THE CASE OF USING TECHNOLOGY BY CANDIDATE TEACHERS OF MATHEMATICS IN CLASSROOMS[*] [1]

SINIF ÖĞRETMENİ ADAYLARININ MATEMATİK ÖĞRETİMİ BAĞLAMINDA TEKNOLOJİDEN YARARLANMA DURUMLARI

ПОЛОЖЕНИЕ ПО ИСПОЛЬЗОВАНИЮ ТЕХНОЛОГИИ ПРИ ПРЕПОДАВАНИИ МАТЕМАТИКИ КАНДИДАТАМИ В ПЕДАГОГИ НАЧАЛЬНЫХ КЛАССОВ

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ABSTRACT

Technology use in learning-teaching environments is of vital importance at the present time, in which science and technology are changing and developing rapidly. Consequently, it is assumed that learning will become permanent and effective, thus will not be forgotten for a long time provided that technology is utilized in mathematic teaching. In this study, it is aimed to determine the problems which classroom teacher candidates encounter while utilizing technology in terms of teaching mathematic. This study has been conducted by using case study method and performed with 32 teacher candidates, who are third grade students and study at Giresun University, Education Faculty, Primary Education Programme, Department of Classroom Teaching. Observations have been made with 32 teacher candidates, who take the course called "Mathematic Teaching-I" for 7 weeks. Finally, a semi-structured interview form, which was prepared by the researchers, has been presented to teacher candidates. The study is analyzed and interpreted by using the descriptive analysis technique. NVivo 8 software has been utilized in order to analyze the data. It is concluded in the study that almost all of the teacher candidates have positive opinions on technology use within the context of mathematic teaching. It is designated that teacher candidates face 4 basic problems while using technology in teaching mathematic. These are problems which are encountered in the process of information seeking and while using technology, security problems and hardware problems.

Keywords: Technology, Teaching Mathematic, Classroom Teacher Candidates.

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ÖZ

Çalışmada, sınıf öğretmeni adaylarının, matematik öğretimi bağlamında teknolojiden yararlanmada karşılaştıkları sorunlara yönelik görüşlerinin belirlenmesi hedeflenmiştir. Çalışma, Giresun Üniversitesi Eğitim Fakültesi İlköğretim Bölümü Sınıf Öğretmenliği ABD'nin 3.sınıfında öğrenim görmekte olan 32 aday ile gerçekleştirilmiş ve durum çalışması yöntemiyle yürütülmüştür. Çalışmada, "Matematik Öğretimi-I" dersini alan adaylar ile 7 hafta süresince gözlemler yapılmıştır. Çalışma, betimsel analiz tekniği kullanılarak analiz edilmiş ve yorumlanmıştır. Verilerin analizinde NVivo 8 yazılımından yararlanılmıştır. Çalışmada, adayların neredeyse tamamının matematik öğretimi bağlamında teknoloji kullanımına ilişkin görüşlerinin olumlu olduğu ortaya çıkmıştır. Adayların matematik öğretiminde teknoloji kullanırken 4 temel sorunla karşılaştıkları sonucuna ulaşılmıştır. Bunlar, teknolojiyi kullanırken karşılaşılan sorunlar, bilgi arama sürecinde karşılaşılan sorunlar, güvenlik problemleri ve donanımsal sorunlardır.

Anahtar Sözcükler: Teknoloji, Matematik öğretimi, Sınıf öğretmeni adayları.

АННОТАЦИЯ

В статье рассмотриваются вопросы о положении и трудностях по использованию технологии при преподавании математики кандидатами в педагоги начальных классов. Наблюдения проводились над 32 кандидатами в педагоги 3-го американского курса педагогического факультета Гиресунского университета в течении семи недель по предмету "преподавание матнматики-I". Итоги наблюдения были анализированы описательным методом. Данные анализа были рассмотрены методом NVivo 8. Итоги исследования показали, что кандидаты положительно относятся к преподаванию математики с включением технологических методов. Были выявлены четыре прблематических вопроса: трудности при исползовании технологии, по поиску информации, безопасности, оборудованию.

Ключевые слова: технология, преподавание математики, кандидаты в педагоги начальных классов.

INTRODUCTION

Today, the advances in technology and the need aroused from technology made it necessary that educational programs need to be changed accordingly (Deniz and Kaptan, 2011). Today, it is aimed to raise individuals who can think fast and creatively, are aware of individual differences and know the ways of reaching information. It is aimed to raise teachers who can match the changing mentality and how the teachers who will raise the individuals having the said qualities should be trained is researched (Umay, 2004). Qualified teachers having the mentioned qualities must be trained in order to reach the said goal. Qualified teacher is the individual who is aware of the emerging developments and innovations; who can integrate the innovations and developments into technology and integrate all the mentioned knowledge into field teaching (Baki, 2000). Teachers are expected to have specific abilities and qualifications due to the fact that technology has become quite influential (Mentz and Mentz, 2003).

Availability, power and versatile use of technology has made it necessary and possible to reconsider how students learn mathematic best as well as how they should learn it (NCTM, 2000). It is suggested that teachers leave the role of being the sole authority in

classroom and guide them to structure mathematical knowledge and enhance the learning and teaching environment (NCTM, 1991, 2000). Teacher training programs also attract attention to use of technology in school mathematics (Lee and Hollebrands, 2008; Powers and Blubaugh, 2005).

Teacher candidates must have a good command of technology and be able to use the mentioned ability effectively in learning and teaching processes (Gündüz and Odabaşı, 2004). Mastering in the ways of utilizing from technology within the context of teaching mathematics will ensure a teacher candidate not only to overcome the feeling of inadequacy but also to have a feeling of being a qualified teacher. Therefore, teacher candidates must first answer the question of how they will teach mathematics through technology. Using technology within the process of teaching leads to participation in learning process and profound learnings; thus, students associate the things which they learn to daily life (Thomas, 2001).

Fendi (2007), in his study, has established that primary school teachers sometimes need to use technology in their classrooms. In this sense, it can be predicted that classroom teacher candidates who will also teach mathematics soon will reflect technology use on their career. Within this context, how teacher candidates utilize technology in terms of teaching mathematics, whether or not they feel sufficient about technology use and what kind of problems they encounter must be analyzed. It is considered that asking teacher candidates' opinions about technology use; designating their technology utilization in teaching mathematics and revealing the problems which they encounter will contribute the literature.

Purpose of the Study

In this study, it is aimed to determine the problems and their dimensions which classroom teacher candidates encounter while utilizing technology as part of teaching mathematics. Answers of the following questions have been sought in line with this general purpose:

1. What do classroom teacher candidates think about the utilization of technology as part of teaching mathematics?
2. How do classroom teacher candidates utilize technology as part of teaching mathematics?
3. What kind of problems do classroom teacher candidates experience while utilizing technology as part of teaching Mathematics?
4. What solutions do classroom teacher candidates offer related to the problems which they encounter while utilizing technology as part of teaching mathematics?

METHOD

Research Model

In this study, in which it is aimed to determine the problems which classroom teacher candidates encounter while utilizing technology as part of teaching mathematics, qualitative research model has been adopted. Qualitative research (Tavşancıl and Aslan, 2001; Yıldırım and Şimşek, 2006) is the research model in which such data gathering methods as observation and interview are used; a qualitative process which aims at revealing perceptions and events in a realistic and holistic way in their natural environment is followed. In the study in which case study pattern is adopted, a single holistic case pattern

is used. In this context, unstructured participant observation and semi-structured interview techniques are utilized.

Participants of the Study

Participants of the study is comprised of 32 teacher candidates who study at Giresun University, Education Faculty, Primary Education Program, Department of Classroom Teaching in 2012-2013 spring semester and take the lesson called "Mathematic Teaching-I". six and 26 participants are females and males, respectively.

Data Collection Tool

In the study, unstructured participant observation and semi-structured interview technique which are among qualitative research techniques are used. In terms of observation, the researcher observed the lecture of the teacher candidates through the semester. In the study in which unstructured observation technique is used, the researcher has taken notes and tried to reveal how teacher candidates utilize technology as part of teaching mathematics and the problems which they encounter while utilizing it.

Semi-structured interviews were performed with the volunteer teacher candidates at the end of the semester. For this purpose, sample interview questions were prepared and reorganized in line with experts' opinions. Then, a testing interview was made with one teacher candidate and interview questions were finalized in line with the expressed opinions; they were conducted with 15 teacher candidates.

Analyzing the Data

Before analyzing the data obtained in the research, the interview data were studied in terms of validity and reliability. In this context, in order to decode sound recordings correctly, they were listened and written separately by the researcher and another independent researcher. Then, interview printouts were controlled and cleared of mistakes and thus finalized. At the next stage, interview printouts were presented to the teacher candidates and the researcher made sure that opinions were narrated correctly.

İnterview and observation data were analyzed through descriptive data analysis technique. NVIVO 8, a qualitative analysis software, was utilized to analyze the data.

FINDINGS

Findings and comments have been presented and commented in this section. While presenting the research findings, the order of research purposes were followed in order to clarify them.

General opinions of the teacher candidates on utilization of technology as part of teaching mathematics have been presented in Figure 1.

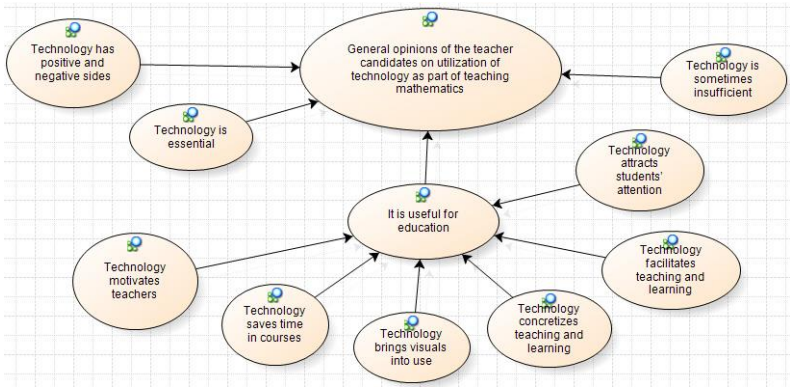


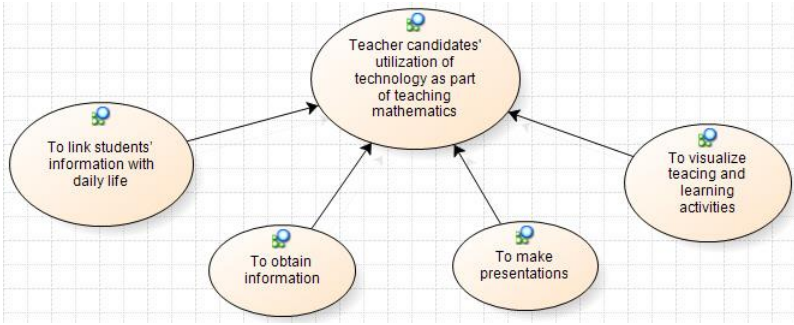
Figure 1. General opinions of the teacher candidates on utilization of technology as part of teaching mathematics.

Examining general opinions of the teacher candidates on utilization of technology as part of teaching mathematics, it is observed that almost all of the candidates have positive opinions. While according to some teacher candidates, technology is essential in teaching mathematics, according to some other candidates, technology is sometimes insufficient. While *"Significance of technology in teaching mathematic is incontestable"* emphasizes the significance of technology, a teacher candidate opining "*In certain cases, technology may remain incapable. We cannot learn everything via technology."* states that technology is sometimes insufficient.

On the other hand, some teacher candidates believe that technology has positive and negative sides. A teacher candidate reveals it by suggesting *"Technology has advantages as well as disadvantages. For instance, using a calculator does more harm than good for someone who is learning multiplication table".*

However, the opinion that technology is useful has an important place among teacher candidates. According to the teacher candidates, technology use in teaching mathematics helps in motivating teacher candidates, saving time, bringing visuals into use, concretizing and facilitating learning and teaching; attracting students' attention. A teacher candidate expresses that technology motivates them by reporting *"We are more motivated about teaching"* and another candidate expresses its time saving feature by suggesting "*We have studied four operations through slides. In this way, we prevent time loss. For example, while lecturing on division, we can save time using slides instead of making students write the operation in their notebook"*. While such an expression as *"Presentations are better when utilizing three dimensional visuals in mathematics"* propounds the contribution of visual features of technology, another expression as *"When we use technology in teaching mathematics to young children, we can transfer information more easily"* addresses the facilitative role of technology in teaching mathematics. A teacher candidate expresses his opinion about the fact that technology attracts students' attention by stating *"Mathematics is a lesson in which students must not be distracted. Technology prevents distraction as people focus on the point which the technology addresses".*

How teacher candidates utilize technology as part of teaching mathematics has been presented in Figure 2.



Examining Figure 2, it is observed that teacher candidates use technology in teaching mathematics in order to link students' information with daily life, obtain information, visualize teaching and learning activities while giving a presentation. One of the teacher candidates refers linking students' information with daily life by saying *"We ensure students to link information with daily life by getting them to watch videos"* while another one manifests how he collects information by indicating *"I benefit from the internet and do research. I download pictures for children. I find interesting things for them."* It is also observed in the participatory observations that teacher candidates benefit from online video services such as Youtube and integrate them into their presentations. Moreover, teacher candidates try to enliven their presentations benefiting from cartoons such as Pepee.

A teacher candidate states technology use as *"it is more fun to give the lecture through slides which I prepare and find on the net before."* Another candidate expresses visualizing teaching-learning activities as "*We ensure students to understand better through showing visual sources thanks to technology."* It is observed that teacher candidates add music to their slides and try to make their presentations more interesting.

Classroom teacher candidates' opinions about the problems which they experience while using technology as part of teaching Mathematics have been presented in Figure 3.

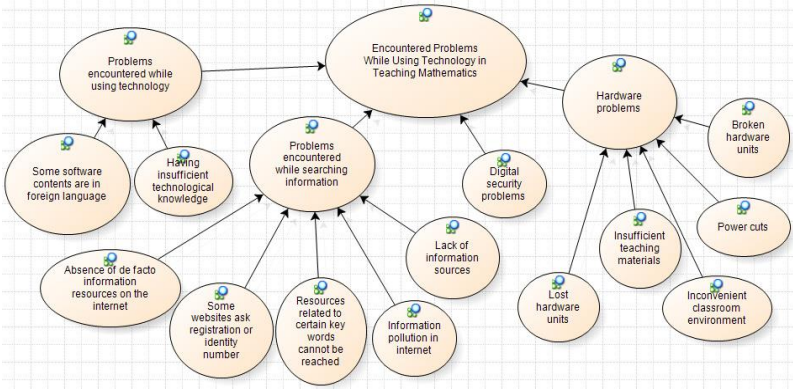


Figure 3. The problems which classroom teacher candidates experience while utilizing technology as part of teaching Mathematics.

Examining Figure 3, it is observed that teacher candidates encounter 4 basic problems while using technology as part of teaching Mathematics. These are the problems which are

encountered while using technology, the problems which are encountered in the process of information search, security and hardware problems.

Certain problems which teacher candidates experience while using technology result from the fact that some software contents are in a foreign language and the candidates do not have enough technological information. A teacher candidate addresses the foreign language problem as *"Some of these programs can be in a foreign language and it could be hard to understand these programs."* while another candidate sets light to lack of technological information *"For instance, in the first year, we studied the software in the computer class which we use in order to prepare presentations. Personally, I do not think that I learnt to use the software precisely. Therefore, I sometimes have difficulty*". Observation data also support this finding.

It is also observed that teacher candidates have the deficiency of competence in technology use and they experience problems in using the software. It is seen that teacher candidates know about Word and PowerPoint softwares, however they do not use them efficiently. Furthermore, it is observed that some teacher candidates have difficulty in using the projector. The candidates have stated that they experience problems such as absence of remote controller and failure of on/off button.

Examining the problems which are encountered while searching information, it can be suggested that these problems are absence of de facto information resources on the internet, information pollution on the internet, lack of information sources, the fact that some websites ask membership or national identity number, resources related to certain key words cannot be reached. A teacher candidate explains the problem of absence of de facto information sources on the internet as *"With regard to finding resource, we cannot figure where we can find anything when we act based on our own knowledge."*; while the same candidate state the fact that some websites ask membership or T.R. identity number as *"Certain websites demand membership and I cannot benefit from them due to the fact that I do not trust them and give my identity number. It sometimes bothers me not to be able to access the sites although I know the things which I inquire are in these websites."* It is concluded from the observations that the teacher candidates try to utilize the information resources of which they are sure and receive help from the websites of the Ministry of National Education.

The candidates who express the key word problem suggesting *"When I type the thing which I inquire, different results display and I cannot make use of the research engine."* express the information pollution suggesting *"it is really hard to find a standard official publishing. There is a lot of erroneous information on the internet."* One of the candidates states the insufficient resource problem suggesting *"We do not have enough resource. We go online, however we cannot find most of what we look for."*

Digital security problem is another problem which is encountered while using technology in teaching Mathematics. A teacher candidate expresses this issue reporting *"there was virus on the website on which we found the information and my computer was infected while preparing my activity. We had to prepare again because we lost the activity we had prepared".*

Examining hardware problems which are among the problems of technology use, it is observed that they consist of lost hardware units, insufficient teaching materials, inconvenient classroom environment, power cuts and broken hardware units. A teacher candidate summarizes reporting *"School sometimes has deficiencies in terms of technology;*

for example, sometimes we cannot find power cable of projector". While another teacher candidate refers to insufficient teaching materials stating *"Teaching materials may not be sufficient"*, another candidate addresses the inconvenient classroom environment suggesting *"When we give a presentation, sometimes slides may not be seen because there is too much light in the environment."* A teacher candidate mentions power cuts reporting *"Electricity was cut off when we were finally ready for presentation."* and another one refers to broken hardware units stating *"We sometimes have problems related to projectors and connecting cables. This is because some of them are not repaired. Therefore, this causes us go to other classes"*.

In the observations which were made for the study, problems which are similar to the problems which the teacher candidates indicate have been observed. In the education environments, certain problems such as disorganization of classes in terms of technology use, insufficiency of certain technological equipment (projection screen, extension cable, the fact that candidates cannot see projection screen well due to the size of the class) and deficiency of some of them have been experienced.

Furthermore, during the observations, it has been sighted that teacher candidates have problems related to presenting the information in an original way which they obtain by using technologies such as internet. It is observed that teacher candidates only paste the activities which they download from the internet, they cannot add anything original. Teacher candidates express that the reason for this, they do not know how to change, add or remove anything in the activities. Another problem which appears while students use technology is the fact that they read the presentation as it is and they do not add anything to the presentation.

What solutions teacher candidates offer related to the problems which are encountered while utilizing technology as part of teaching Mathematics is presented in Figure 4.

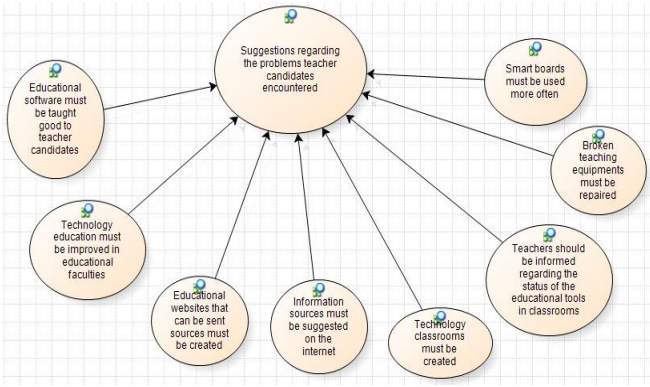


Figure 4. Solutions which classroom teacher candidates' offer related to the problems which are encountered while using technology as part of teaching Mathematics.

Examining Figure 4, it is observed that classroom teacher candidates' offer 8 basic solutions related to the problems which are encountered while utilizing technology as part of teaching Mathematics. These are teaching educational softwares to teacher candidates well, improving technology education at education faculties, creating educational websites on which information resources are uploaded, suggesting information resources on the internet, creating technology classes, acquainting teachers with the tools in the classrooms, repairing broken hardware units and using smart boards more often.

While one of the teacher candidates' express the solution of teaching educational softwares stating *"All of these softwares must be taught finely"*, another one describes the solution of enhancing technology education at education faculties as the following:

"I believe that we must have a good command of technology. There may be some problems. Teacher candidates should have the good command of technology so that they can address the children. Perhaps, the children know more than us about technology. We should be familiar with technology in order not to feel lowly. Smart boards cannot be used at some schools. We will be classroom teachers and they will most probably not present there but we will, in a sense, take technology there. For this reason, more things can be done at the faculty for the sake of technology. Smart boards can be taught us one to one. We must learn everything related to technology. We do not use technology adequately. We must be taught well so that we can teach better"

A teacher candidate expresses the solution of creating educational websites on which information resources are uploaded, one of the solution offers, asserting *"I want to have a website that everybody would be able to share the activities .If a teacher found a new technique, he would put it on the site so everybody benefits form it."* Another student expresses the solution of suggesting information resources on the internet through the following sentences:

"First things come to mind are internet and computer. For example, when we need to do a research, we try to do it on the internet directly. Therefore, we need to know how to reach the needed resources. It is sometimes difficult to do research. Our teachers may recommend us websites."

Another offer is creating technology classrooms. A teacher summarizes it suggesting "Technology classes can be formed" while another teacher expresses the solution of acquainting teachers with the tools in the classrooms stating *"It is a good idea to act upon the available materials. For example, we should know before if there are appropriate materials that can project the slides."* A student expresses the solution of repairing broken hardware units stating *"Some projectors in classrooms do not work. They can be repaired."* Another student expresses the last solution which is using smart boards more frequently *"It would be better if smart boards were brought to the school, all of us will be ignorant about them, I do not know what to do and how to use them".*

CONCLUSION AND DISCUSSION

In the study, examining general opinions of the teacher candidates on utilization of technology as part of teaching mathematics, it is ascertained that almost all of the candidates have positive opinions. Furthermore, it is observed that teacher candidates use technology in teaching mathematics in order to link students' information with daily life, obtain information, visualize teaching and learning activities while giving a presentation. This result shows similarity with the results of the study which Umay (2004) performed with teacher candidates on the same issue. The result of the same study concluding that teacher candidates do not need technology use in such classes as Mathematics and they think that students will learn more easily and pleasurably through practice contradicts the result of this study. Similarly, findings of this study differ from the results of the study performed by Çakıroğlu, Güven and Akkan (2008) which suggest that teachers have negative opinions on using computers in teaching Mathematics.

It is observed that teacher candidates use technology in teaching mathematics basically in order to link students' information with daily life, obtain information, visualize teaching and learning activities while giving a presentation. It is also observed in the

participatory observations that teacher candidates benefit from online video services such as Youtube and integrate them into their presentations. These results are consistent with the results of the study performed by Niess (2006) which concludes 'teacher candidates have difficulty in integrating the technology education which they receive in undergraduate education into their classes and they cannot link the information which they obtained in technology classes with their classes.

It is ascertained that one of the problems which teacher candidates encounter is digital security problems. Besides, examining hardware problems, one of the technology use problems, it is observed that they consist of lost hardware units, insufficient teaching materials, inconvenient classroom environment, power cuts and broken hardware units.

One of the results which has been reached is that teacher candidates have problems related to presenting the information in an original way which they obtain by using technologies such as internet. It is also observed that teacher candidates only paste the activities which they download from the internet, they cannot add anything original. Moreover, it is concluded that teacher candidates read the presentation as it is and they do not add anything to the presentation.

In the study, it is concluded that teacher candidates encounter 4 basic problems while using technology as part of teaching Mathematics. It is ascertained that they are the problems which are encountered while using technology, the problems which are encountered in the process of information search, security and hardware problems. It is observed that certain problems which teacher candidates experience while using technology result from the fact that some software contents are in a foreign language and the candidates do not have enough technological information. It is observed that teacher candidates have the deficiency of competence in technology use and they experience problems in using computer softwares. It is also seen that teacher candidates know about Word and PowerPoint softwares, however they do not use them efficiently. Furthermore, teacher candidates express that they encounter certain problems while searching information, it can be suggested that these problems are absence of de facto information resources on the internet, information pollution on the internet, lack of information sources, the fact that some websites ask membership and T.R. identity number, resources related to certain key words cannot be reached. Umay (2004) revealed that teacher candidates and active teachers do not include technology use in their instructional plan. Furthermore, he has emphasized that technology use in education process and its integration into education is in its infancy. Although ten years passed, the results of the study show similarity with the mentioned study.

Suggestions

Following suggestions can be made for the teacher candidates based on the results of the study:

- Educational softwares must be taught well.
- Technology education at education faculties must be improved.
- Educational websites on which information resources are uploaded must be created.
- Technology classrooms must be formed.
- Teachers must be acquainted with the operating status of the equipment in classrooms.
- Broken hardware units in classrooms must be repaired.

REFERENCES

Baki, A. (2000). Preparing Student Teachers to Use Computers in Mathematics Classroom Through A Long-Term Preservice Course in Turkey. *Journal of Information Technologyfor Teacher Education*, 9(3), 343-362.

Çakıroğlu, Ü., Güven, B. & Akkan, Y. (2008). Matematik Öğretmenlerinin Matematik Eğitiminde Bilgisayar Kullanımına Yönelik İnançlarının İncelenmesi. *Hacettepe Üniversitesi Eğitim Fakültesi Dergisi*, 35, 38-52.

Deniz, E. & Kaptan, F. (2011). Yapılandırmacı Fen Eğitiminde Tamamlayıcı Ölçme Değerlendirme Uygulamalarından Performans Temelli Değerlendirmenin Önemi. *Uluslararası Karadeniz Sosyal Bilimler Dergisi*, Karadeniz, Black Sea - Черное Море, Sayı: 9, 25-43.

Fendi, F. (2007). *İlköğretim Öğretmenlerinin Teknoloji Kullanım Yeterliliği.* İstanbul: Yayınlanmamış Yüksek Lisans Tezi, Yeditepe Üniversitesi Sosyal Bilimler Enstitüsü, İstanbul.

Gündüz, Ş. & Odabaşı, F. (2004). Bilgi Çağında Öğretmen Adaylarının Eğitiminde Öğretim Teknolojileri Ve Materyal Geliştirme Dersinin Önemi. *The Turkish Online Journal of Educational Technology*, 3(1), 43-49.

Lee, H. & Hollebrands, K. (2008). *Preparing to Teach Mathematics With Technology: an Integrated Approach to Developing Technological Pedagogical Content Knowledge. Contemporary Issues in Technology and Teacher Education* [Online Serial], 8(4). Web: Http://Www.Citejournal.Org/Vol8/İss4/Mathematics/Article1.Cfm 21.04.2013 tarihinde alınmıştır.

Mentz, E. & Mentz, K. (2003). Managing Technology Integration Into Schools. A South African Perspective. *Journal of Educational Administration*, 41(2), 186-200

Monaghan, J. (2004). Teachers' Activities in Technology Based Mathematics Lessons. *International Journal of Computers for Mathematical Learning*, 9, 327-357.

National Council of Teachers of Mathematics. (1991). Principles and Standards for School Mathematics. Reston, VA: NCTM.

National Council of Teachers of Mathematics. (2000). Principles and Standards for School Mathematics. Reston, VA: NCTM.

Niess, M. (2006). *Preparing preservice teachers to teach mathematics with technology* - Technological Pedagogical Content Knowledge (TPCK) *In C. Crawford Et Al. (Eds.), Proceedings of society for information technology and teacher education international conference* 2006, 3788-3795. Chesapeake, Va: Aace.

Powers, R. & Blubaugh, W. (2005). *Technology in Mathematics Education: Preparing Teachers for the Future. Contemporary Issues in Technology and Teacher Education* [Online Serial], 5(3/4). Web: Http://Www.Citejournal.Org/Vol5/İss3/ Mathematics/Article1.Cfm.24.04.2013 tarihinde alınmıştır.

Yıldırım, A. & Şimşek, H. (2006). *Sosyal Bilimlerde Nitel Araştırma Yöntemleri*. Ankara: Seçkin Kitabevi.

Tavşancıl, E. & Aslan, E. (2001). *İçerik Analizi ve Uygulama Örnekleri*: İstanbul. Epsilon Yayınevi.

Thomas, G. P. (2001). Toward Effective Computer Use in High School Science Education: Where to from here? *Education and Information Technologies*, 6(1). 267-285.

Umay, A. (2004). İlköğretim Matematik Öğretmenleri Ve Öğretmen Adaylarının Öğretimde Bilişim Teknolojilerinin Kullanımına İlişkin Görüşleri. *Hacettepe Üniversitesi Eğitim Fakültesi Dergisi*, 26, 176-181.