

THE ATTITUDES OF THE PROSPECTIVE MATHEMATICS TEACHERS TOWARDS INSTRUCTIONAL TECHNOLOGIES AND MATERIAL DEVELOPMENT COURSE

Yrd. Doç. Dr. Sevinç Mert UYANGÖR
Department of Secondary Mathematics Education
Necatibey Faculty of Education, Balıkesir University, Balıkesir, Turkey 10100
e-mail: suyangor@hotmail.com

Öğr. Gör. Denizhan Karaca ECE
Department of Secondary Mathematics Education
Necatibey Faculty of Education, Balıkesir University, Balıkesir, Turkey 10100
e-mail: denizhan@balikesir.edu.tr

ABSTRACT

This study aims to determine the attitudes of prospective teachers of Secondary Mathematics Education toward Instructional Technologies and Material Development (ITMD) Course. The participants of this descriptive research include 44 students, who take ITMD Course at Department of Secondary Mathematics at Necatibey Faculty of Education in Balıkesir University. The questionnaire developed by researchers was conducted before and after the course at 2007-2008 fall semesters.

The accuracy of the difference in the attitudes of the prospective math teachers before and after the course was tested by t test and it was seen to be statically significant in the level of $p=0.05$. Moreover, according to results of the interviews, the prospective teachers emphasized that ITMD Course aims to provide permanent learning and to prepare materials that are appropriate to the teaching methods through an effective teaching process. At the end of the semester, the attitudes of the prospective teachers toward the course developed in a positive way. Besides, it was observed that the instructor's positive attitudes toward the course, and group works contributed both to that development and to the success of the prospective teachers in the teaching and learning activities.

Key words: Instructional technology, Material development, Mathematics education

INTRODUCTION

Learning means an individual's developing a new knowledge, skill or attitude as a result of his/her interaction with his /her knowledge and environment. Learning may happen at any time. However what concerns the educators is the purposive learning realized through instructional efforts. The way we plan the instruction has an effect both on what has been learnt and on how an individual will use the things he/she has learnt. For this reason, teaching-learning process includes selection, arrangement transferring knowledge in a proper environment and interaction between this information and the individual. Learning environment means not only the place that instruction will occur but also the methods, instruments, equipments, and materials which will be used in transferring the knowledge and guiding the works of individuals in learning process (Demirel, Yağcı, Seferoğlu, 2003).

Instructional Technology can be defined as a process including creation and organization of necessary environments to realize the learning, guiding the educators through the solutions to the problems which will come out, enabling a proper selection, arrangement and preparation of instruments, equipments.

When the studies in the field of Instructional Technology were analyzed; Hu, Clark and Ma (2003) have stated that teachers at schools are resistant to instructional technologies and one of the reasons may stem from pre service teacher trainings. Betrus and Malenda (2002) explained that in institutions where teachers are educated, prospective teachers have been given instructional technology courses for a long time, but incongruity has been observed between the things taught in this course and implementations of teachers.

Gökdaş's (1998) research has showed that in transition process of integrating technology with instructional processes, the institutions training teachers do not have enough courses and the existing courses are not directed toward that goal.

Demetriatis and et al (2003) have stated that teacher can not carry out computer assisted implementations in their professional life through they have taken courses related to computer in pre service period, and the reason of that results from the fact that courses they have had are not enough. According to results of Akdeniz and Alev (1999), teachers stressed that although they took courses about computers during their preservice education, they could not use computer supported implementations in their teaching activities. The reason is

that there are not enough courses about using computer in their university education. In the study carried out by Namlu and Ceyhan (2002), it has been said that anxiety level of prospective teachers about computer has been accumulated around middle and below it and that situation may be an indication of potential problems in their utilizing technology in their future classes.

Imer's study (2000) has stated that the number and hour of courses which are necessary for integrating technology with education in undergraduate programs at Faculties of Education in Turkey are not enough and they need to be raised. Within the framework of Instructional Technology and Material Development course, skills of developing instructional materials and utilizing the existing ones need to be acquired to prospective teachers. Generally, instructional materials are used to perform a more permanent and effective teaching by facilitating learning in teaching-learning process.

According to Akkoyunlu (2002), instructional materials motivate students, and encourage them to study lesson providing them with opportunity to have an access to information and to evaluate it. Instructional materials are a significant element in raising the quality of education. Şahin and Yıldırım (1999), have stated that some efficiently prepared instructional materials may show all activities presented by teacher (drawing attention, conveying information, cue, participation, drill and practice, providing feedback, error correction and evaluation) in teaching environment. Although instructional materials do not offer an alternative which is to replace a teacher, it serves like assistance for teachers to convey the subject to students.

Demirel (2005) states that utilization of instructional technology in teaching-learning processes provides a more effective presentation of subject, moreover, makes instruction more meaningful and enjoyable. After all, teachers should acquire the quality of technology literacy for them to offer students rich learning environments integrated with new technologies. And then, they should learn how to integrate with learning environments. These successive courses have been given compulsorily and gradually at the faculties of education training prospective teachers in Turkey. (YOK, 1998).

In the research of Gündüz and Odabaşı (2004), called "The importance of Instructional Technology and Material Development course in training prospective teachers in information area", these conclusions have been reached: today, teachers are expected both to develop skills of utilizing of technology and to integrate technology which is the requirement of contemporary education with learning environments. The aim of "ITMD" course at the faculties of education in Turkey is to enable the prospective teachers to integrate technology with their lessons. What is important here is to teach a lesson in an effective, efficient and enjoyable way. To achieve the goals of a lesson, a lesson should be carried out in a way of planned content including 2 hours of theory and 2 hours of practice. It is expected that cognitive, affective and psychomotor skills developed in prospective teachers in the course of ITMD, will help prospective teachers to integrate technology into teaching in their professional experiences, which is to assist effective and efficient functioning of our education system and contribute to educate qualified individuals.

The purpose of the research conducted by Özgen and Obay (2008) is to investigate, within the range of various variables, the attitudes of prospective teachers of secondary mathematics towards educational technology. The study took place in 2007-2008 academic year in Dicle University Faculty of Education and 162 prospective teachers attended the study. According to the results, it was determined that the attitudes of prospective teachers towards educational technology didn't change according to the sex variable, but it changed according to the class and related lesson variables. In addition to this, it was determined that prospective secondary mathematics teachers had positive attitudes towards educational technology.

The findings of Şekerci and et al (2008) establish that most students in faculties of education use information and communication technologies for learning purposes, but they also think that the use of these aids by their lecturers in the class is insufficient. The results also show that the students have a positive attitude towards the use of technology in the class, and that they especially welcome the use of the technology through which they can become more active during the lessons and have easy access to resources.

Mathematics Education & Utilizing Materials

Usage of symbols, shapes, mental images, concrete models and such kind of demonstrations in expression of concepts in mathematics, is highly significant in terms of learning process. In teaching, utilizing just one or two of these types of demonstrations and ignoring the others will not support the process of children's having the concepts of mathematics sufficiently. Providing diversity in types of demonstrations and utilizing concrete models, notably in teaching towards children, will facilitate the meaningful instruction of mathematics on a large scale.

In this respect, it is thought that material supported mathematics education will be able to concretize most of mathematical concepts for students and help them to comprehend these concepts more easily. The importance of material supported mathematics education is realized better when the studies in this area are examined: the study carried out by Öztürel (1987) and Sezer (1989) has put forward that computer supported mathematics teaching makes a significant difference on student's success in mathematics. The study conducted by Asfuroğlu (1990) on students at primary schools has indicated that material supported geometry teaching has a positive effect upon developing concepts of triangle, circle and square in students and increases their success.

The study conducted by Dündar (1997) has shown that education with supplementary materials in fourth year at primary schools has significantly enhanced the comprehension of mathematics.

The study carried out by Toluk, Olkun and Durmuş (2002) has analyzed the effects of problem oriented and visual model supported geometry teaching upon the geometrically thinking levels of pre service class teachers and has shown that there has been a significant development in the geometrically thinking levels of students. These results have shown that if the attention of students who have implemented the activities concerning the classification of quadrangles and triangles which are suitable for first and second levels, is not drawn to the relations between shapes and characteristics, students can not establish these connections themselves; besides, it has been helpful for students to establish such relations in forming their own definitions. It has been observed that dynamic models such as master ruler have been effective in student's creating those definitions. It has been provided that success in mathematics has been high when materials are utilized.

The importance of material supported education in mathematics has increased the need for well equipped and well informed teachers in this area. Arousing interest among students, teaching in accordance with their interest and wishes, showing them how to gain information and enabling them to transfer the gained knowledge to the areas necessary for them and to share them, should be the objectives of educational system.

Teachers in the system of education are thought to be the most important factors to realize those goals. Besides having enough knowledge and skills in this area, the teachers who will realized the material supported education using educational technologies, should also believe in the benefits of utilizing material in lessons and should be interested, willing towards this area and develop a positive attitude towards it. Within this context, the aim of this study is to determine the attitudes of prospective secondary school mathematics teachers towards ITMD course. It is believed that this will be able to give us an idea about prospective teacher's integrating their future lessons with technology. For this reason, in this study, the following questions and sub questions were examined;

Problem: what are the attitudes of prospective secondary school mathematics teachers toward ITMD lesson?

1. Is there any significant difference in the attitudes of prospective secondary school mathematics teachers' pre and post ITMD lesson?
2. What kinds of things affect the attitudes of prospective secondary school mathematics teachers towards ITMD lesson?

METHOD

The model of research, study group

Study group of this descriptive research consists of 44 students taking ITMD lesson at the Department of Secondary School Mathematics Teaching at Necatibey Faculty of Education at Balıkesir University.

Development of data collection instrument

First of all, the literature has been reviewed to develop a scale; but, as no scale directly related to the subject is found, a pool of items has been created from the studies concerned with similar studies by researchers. Moreover, the researchers have made use of the form of scale constituted for another course. A draft questionnaire has been prepared by arranging the attitude sentences created from the pool by taking expert's view in harmony with "likert" type of 5 degrees. Data collection means consisting of 26 items has been applied as a pilot study to 65 prospective teachers at the department of Computer Education and Instructional Technology and to 47 prospective teachers at the department of secondary school mathematics teaching who have taken ITMD course at Necatibey Faculty of Education at Balıkesir University during 2006- 2007 fall-semester. After necessary validity and reliability study has been conducted and expert's views have been taken, 8 items are omitted from the scale on the basis of findings. Moreover, Cronbach alpha reliability coefficient of the scale developed has been found 0.94.

Data Collection and Analysis

The scale developed has been applied to 44 prospective teachers at the department of secondary school mathematics teaching during 2007-2008 fall-semester pre ITMD and post ITMD and the attitudes of prospective mathematics teachers towards ITMD course has been examined. The other way to find the reason of this attitude is interview. For this aim, a form of semi-structured interview with 16 prospective teachers has been prepared by researcher. In analyzing the data obtained as a result of applying the scale, SPSS 15.0 package program has been used. As a result of the evaluation of attitude scale with the aim of answering the sub problems, the significance of difference in the attitudes of prospective teachers' pre ITMD and post ITMD course has been determined with related "t" test. With the intension of finding the reasons of attitudes, answers given to questions in interview form have been analyzed and have been presented in tables following categorization process.

RESULTS

Findings and Interpretations

Findings obtained through attitude scale and interview form are as follows:

1. Findings belonging to first sub question

Table 1 shows standard deviations and the means of score prospective secondary school mathematics teachers have made in attitude scale pre ITMD and post ITMD course.

Table 1. Comparison between Pre Attitude Scores and Post Attitude Scores of Prospective Teachers

Group	N	\bar{X}	S	t
Pre-test	44	3.55	.39	-7.83*
Post-test	44	4.12	.45	

p<0.05 significant

When Table 1 is examined, it is seen that the means of pre test and final test are high in final test's favor. Whether to accept or not to accept the difference in the attitudes of prospective mathematics teachers' pre ITMD and post ITMD course significant has been tested via "t" test and it has been understood that the difference is significant at the level of p=0.05. The elements effecting this situation have been determined through interviews and Table 2-3-4 includes the opinions of prospective teachers.

2. Findings belonging to second sub question

When the opinions of prospective teachers on the goals of subjects of ITMD course are analyzed using qualitative research techniques (Yıldırım & Şimşek 2006), it is seen that these views consist of 3 basic categories, namely, in terms of teaching methods, in terms of teaching materials and teaching element. Moreover, these categories has been divided into sub categories, namely, concretization/permanent and effective learning/organizing the course well/proper method and effective use of method/enriching the course/increasing the quality in education/drawing attention, making it attractive, effective utilization/guidelines/preparing good material/the importance of material/choosing material/material examination and in terms of subject area, in terms of profession of teaching knowledge/ in terms of knowledge on general subjects/approach to students.

Table 2. Categories and Subcategories

Basic Categories	In terms of teaching methods (TM)	In terms of teaching materials (TMA)	Lecturing/Lecturing Time (L/LT)	Instructor (I)
Subcategories	Concretizing	Effective utilization	Enough/	Subject area (SA)
	Permanent and effective learning	Guideline	Adequate	Profession of teaching knowledge (PTK)
	Organizing course well	Preparing good material	Individual activities/Group works	General knowledge (GK)
	Proper method and effective usage of method	Importance of material		Approach to student (AS)
	Enriching course	Choosing material		
	Increasing quality in education	Analyzing material		
	Drawing attention, making it attractive			

Table 3. *Teacher Candidates' Opinions about Objectives of ITMD Course Topics*

Person	Categories and Subcategories	Opinion-Quotation
2	TM - Permanent and effective learning	<i>...to make students' learning more permanent by executing education and teaching process efficiently in schools.</i>
	TM- Effective usage of method	<i>...to provide effective usage of teaching methods. ...Congruency of teaching materials to the technique of method which is used</i>
13	TMA- Effective /well material preparation	<i>...to show how to develop materials, conditions and principles of material utilization.</i>
	TM - Permanent and effective learning	<i>...will help the courses be more comprehensible</i>
15	TMA- Effective utilization /well material preparation	<i>...Thanks to this lesson, we learnt how to prepare materials and what to pay attention while preparing in order to make subjects more comprehensible.</i>
	TM – Draw attention, making interesting	<i>...We learnt what kind of materials will best support what kind of teaching methods. Consequently, more effective teaching has been provided through drawing attention and motivation.</i>
7	TM –Concretizing	<i>Concretizing in teaching is important. Aim of the lesson is to find out using what and how to make lesson concrete (at least understandable).</i>
10	TM -Concretizing/ Proper method and effective usage of method	<i>This course is very important with respect to effective usage of teaching methods. Since it concretizes teaching, it has contributions to full realization of learning.</i>
	TMA-Effective utilization	<i>Since it is the course we learn how to use teaching materials more efficiently, it guides us to what to do and how to do while teaching.</i>
18	TM - Organize lecture well/ permanent and effective learning	<i>By using material, you can organize lesson better and manage it. In order to form more permanent learning, it is necessary to create more learning-teaching situations that address to more sense organs. With the assistance of materials, it will be possible.</i>

Opinions about categories and subcategories are given at Table 3. According to Table 3, teacher candidates state that the aim of the ITMD course is providing effective education, teaching process and permanent learning and preparing materials adequate with teaching methods.

According to this result, it can be said that teacher candidates are aware of the goals which have been determined by YÖK: gaining efficiency and ability for knowledge about the content of “properties of several teaching technologies, position and usage at teaching process, development of teaching materials by using teaching technologies (slides, video, computer based lecture material)”, to know properties of some teaching technologies (their properties and restraints with respect to each other, usage areas) and to use them after finishing this course, developing new teaching materials or evaluation existing materials’ quality in order to use in the lessons Teacher candidates’ opinions about lecturing process are given at Table 4.

 Table 4. *Teacher Candidates' Opinions about Lecturing Process*

Person	Category-Subcategory	Opinion-Quotation
3	LT(Lecture Time)- Enough	<i>...In my opinion lecture time was enough</i>
	L(Lecturing)- Not boring-group Works	<i>...I did not get bored in the lesson. Lecture was done in a positive class atmosphere....Doing activities as groups resulted in production of good works since everybody did their bits perfectly.</i>
11	LT - Adequate –it can be more	<i>...In the period that we approach to profession of teaching, we can start with fresh knowledge. Number of lecture hours can be increased some more to sparing time for material preparation.</i>
	L- Student is active-group works	<i>... Lecture was entertaining because we actively engaged in lecturing process. Group Works were done rather. These works were successful in producing different alternatives.</i>

8	LT- Inadequate -Lecture hour is too much	<i>I think this course should be given at 1st semester of 4th year. Courses such as ÖPD, “Development and Learning” and ones that we responsible in KPSS should be given at 5th year. Moreover, in my opinion lecture hour is too much.</i>
19	LT-Enough L- efficient-student is active	<i>4 lecture hours in a week was appropriate. ... Since courses have given the opportunity for active and visual learning, each course was very efficient. Courses were not boring when active participation of students’ was achieved.</i>
21	LT- Can be much L- Individual activities	<i>....One more hours can be added. Sometimes we can not finish... ... Individual activities were better I think because it is hard to arrange a common time owing to being senior. Also, things that we wanted to do were not approved by our friends because they were not understood exactly. Or we had problems about division of labor. Designing and preparing materials our own was appropriate because after being a teacher we will do all these alone.</i>
22	LT- Enough L- Group works	<i>...4 lecture hours in a week gave opportunity to do both theory and application. ... As a result of working as group, different ideas came into this added diversity.</i>

In general, lecture hours were enough for teacher candidates. Besides going against to studies in literature (Betrus & Molenda 2002, İmer 2000), especially giving courses orderly may make them think in this way. For congruency, some candidates state that course can be given at previous semesters because of KPSS exam. Teacher candidates who regard lecturing process efficient state that group works in which students actively engaged were successful and they enjoyed.

Table 5. Teacher Candidates’ Opinions about Instructors

Person	Category-Subcategory	Opinion-Quotation
15	SA	<i>I think that our instructor informed us well about subject area. Now, if I use appropriate materials and try to produce different alternatives before getting ready to a lesson, this is thanks to our instructor because she opened new prospects to us.</i>
	PTK	<i>She is an idealist person that tries to her job better. Styles of address to students, shaping lecture flow etc. indicate how good teacher she is.</i>
	GK	<i>Our instructor was a source for us in general culture.</i>
	AS	<i>An instructor that close with students and has good relations.</i>
6	SA	<i>We liked course thanks to our instructor. Otherwise we would have a rough time. I think she has developed herself well in her subject area. Her profession knowledge, general culture and communication with students include no fault.</i>
	PTK	
	GK	
	AS	
17	SA	<i>Instructor is so successful thanks to her perfect lecturing. But she is a bit insufficient while interaction with whole students. Except this, her profession knowledge, subject knowledge and general culture is at appropriate level.</i>
	PTK	
	GK	
	AS	
20	SA	<i>Instructor is erudite about every subject. She was really forcing herself to lecture the course best and I think she achieved this.</i>
	PTK	<i>Instructor’s communication with students, her control in the class and her profession knowledge was appropriate. She does her job willingly and truly. Her relation with daily life could be understood from our conversations in the lessons and this was bringing up her culture level.</i>
	GK	
	AS	<i>She is well-meaning, tries to teach, helps, volunteer while solving our problems and more important, her communication was really good.</i>

After examining Table 5, it can be said that one of the important factors that affect attitude of teacher candidates toward ITMD course is properties of instructor (being expert on subject, communication with students and profession of teaching).

CONCLUSION

As a result of this study, teacher candidates' attitude toward Material Development Course has increased positively as it can be understood from the findings. As the teacher candidates state, group works, instructors' positive interest toward course, reflection of teacher candidates to their education after course have been effective for this favorable variance. Akkoyunlu (2002) found out that, preparing instructional materials motivates students and triggers their study will by supplying them opportunities to access information and evaluation, in one of his similar study.

Teacher candidates support that instructional materials makes education more effective, which can be seen in many studies. (Asfuroğlu 1990, Öztürel 1987, Toluk, Olkun, Durmuş, 2002, and Sezer 1989.). Moreover, it can be said that teacher candidates are aware of ITMD course objectives. Besides applying what they learned, they want to do more applications in much more areas via teacher training. At this work, teacher candidates who developed acquirement in ITMD course positively emphasize their wishes to get opportunities for more application via opinions below:

1. Content of the course should be developed and weekly course hours should be increased.
2. Application should be supplied in the schools in which student teachers do training.
3. More visual learning should be provided via conveying materials or studies in lessons orderly to other students.
4. At the end of the lesson, students should take pain over necessity and importance of material usage.
5. A material book that encloses whole mathematics course should be prepared.
6. Since motivation is high in lessons that materials are used, much more creative materials should be developed.

Number of class hours can be taught enough thanks to having classes orderly and disciplined. As teacher candidates state, orderly and efficient ITMD courses effect them positively and it to makes simpler usage of ITMD in the following lessons. However in the following years, having resources for materials which can be helpful while preparing and using other materials will stand in good stead. Moreover, in conjunction with technology's lightning progress, it is unavoidable that materials, prepared with the help of technological tools also, makes education and instruction more visual and more entertaining (Molenda, H. R., & Russell, J. D., Smaldino, S. E. 2002). Especially lately, it draws attention that materials, prepared in computer-aided environments, do not make students passive anymore; in stead they let students think critical; develop problem solving and communication skills. In activity based new curriculum that prepared in parallel with that, it is very important to prepare materials and integrating them into courses (Ministry of Education 2004). Because of this, knowledge and interest of teachers who are going to prepare and use these materials become fundamental. Study of Gündüz and Odabaşı (2004) supports this idea. According to Odabaşı, nowadays exhibiting technology usage skills and integrating technology to learning environments are wanted from teachers. Conducting of similar studies in other departments of Education Faculty and making necessary arrangements according to attitude and interest of teacher candidates, from each branch, to ITMD course are very important as a matter of new curriculum's and training teachers' qualities.

REFERENCES

- Akdeniz, A.R. ve Alev, N. (1999). Bilgisayar Destekli Fizik Öğretimi İçin Öğretmen Eğitimi. *4. Ulusal Eğitim Bilimleri Kongresi Bildirileri 2 Kitabı*: 172-185.
- Akkoyunlu, B. (2002). Educational Technology in Turkey: Past, Present and Future. *Educational Media International.*, Vol. 39, No 2: 165-174
- Betrus, A.K. ve Molenda, M. (2002). Historical Evolution of Instructional Technology in Teacher Education Programs. *Techtrends For Leaders in Education and Training*, Vol. 46, No 5: 18-21.
- Demetriadis, S., et al. (2003). Cultures in negotiation: teachers' acceptance/resistance attitudes considering the infusion of technology into schools. *Computers & Education*, Vol. 41, No 1: 19-37
- Demirel, Ö. (2005). *Planlamadan Değerlendirmeye Öğretme Sanatı*. Pegem A Yayıncılık., Ankara.
- Demirel, Ö., Serefoğlu, S. ve Yağcı, E., (2003). *Öğretim Teknolojileri ve Materyal Geliştirme*, (2. Baskı), Pegem A Yayıncılık, Ankara.
- Dündar, Y. (1997). İlkokullarda Matematik Eğitiminde Yardımcı Araçların Rolü, Yüksek Lisans Tezi, H.Ü. Ankara.
- Gökdaş, İ. (1998). Bilgisayar Eğitimi Öğretim Teknolojisi. *VII. Ulusal Eğitim Bilimleri Kongresi, 9-11 Eylül, Konya*.
- Gündüz, Ş., Odabaşı, F. (2004) Bilgi Çağında Öğretmen Adaylarının Eğitiminde Öğretim Teknolojileri ve Materyal Geliştirme Dersinin Önemi. *TOJET*. Retrieved October 15, 2005 (de indirildi) form the World Wide Web: <http://www.tojet.net/articles/317.htm>

- Hu, P.J., Clark, T.H.K. ve Ma, W.W. (2003). Examining technology acceptance by school teachers: a longitudinal study. *Information & Management*, Vol. 41, No 2: 227-241.
- İmer, G. (2000). *Eğitim Fakültelerinde Öğretmen Adaylarının Bilgisayara ve Bilgisayarı Eğitimde Kullanmaya Yönelik Nitelikleri*. Eskişehir, Anadolu Üniversitesi Eğitim Fakültesi Yayınları.
- MEB Komisyon (2004). *Fen ve Teknoloji 4-5 Sınıflar Dersi Programı Klavuzu*. Milli Eğitim Bakanlığı Talim ve Terbiye Kurulu Başkanlığı Fen Dersleri Özel İhtisas Komisyonu. MEB, Ankara.
- Molenda, H. R., & Russell, J. D., Smaldino, S. E. (2002) *Instructional Media and Technologies For Learning*, New Jersey: Merrill Prentice Hall.
- Namlu, A.G. ve Ceyhan, E. (2002). *Bilgisayar Kaygısı (Üniversite Öğrencileri Üzerinde Bir Çalışma)*. Eskişehir, T.C. Anadolu Üniversitesi Yayınları; No 1353.
- Öztürel, L. (1987). *Bilgisayarla Öğretimin Matematik Erişimine Etkisi*. Yüksek Lisans Tezi. Hacettepe Üniversitesi, Ankara.
- Ozgen K. ve Obay, M. (2008). *Ortaöğretim Matematik Öğretmen Adaylarının Eğitim Teknolojisine İlişkin Tutumlar*, IETC 2008, Anadolu University Faculty of Education Department of Computer Education & Instructional Technologies Eskişehir.
- Sezer, N. (1989). *Bilgisayarlı Öğretimin İlkokul 5. Sınıf Öğrencilerinin Matematik Erişimine Etkisi* Yayınlanmamış Yüksek Lisans Tezi. Hacettepe Üniversitesi, Ankara.
- Asfuroğlu, B. (1990). *Anasınıfına Devam Eden 5-6 Yaş Çocuklarına Üçgen, Daire ve Kare Kavramlarının Kazandırılması*. Çukurova Üniversitesi, Sosyal Bilimler Enstitüsü, Yayınlanmamış Yüksek Lisans Tezi, Adana.
- Şahin, T.Y. (2003). Student teacher's perceptions of instructional technology: developing materials based on a constructivist approach. *British Journal of Educational Technology*, Vol. 34, No 1: 67-74.
- Şekerci and et al (2008). *Öğretim Teknolojilerinin Eğitim Fakültelerindeki Durumu: Öğrenci Görüşleri*. IETC 2008, Anadolu University Faculty of Education Department of Computer Education & Instructional Technologies Eskişehir.
- Toluk, Z., Olkun, S., Durmuş, S. (2002). Problem Merkezli ve Görsel Modellerle Destekli Geometri Öğretiminin Hizmet Öncesi Sınıf Öğretmenlerinin Geometrik Düşünme Düzeylerine Etkisi. *V. Ulusal Fen Bilimleri Ve Matematik Eğitim Kongresi Kitapçığı*.
- Yıldırım A., Şimşek H. (2006) *Sosyal Bilimlerde Nitel Araştırma Yöntemleri*. Seçkin Yayıncılık A.Ş., Ankara
- YÖK (2003b). Bilgisayar ve Öğretim Teknolojileri Öğretmenliği Lisans Programı. Retrieved November 02, 2005 from the World Wide Web:
http://www.yok.gov.tr/egitim/ogretmen/ogretmen_yetistirme_lisans/bilgisay.doc