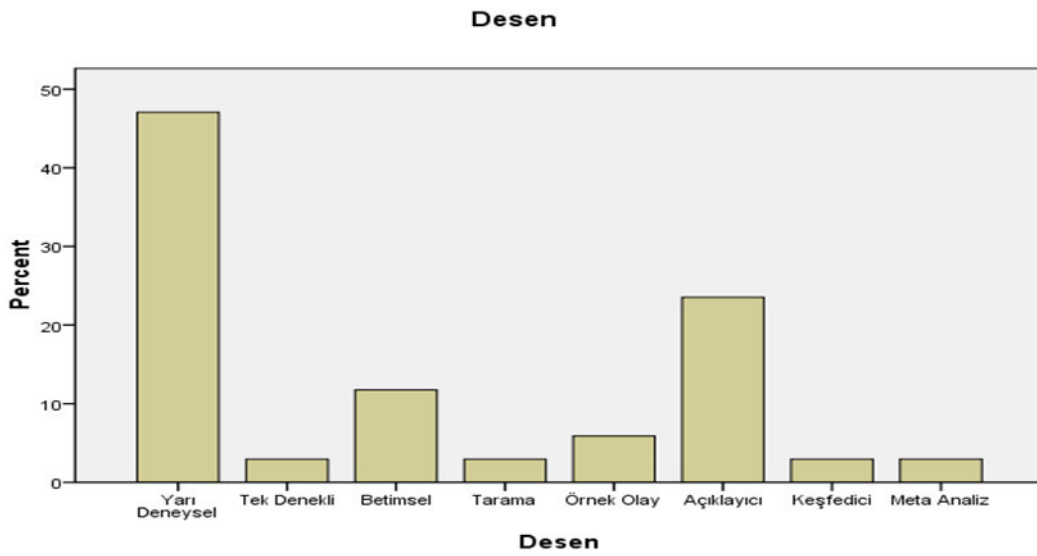

Figure 1

Preferred research designs in computer assisted mathematics education thesis research
In the quantitative research methods according to Figure-2, it is seen that semi-experimental (47.1%) design among experimental ones and descriptive model (11.8%) among non-experimental design are forerunner. Case studies (5.9%) were used in all of the qualitative research methods. In the mixed method, it is seen that mostly the descriptive (quantitative) design (23.5%) is the forerunner. Among the quantitative research methods, it is seen that the full and quasi-experimental design and, among the non-experimental research designs descriptive research design is the forerunner. A case study was used for all of the qualitative research methods. The explanatory design is also used in all mixed method designs.

Figure 2

Data collection tools commonly used in computer assisted mathematics education thesis research
The data collection tools used in published theses are given in Figure-3. It was determined that researchers used attitude-perception-ability (22%), achievement test (28.8%), interview (18.6%) and alternative assessment tools (18.6%). Besides, it is seen that researchers do not prefer observation (1.7%) and document (1.7%) very much. Survey, achievement test, perception-attitude test and interview forms were used as the data collection tools.
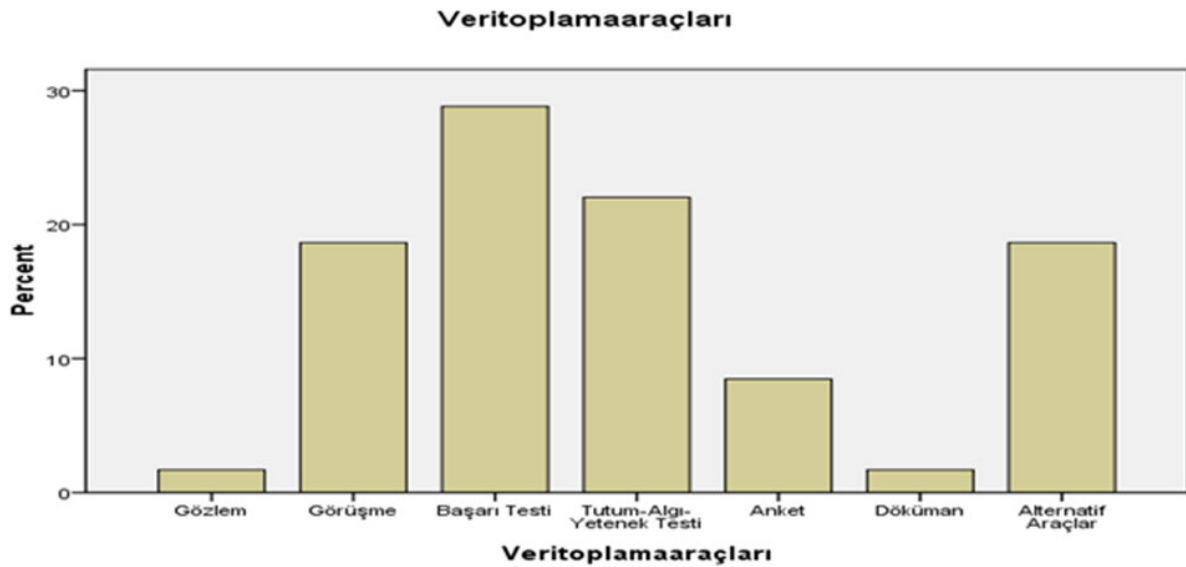
Figure 3
　　Figure-4 shows the percentage of data collection tools used by researchers in their work. As can be understood from Figure-4, 1 use (20%), 2 usage (56%), 3 usage (24%) are among the data collection tools.
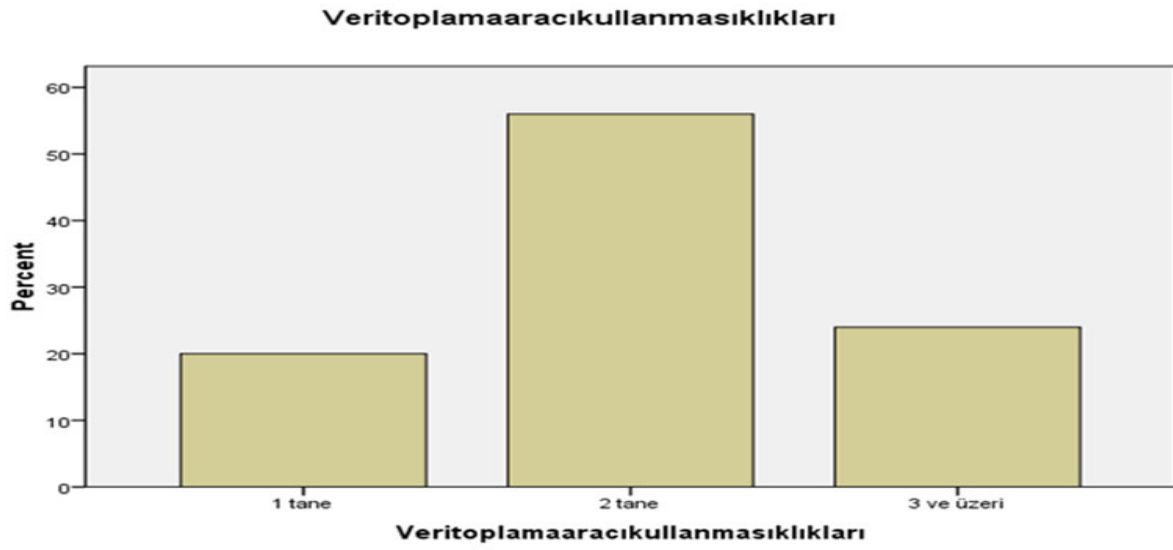
Veritoplamaaracıkullanmasıklıkları

Figure 4

Sample sizes used in computer assisted mathematics education thesis research
A. Which sampling methods are commonly used?
Most of the researchers in the 25 theses examined for the research selected random (44.4%) sampling, followed by the appropriate (40.7) and easily achievable (7.4) sampling methods. Looking at the theses examined, it is seen that the researchers did not apply to the whole of the universe and others in the sample.
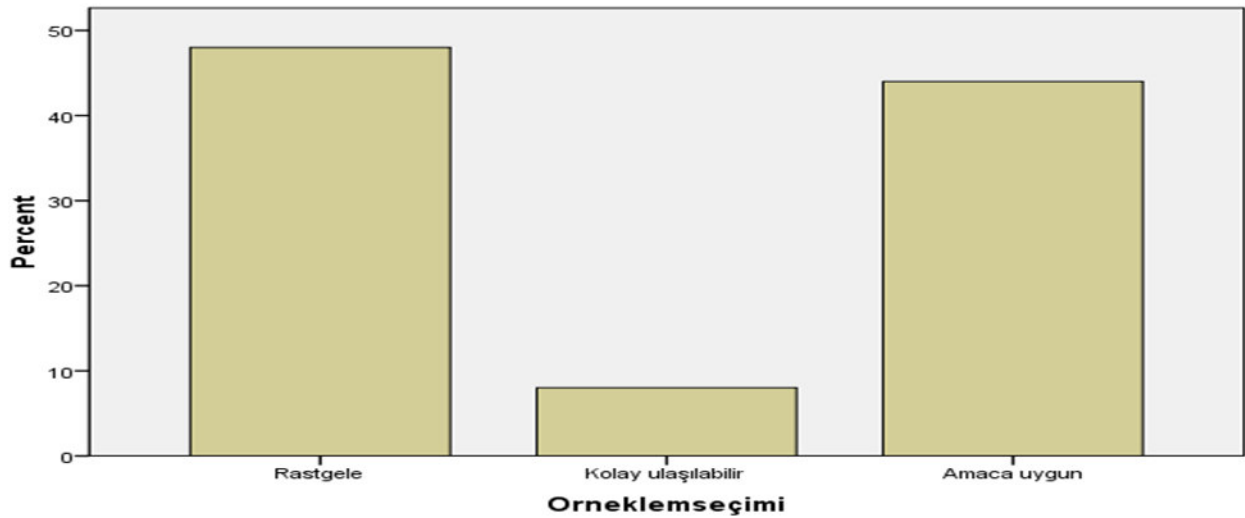
Orneklemseçimi

Figure 5

B. Which sample levels are commonly preferred?
In Figure-6, it is seen that the samples preferred by the researchers are at the undergraduate (23,1%) and primary (46,2%) level. It is also seen that secondary education (11.5%), pre-school (3.8%) and other samples (7.7%) are not preferred much.
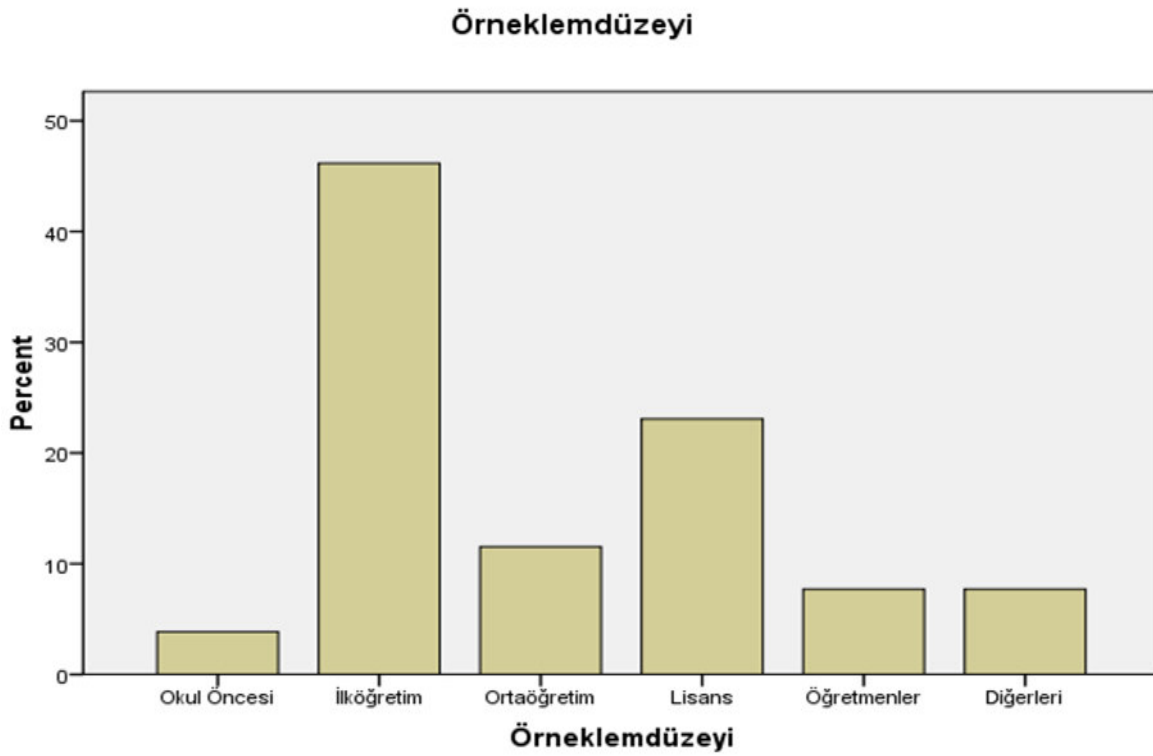
Örneklemdüzeyi

Figure 6

C. At what intervals are sample sizes commonly used?
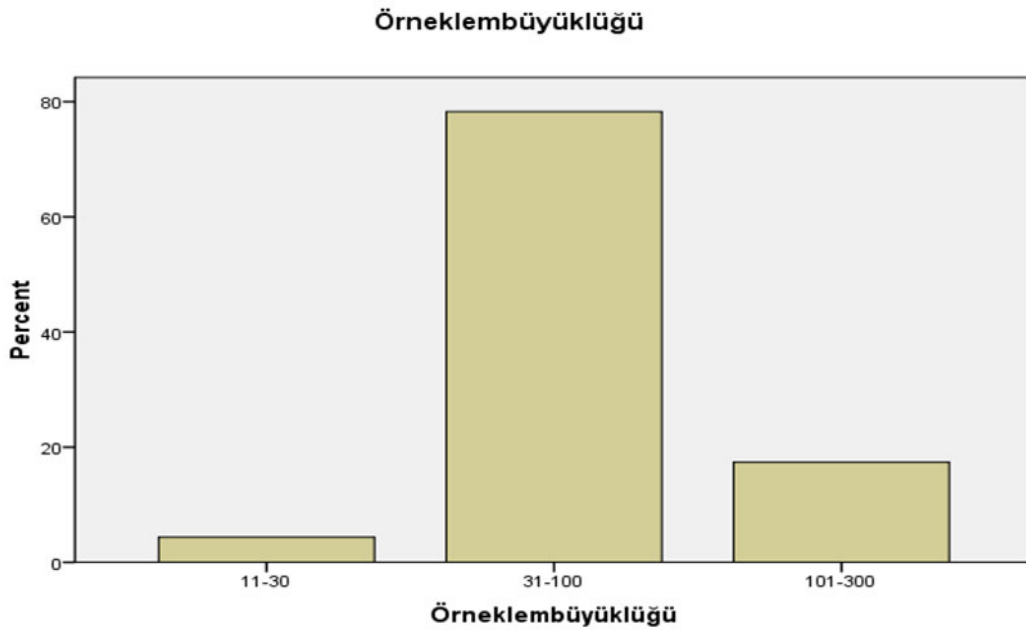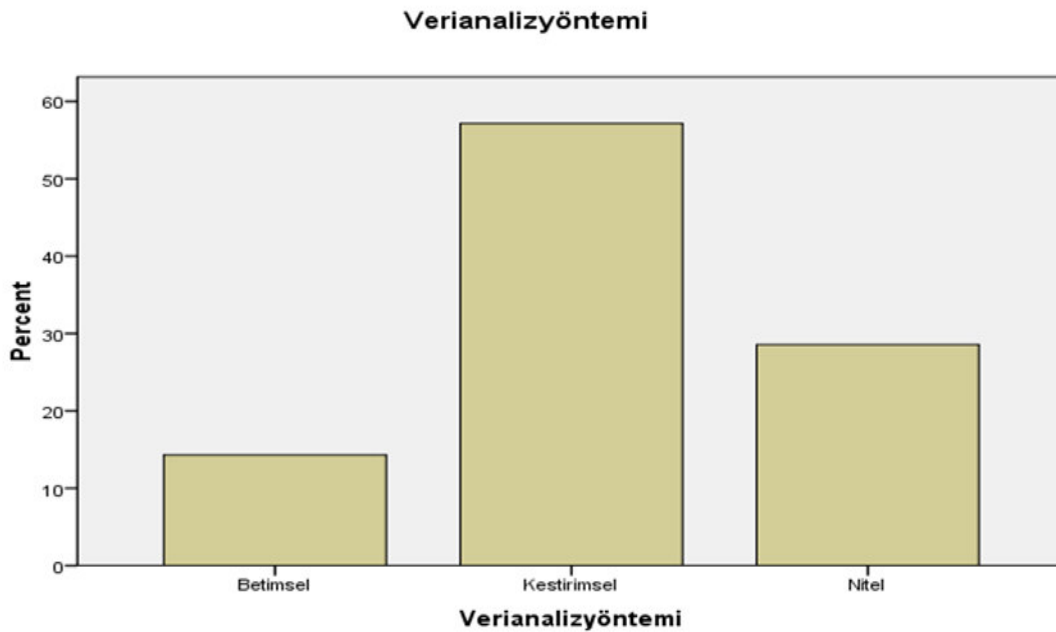
Örneklembüyüklüğü

Figure 7

Similarly, when figure-7 was examined, it was determined that researchers were working with 31-100 (78.3%) and 101-300 (17.4%) sample sizes. However, it is seen that researchers do not prefer 1-10 (0%) and 11-30 (4.3%) sample sizes.

Data analysis methods commonly used in computer assisted mathematics education thesis research

Figure 8

As seen in Figure 8, researchers preferred descriptive statistical methods (14.3%), predictive statistical methods (57.1%) and qualitative methods (28.6%) in the theses they published. All those who preferred descriptive statistical methods used percent-frequency (14,3%). Researchers who used predictive statistics methods preferred t-test (31.4%) more. Descriptive analysis (20%) was preferred for qualitative data analysis methods.
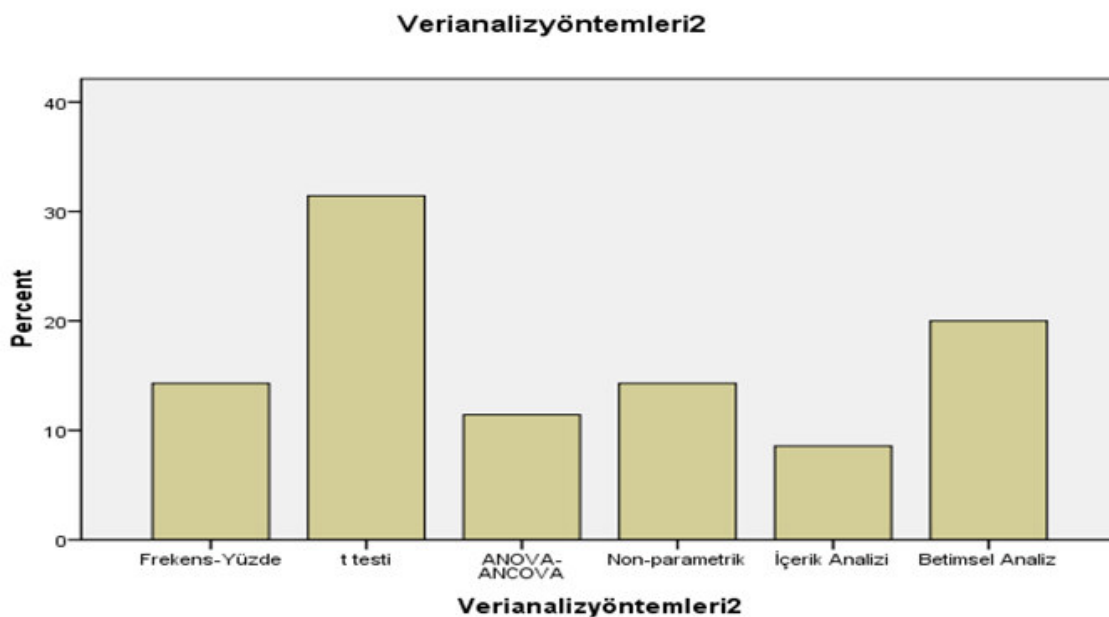
Figure 9

While most researchers use two different data analysis methods (64%), this order is followed by the researchers who use only one data analysis method (32%). As seen in Figure 10, three (3%) and over-data analysis methods (4%) are not preferred.

Figure 10

Conclusion and Discussion

In this study, computer-assisted mathematics education master's and doctoral dissertations were investigated through YÖK national thesis center and examined in terms of research methods, research designs, sample levels, sample selection methods, sample numbers and data analysis methods.

It was determined that among thesis researches carried out between 2005 and 2015, 13 were made in algebra field and 9 were made in geometry field. The fact that algebra is more frequently researched can be caused by the fact that algebra is predominant in teaching programs. When the curriculums are examined, it is seen that geometry contains fewer gains than the number of gains according to the algebra, and when the lesson hours are examined, it is seen that the algebra lesson hours are more than the geometric lesson hours. This can be interpreted in a descriptive manner as to why more theses studies have been done in the field of algebra.

When theses research have been rated in terms of method diversity, it was found that more than half of them are using quantitative method, secondly, mixed method is preferred and less qualitative method is used. This information is supported by Çiltaş, Güler and Sözbilir (2012). They found that quantitative research is more preferred by the Turkish researchers in the field of mathematics education between 1987 and 2009. In addition, Çelikoz (1997) found that when the methods used in the researches that he investigated were ranked according to their frequency, the first order was quantitative while the second order was qualitative and the last order was mixed method. This situation reveals that the method called mixed method is more important than the qualitative method and it is included in the research studies done in our country over time. In mathematics education research, supporting qualitative research with quantitative research can be due to the fact that researchers prefer to use numbers in order to support qualitative data, prefer to tell figures graphically and figuratively and the possibility to generalize the results when supported with quantitative research.

When the research studies are analyzed in terms of research design, in most of the studies, the preference of quasi-experimental design out of the experimental designes is preferred almost in half. This situation causes that experimental design is used more than half of the research studies. Also, it can be said that quasi-experimental design is preferred to the aim of increasing the internal validity of the studies.

It was seen that the experimental design is mostly preferred when the research is reviewed in terms of research designes. Quasi-experimental design is preferred mostly out of the all experimental designes. It can be said that the reason of this preference is to increase the internal validity.

While Çiltaş, Güler and Sözbilir (2012) point out that they use only one data collection tool in the articles they examine, in this study mostly success test are used as data collection tools in thesesand it is followed by emotional scales, interview forms and alternative measurement tools. In terms of the number of data collection tools in the theses, the reason of using more than one data collection tools and in four in five studies preferred in this respect can be in order to increase the reliability of the study and to show the results of the study in order to show its consistency and support.

In addition, in quantitative studies, the experimental design is heavily preferred and the result of the research on the sample may be due to the ability of the sample to be analyzed by a computer program to easily

score the achievement test and affective scales. Less choice of interviewing and alternative measurement tools may be due to the fact that qualitative and mixed research is less preferred than quantitative research. We may also find it more difficult and time-consuming to conduct interviews and analysis of alternative measurement instruments than to perform analysis of other achievement tests or affective skill scales.

When the sample selection methods of the research are examined, it is seen that the most preferred selection method is random and the second most favorable method is purposive and the convenient method is preferred the least. The reason of not preferring to reach the whole universe can be due to the fact that it would be difficult to reach, it would be time consuming and costly. The reason of preferring random selection is due to the equal chance of each member of the study for sampling, and the purposive sampling would have been preferable to the portion of the universe best suited to the problem. We can say that the reason for choosing the convenient sampling is to minimize the likelihood of representing the universe and avoid as much mistake as possible in statistical calculations. The reason of preferring primary school children and undergraduate students as sampling groups in the research can be due to the fact that graduate students who conduct these research can reach these groups easily and less costly in terms of time and money. Likewise, when examining the preferred sample sizes in research, nearly four in five of all research studies the reason of preferring 31-100 sample size can be that the calculations of the data would require more time in proportion to the size of the sample, and the cost.

The number of analysis methods used in the research can be increased depending on the method and the data collection tools used. It can be seen that two or more analysis methods are used in most of the researches when the researches are examined. This is a natural result as the methodologies used will be increased in direct proportion by increasing the diversity of data collection tools in the same thesis. In the same way, we can say that more quantitative statistical methods are preferred in parallel with the preference of quantitative methods in the analysis methods that are suitable for quantitative research methods.

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