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EDUCATIONAL TECHNOLOGY USAGE AND NEEDS OF SCIENCE EDUCATION in TURKEY

A Dissertation APPROVED FOR THE
DEPARTMENT OF INSTRUCTIONAL LEADERSHIP & ACADEMIC OF CURRICULUM

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DEDICATION

This dissertation is dedicated to my wife and my parents. Their constant love and caring are every reason for where I am and what I am. My gratitude and my love to them are beyond words.

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ABSTRACT

The purpose of this study was to examine Turkish science teachers and pre-service teachers' attitudes towards the use of technological tools in their science lessons in Turkish colleges of education in the assist of Turkish government projects, and how science education teachers, who have earned a science education degree from western countries, influence the use technology in Turkish higher education.

The research method employed were quantitative data sources, including a technology background questionnaire, which is cross-sectional design, and qualitative historical research data sources. The study analyzed the data under a cross-section or between subjects' method with four factors: Turkish science teachers; Turkish pre-service science teachers; Turkish science teachers who have earned science degrees from western universities; and Turkish graduate students whose majors are in science education in U.S. It was anticipated that an analysis of variance (ANOVA) would be used to analyze data and "level 0.05" was established.

Major findings of the study include:

1. Science education faculty members who have earned science education degrees from western countries have a positive effect on the use of technological tools in science courses in Turkish higher education.
2. Science education faculty members who have earned science degrees from Turkish universities have a limited knowledge on the use of technological tools in science courses in Turkish higher education.
3. Science education graduate students who have been studying in science education in western countries have positive attitudes for the use of

technological tools in science courses have potential to impact Turkish higher education, when they return to Turkey.

4. Most Turkish pre-service teachers know very little about effective use of technology in education. Gender differences are apparent and females consistently indicated that they knew less and hence may not integrate technological tools in their teaching.
5. Turkish pre-service or new teachers are exposed to teacher educators that do not sufficiently model the appropriate use of computers for instructional purposes, either in courses or in field experiences. The technology that is used focuses more on older and simpler instructional applications of computer technology (e.g., computer assisted instruction, word processing) and older educational technologies (e.g., overhead projectors, calculators, slides).
6. Faculty rank in general, made little vis-à-vis technology use in knowledge.

Integrating technology into teaching and learning in Turkish education is a slow, time-consuming process that requires substantial levels of support and encouragement and requires patience and understanding. In light of efforts by the Turkish government, Turkish faculty members who earned their degrees from western universities, and graduate students earning degrees from American universities will be leaders on the long road to change.

CHAPTER I

INTRODUCTION

Turkey is located in the Asian and European continents, with a population of 67.8 million (2002 census). Because of its geographic location, Turkey acts as a bridge between Europe and Asia. The country was established in 1923 by the Turkish Grand National Assembly, after the Ottoman Empire collapsed at the end of the World War I. Turkey is the only country among Islamic countries, which has included secularism in its constitution and guarantees complete freedom of worship to non-Muslims.

The Turkish Educational system was centralized by the act of "Law of Unification of Instruction" in 1924. The Turkish Education system includes preschool, primary, secondary, and higher education and non-formal education including all the activities organized outside or alongside the school (such as cram schools, and private lessons). The Ministry of National Education (Milli Egitim Bakanligi, [MEB]) is responsible for all educational services in the country excluding higher education. The authority for the regulation of higher education is the Council of Higher Education (Yuksek Ogretim Kurulu, [YOK]), which is a fully independent national body without any political or government affiliation. Thus, the Council of Higher Education is the planning, coordinating and policy making governmental agency for Turkey. The objective of Turkish education, according to Basic Law No. 1739 for National Education, is to educate individuals who:

• adopt the values of the Turkish nation;

• know the duties and responsibilities to their country and have made them a part of

their behavior'

• can produce knowledge, can utilize the knowledge and technology produced; and

• are democratic citizens and respect human rights (Ministry of National Education, 1999).

There are 52,616 schools (11,314 preschool, 35,168 primary, 6,134 secondary) in Turkey. But, the number of schools is not adequate when compared to the number of children of school age. In the primary schools, classes average 38.6 children (Ministry of National Education, 2003), and teacher-student ratios are 1:32 for primary schools and 1:18 for secondary schools (Ministry of National Education, 2001). Primary education programs include Turkish language, Turkish literature, mathematics, social studies, science, civics and human rights, the history of the Turkish Republic and Ataturk's reforms, a foreign language (English, French, or German), individual and group activities, religious culture and ethics, art/handicraft, music, physical education, traffic safety and first aid, career guidance, and elective courses. The MEB prescribes how many hours of each subject must be taught per week at Turkish schools. The MEB also prepares students' textbooks, teachers' textbooks, worksheets, and teaching aids. Any materials to be used in schools must be approved by the Ministry.

After finishing compulsory education, all high school graduates must take the national university entrance examination called Student Selection Examination (Ogrenci Secme Sinavi [OSS]) to gain access to higher education. All institutions of higher education in Turkey have, each year since 1974, accepted students in accordance with the results of the examinations organized by the Student Selection

and Placement Center (Ogrenci Secme Yerlestirme Merkezi [OSYM]). In 1981 OSS was put into practice two-stage examination, the Student Selection Examination (OSS) and the Student Placement Examination (Ogrenci yerlestirme Sinavi [OYS]). The second stage was administered approximately two months after the first, and the high school grade-point averages of the candidates were also taken into consideration in the calculation of composite scores. In 1999, the entrance examination system was changed to a one-stage examination, named the OSS. OSS, composed of two tests, measures the candidates' verbal abilities, and the other, their quantitative abilities. The total time to take the test is three hours. A minimum score of 120 points is required for qualification to be considered for placement in the four-year undergraduate programs. Those candidates, whose composite scores are between 105 and 119 points, are offered a restricted choice of higher education programs. Those with good enough grades to be accepted by universities qualify for the four-year undergraduate programmes or two-year higher education programmes.

The number of universities and colleges available for higher education is significantly lower than the number of students who take the exam. During high school, students study after school and on weekends at "Dershane" (cram schools) to raise their scores on the OSS and other school examinations. The OSS coerces students during their three-year high school to go to a Dershane and prepare themselves for the national test. For students who wish to attend a university, the score on this test is the primary determiner of where he or she will be allowed to go for post-secondary education in Turkey. This situation places a tremendous amount of pressure on students, their families and their school. Cram schools, attended in the

evenings and on weekends, are the norm for seniors and emphasize rote learning through drills (Stevens, Sarigul & Deger, 2002).

In many Muslim countries, education is undervalued and under financed; therefore the returns from education to society are very low. However, Turkey is one Muslim country which is breaking this vicious cycle of minimal funding, output, and impact on society. In Turkey, the government's commitment to education has been increasing, funding is on the rise, and public support for the role that education can play in economical development has been becoming stronger in last decade. Like other developing countries, Turkey pays great attention to education. The majority of Turkish people believe that Turkey can catch up to other developed countries through solid education. Although Turkey has modeled its educational system on Europe's, Turkey, in fact, is still trying to become a full member in good standing of the European Union (McIsaac, Askar & Akkoyunlu, 2000). For these reasons, the Turkish government is aware of the importance of education for Turkey and the Ministry of National Education considers the educational requirements of the 21st century as a priority. Thus, the MEB has become a member of many international educational programs, projects, and associations, such as the International Association for the Evaluation of Educational Achievement in 1998; the Third International Mathematics and Science Study Repeat (TIMSS-R) for 8th graders; and, Progress in the International Reading Literacy Study for 4th graders. As a member of Organization for Economic Co-operation and Development (OECD), Turkey also takes part in the program for International Student Assessment for 9th graders (Ministry of National Education, 2003).

Primary, elementary and secondary school science education modifications and developments started in 1992. Primary school science curriculum for the first three years was taught as a combination of social and environmental sciences for four periods every week and was called life science (Ministry of National Education, 1992). The MEB and the Turkish government made a big step in August, 1997, by increasing compulsory education from five years to eight years. With the implementation of eight-year compulsory education, The Turkish education system has been completely reorganized and the primary science curriculum was revised by the MEB. Because of these reforms efforts, many Turkish teachers have been sent to the U.S., France, and the U.K. via the National Educational Project supported by the World Bank since 1993.

A focus of this project has been science education. More specifically science teachers seeking, master and Ph.D. degrees in science education, and science majors, have been sent to study science education in the U.S., France and the U.K. since 1997. Also, around the same time, many Turkish universities began to open science education departments or programs in their universities to address this new focus. Currently there are 34 science education departments or programs in Turkey, and the number of science education programs or departments continues to increase (Ministry of National Education, 2001; 2003).

On the one hand, the MEB has made great efforts in modernizing the national educational system. On the other hand, Turkey has yet to make the same efforts regarding the integration of technology into the school curriculum. Technology and science continue to play a major role in shaping our modern world and today's

nations are much more closely linked by technology than any other time in history. Because of this, modern countries are playing a major role in shaping educational systems for all the world's children. Developing countries, like Turkey, are always paying close attention to innovations in education from developed countries so they might modernize their own education system. Turkey has been influenced by the U.S. and other modern European countries, especially those in European Union (EU), as she continues to shape and to modernize her educational system, especially in the areas of learning theories, curriculum development, and educational technology.

In the U.S., national as well as state standards and benchmarks inspired by Project 2061 (American Association for the Advancement of Science, 1990) have gained wide acceptance. Scientists and educators worried that students weren't being prepared well enough to live in tomorrow's technology and science-oriented world. So the essential aim of the Science for All Americans; Project 2061 (American Association for the Advancement of Science, 1990), Benchmarks for Science Literacy (American Association for the Advancement of Science, 1994), and National Science Education Standards (National Research Council, 1996) is to help reform K-12 education nationwide so that all high-school graduates are literate in science, mathematics, and technology. Like the U.S., other western countries (the U.K., France, and Germany) started to reform their educational systems in1980's.

Within Europe, there is a diversity of responsibilities for the funding, management and evaluation of education. Although each European country has its own approach to reform, the EU is a playing big role in shaping all European countries, even non members of the EU, like Turkey. Indeed, the EU, a family of

democratic European countries committed to working together for peace and prosperity since 1950, provides many projects or programs to EU members, such as Erasmus, Socrates, Maastricht Treaty, Eurydice Education Information Network, and e-Learning: designing tomorrow's education. Many of these projects focus on the development and implementation of technology into all disciplines including science.

Like the U.S., U.K., France, and other countries in the world, parents, students, and teachers in Turkey agree that technology should be integrated as an educational tool in order for today's students to be prepared to succeed in the 21st century. In addition, technology has the potential to assist teachers in overcoming some of the obstacles they face in the classroom such as student participation and addressing the unique needs of their students.

Today in Turkey, most people believe, like many others, that computers represent a key educational technology tool available to teachers. Of course, there are many different kinds of technologies in the classroom that can be used to enhance learning. The goal is to build an understanding that overhead projectors, slides and slides shows, documentary videos as well as other mundane technology such as blackboards all represent technology. Teachers must understand that they should use the "best" technology for the situation to enhance learning – be it a blackboard or computer. There is evidence to show that technology can be useful and an advantage for learners. Usun (October 2003) indicates that "advantages of technology for learners are:

- reaching learners outside of classrooms
- using learning time efficiently
- sustaining motivation
- individualizing instruction

- providing access to information tools" (Usun, October 2003, ¶ 14).

As with other educational related reforms, Turkish government plays a significant role in the integration of technology in education. As described previously, the Turkish education system is controlled by the Turkish government and has sought assistance in improving the quality of education. Of central concern to all reform is the use of technology as a catalyst for changing schools in ways that better support the acquisition of higher-order skills by all students. Projects currently supported by the Turkish government include up-grading the extant curriculum, and instructional materials; revising student achievement tests; improving the teacher training system; and, increasing the quality and quality of research conducted in education.

Statement of the Problem

Historically, Turkey has always valued education and made efforts to establish an education system capable of providing young men and women with a broad range of knowledge and skills. However, within the current climate of Turkey, there is widespread dissatisfaction with the educational system. Government employees, teachers, educators, as well as parents have all expressed this dissatisfaction. Recognizing the need for educational reform within the current system, the leadership of the Turkish government has made significant commitments to improve the Turkish education system. As part of this change process, the Turkish government has sought assistance by sending teachers to western countries (especially United States, England, Germany, and France) in order to study and learn about innovations in education and how these innovations may improve Turkish education.

This study will examine the impact of sending teachers to western countries to study and learn about innovations in education. More specifically, this study will focus on current trends of technology implementation and use in Turkish science classes as influenced by Western education. I will examine how science teachers, who have earned a science education degree from a western country, have influenced the Turkish education system through the implementation of technology in their science classrooms. I will also examine science teachers' perceptions of technology use and how current technology is influencing the use technology in Turkish higher education.

Purpose

The purpose of this study is to investigate Turkish science teachers and preservice teachers' attitudes towards the use of technological tools in their science lessons in Turkish schools, and how science education teachers, who have earned a science education degree from western countries, influence the use technology in Turkish higher education. In light of this investigation, my hypotheses are that

7. Science education teachers who have earned science education degrees from western countries have a positive effect on the use of technological tools in science courses in Turkish higher education.
8. Science education teachers who have earned science degrees from Turkish universities have no positive effect on the use of technological tools in science courses in Turkish higher education.

9. Science education graduate students who have been studying in science education in western countries have a positive effect on the use of technological tools in science courses in Turkish higher education.

Western countries educational systems are having a direct influence on the Turkish educational system through the education of science teachers who have earned science education degrees from the U.S. and France.

Research Questions

1. What are Turkish science teachers' perceptions on using technological tools in science courses?
2. What are Turkish science education preservice teachers' perceptions on using technological tools in science courses?
3. What are the differences in perceptions on using technological tools in science courses among Turkish faculty members (who have been working in science education departments in Turkish universities), Turkish faculty members (who have earned a science education degree from western countries and have been working in Turkish universities), Turkish pre-service teachers in the Turkish universities, and master and PhD students' (who are currently studying in the western countries)?

CHAPTER II

REVIEW OF LITERATURE

Roots of the Science Education in Turkish Education System

Turkish schools have the ultimate authority and responsibility to educate children in Turkey. In the Turkish culture, there is a proverb about how parents view the role of schools: "The kid's bones are mine, but the flesh is yours." Turkish parents want schools to not only educate, but to sculpt the values of their children in ways that assist their children in becoming productive citizens for Turkey and the Turkish Government. To become an educated person was one of the highest honors in Turkish culture. Formerly, in Turkish villages, anyone with an education was highly respected. Even old people stood up out of respect when a student returned to the village with a high school diploma or, even better, a college degree. But today, this is not true because Turkish culture has been influenced by western culture and other foreign cultures (Steven, Sarigul, & Deger, 2002).

After World War I and the war of Independence of the Turks, on October 29, 1923, the Ataturk and the Grand National Assembly established the Republic of Turkey, rebuilding the remains of the collapsed Ottoman Empire. Ataturk undertook many reforms with the aim of modernizing Turkey in a short time. In his program of modernization, secular government and education played a major role. He believed that Turkish people could live in a world that makes a distinction between religious and government management. He eliminated Islamic education as the official mission of the Turkish state. He created a truly secular system in Turkey, where the large Muslim majority and the small Christian and Jewish minorities are free to practice

their faith. That perspective means that Turkey is going to be unlike any other Islamic country (Brickman, 1985). In light of this perspective, the Turkish education system was totally changed by Educational and Cultural Reforms called "Unity in Education" in 1924. The first crucial change in Turkish education was the closing of religious schools and the establishment of secularized education under the responsibility of the MEB. The second big change was the introduction and the acceptance of the Latin alphabet in 1928. Other important changes such as "The foundation of the Turkish History Institution" and, "The foundation of the Turkish Language Institution" also took place at this time. In 1929, The Turkish government made education compulsory for all children between seven and twelve years old (Akkoyunlu & Orhan, 2001; Villalta, 1991).

The Turkish education system and science education developments can be examined after 1923 in two phases, before 1960 and after 1960 (Ayas, Cepni, & Akdeniz, 1993). From 1923 to the 1960's, the Turkish education system can be seen as steady and shaped. Science teaching in secondary schools was for the selected students who wanted a career in science. Many famous foreign educators and philosophers, such as Kuhne, Dewey, and Buyse, were invited to Turkey by Ataturk (Basgoz & Wilson, 1968). Their ideas were discussed by Turkish educators, and attempts were made to implement their suggestions.

Prior to the declaration of an independent Turkey in 1923, an effort was made to catch up to "modern" western civilization during the Ottoman's rule. Basic education in the Ottoman Empire included teaching reading and writing to children and learning the basics of the Islamic religion and the Quran. In higher education,

> "Lessons were given in all branches of Islamic learning, including calligraphy, Arabic language and grammar, rhetoric and poetry, the science of reasoning such as logic, philosophy, and astronomy, and the religious science such as analysis of Quran, doctrines of the faith, the traditions of Prophet and his companions, the bases of the religious law and jurisprudence, as well as theology and ethics" (Shaw, 1977).

In the Ottoman educational system, science courses (physics, chemistry, and biology) were limited in the curriculum, and the Ottoman philosophers and educators could not follow the scientific innovations and developments in science. Some of the main reasons were language problems and the power of the Ottoman Empire at that time. Although the first university, Iznik Madrasa, was built in 1331, and the Ottoman Empire was the leader of Islam in science and Islamic science from the 14th to 17th century, after the French Revolution, the Ottoman Empire could not catch up to western civilization. In the 18th century, the French Revolution, and the economical and political changes in the European countries affected the Ottoman Empire in a positive way. The last Ottoman emperors realized this problem. Ottomans were behind in scientific innovations, and the effort to modernize their country by reforming education, the military, and technology began. Even, during the Tanzimat era (1839-1876), a Ministry of Education was established in 1857, and the Ottoman state school system was recognized. Many scientific books were translated into the Turkish language and were read in high schools and universities. Also many Turkish philosophers and scientists were sent to Europe, especially France, Germany, and England, to learn western scientific innovations and developments (Fazlioglu, 1998). Even though these types of developments in the Ottoman Empire were the first steps to reform and the modernization of the education system, the reform efforts could not

be maintained because of economical problems within the country and problems associated with World War I.

During this first phase of educational reform, there is a significant influence from John Dewey's advice and recommendations on how to improve the Turkish educational system. Dewey visited the newly established Republic of Turkey in the summer of 1924. At that time, Turkey had barely survived a brutal war for independence against Greece, Great Britain, Italy, and France. His visits to Turkey in 1924 and to Mexico in 1926 confirmed his belief in the power and necessity of education to secure revolutionary changes for the benefit of the individual, so that they would not become mere alternations in the external form of a nation's culture (Farrell, 1967).

Dewey's reform developed the idea that students working in groups on a central project related to their own interests were the key to learning. Dewey, in 1924, brought this idea to Turkey and attempted implementation within the Turkish education system. He noted, "The basic aim and purpose of schools in Turkey ought to be reform and progressive gradual development" (Dewey, 1983, p. 275). He also claimed that the mission of elementary education is related to the formation of its citizens. The ability to think scientifically must be part of modern society and the scientific sprit should go hand-in-hand with democratic communal life. Dewey pointed out that "education should be understood as a primary investment in future generations who will be responsible for fulfilling the promise of the Turkish experiment. According to Dewey, knowledge is not merely power; it is a precious capital for the modern state" (Wolf-Gazo, 1996, p. 21). Dewey felt that the Turkish

Ministry of Education should take an enlightened position to lead the Turkish education system, while the leadership over a centralized education system should take into account the education of the general public (Wolf-Gazo, 1996). According to Dewey, the big problem of all schools in Turkey is the disconnection between school studies and the real life of students. Schools have become isolated and what students have done in school has nothing to do with real life. The educational system must be viewed as a social reconstruction promoting a democratic society (Dewey, 1970; 1983; Turan, 2000). Dewey's ideas helped to guide Turkey toward becoming a modern, dynamic society. That means a revolutionary change in Turkey. Dewey's observations and recommendations for Turkey's educational institutions are still fresh and relevant today.

Turkey has been investing intensive efforts to catch up with the changes of the new age since the founding of Turkey on October 29, 1923. In 1931, the government invited Professor Albert Malche from the University of Geneva to prepare a report on Turkish university reform. Dewey's suggestions and Malche's report was used along with Ataturk's own thoughts on university reform. Following this report, the Grand National Assembly passed law 2253 in 1933 replacing the *Darülfünun* with Istanbul University, which was officially opened on November 18, 1933. Reinforced by several German-Jewish professors who came to Turkey to escape Nazi persecution, Istanbul University soon became one of the leading centers of education and research in Turkey. The objective of this reform was to raise the activities of education, training, science and research to a contemporary level. This law 2253 is accepted as

the beginning of the modern era for scientific activities and science education in Turkey.

The establishment of universities and many Research and Development institutions, especially in the fields of agriculture and forestry, was the proof of the changing face of Turkey. The established pattern of the Turkish university, based on the Continental European model, underwent a critical change in the 1950's, following the Democratic Party's rise to power. The more market-oriented new government apparently believed that manpower requirements of the growing market economy would be better met by the American university model and showed a keen interest in the expansion of the university system.

After World War II, the Turkish education system was revised again with the primary goal of increasing literacy and reaching out to everyone in the country. Although foreign educators' suggestions were applied to the education system, the science curriculum kept using textbooks as a source of science curriculum and did very little to meet regional and local needs.

In the second phase of reform, the technological competition between the west and east after World War II had a big influence on the developments of Turkish education. The most important development in the field of science and research during this period was the establishment of the Scientific and Technical Research Council of Turkey (Turkiye Bilimsel ve Teknik Arastirma Kurumu) in 1963, which guides scientific activities. The MEB of Turkey and the Turkish Scientific and Technological Research Institute (Turkiye Bilimsel ve Arastirma Kurumu [TUBITAK]) made a great effort to adapt the new science curricula from the United

States. In addition the new curricula, the Turkish government supported the reform by opening a science classroom laboratory for every secondary school, complete with supplies. Although Turkey was in the midst of change, it was not enough just to catch up with "modern" western countries (Cicek, 2000; Kiray, 1979; Kucukahmet, 1986).

There were a few reasons why these types of science curricula were not successful in Turkey. First of all, an adapted American curriculum was prepared for American students, and America was and is a more technologically advanced country. Turkish society was simply not ready for these curricula, because Turkish people were still heavily influenced by eastern culture and religion. They needed time to adjust to western scientific developments and innovations. Another reason was the political climate in the Turkish education system. During this period there was political instability in Turkey. These same problems still exist in Turkey. Changing government and education ministers every two or three years has had a profound impact on the education system for almost 50 years. Each government or education minister has promoted a new agenda and has not addressed previous governments' or ministers' unfinished attempts. Although each Turkish Government has attempted to improve science teacher preparation programs, they did not succeed because many of the solutions were simple and temporary. For example, there were not enough colleges of education in Turkey; therefore, many secondary and elementary schools had staffing problems. The solution the Turkish government implemented was to allow high schools graduates or any college graduates, who did not have educational diplomas, to become teachers without any additional education. In 1993 for the first time, some colleges of education established science education departments in order

to address the shortage of science teachers, especially in primary schools. In these schools, science was taught as a single course covering biology, physics, earth science, and chemistry (Duman & Williamson, 1996; Karagozoglu, 1991; Karagozoglu & Murray, 1988).

In the United States of America, the National Science Education Standards (National Research Council, 1996), one of the more important reforms in science education, declared that science is for everyone and its purpose is to prepare students to be scientifically literate citizens. These science education standards greatly influenced the MEB and Turkey took a big step in August, 1997 by increasing compulsory education from five years to eight years. Prior to 1997, primary education was composed of five years of primary school or elementary school; three years of middle school or junior high school; and three years of high school. The change required by Turkish Law (No: 4306 published in the Official Gazette dated 18 August 1997, numbered 23084) has the potential to be one of the greatest steps in Turkish educational reform since 1923. The MEB eliminated middle schools and moved these grades to the primary school buildings. The implementation of an eight-year compulsory primary education is part of the program for educational modernization for the 21st Century (Ministry of National Education, 2001). With the implementation of an eight-year compulsory education in 1997, the Turkish education system and education programs for primary and vocational secondary education; vocational courses; and, private schools and institutions have been reorganized. The primary curriculum for science (4th- 8th grade) was revised (Ministry of National Education, 2001; 2003) and essentially covered the universe and earth; energy and substance;

living organisms; and, our national resources. For the first time, the primary science curriculum was prepared by science educators, curriculum specialists, primary school teachers, and university science faculty. Some of the earth science concepts of the new curricula were moved to the primary science curriculum in spite of the social emphasis. The purpose of the primary science curriculum widened to include preparing students to be scientifically literate citizens who are able to use scientific facts in their daily life. In this new perspective students are to be equipped with advanced thinking; and, perception and problem solving skills; enabling them to interpret different cultures and contribute to modern civilization as well as mastering their own national culture. Prior to current reform efforts, preservice teachers' preparation methods were mostly teacher-centered in the Turkish education system. However, in recent years many Turkish teachers have been educated in and have been encouraged to use other teaching methods which have a constructivist theory base, and include inquiry and other student empowering methodologies. With the new science teacher education curriculum, 65% of all hours must be in the natural science, 11% of course hours must be in general culture, and 24% of course hours must be within their professional area of concentration, including teaching methods, measurement, educational administration, psychology, and sociology.

In addition to the changes occurring within Turkey (both curriculum and instruction) many Turkish master and doctoral students have been sent to study in modern countries via the National Educational Development Project (NEDP), which has been supported by the World Bank since 1993. Since 1997, there have been 689 students in the U.S., 76 in the U.K., 41 in France, 38 in Germany, and 1 student in

Switzerland studying education. 500 Turkish students have studied in science alone (426 in the U.S.) and 345 Turkish students have studied in the social sciences (263 in the U.S.). Currently 29 Turkish students (25 in the U.S and 4 in France) are studying in the field of science education in graduate colleges in various universities, which are ranked as top schools in their country (Yuksek Ogretim Genel Mudurlugu: Turkiyedeki Universiteler, http://yogm.meb.gov.tr/Resmiburslular.htm). Around the same time some students were being sent abroad, many Turkish universities began to open science education departments or programs. Currently, Turkey has 53 public and 24 private universities. Forty of these universities have colleges of education. Colleges of education began to open science education departments or merge biology, chemistry, and physics education departments under a single science education department due to the increased time required for compulsory education**.** Currently, 32 public universities have science education departments or programs under education colleges (Yuksek Ogretim Genel Mudurlugu: Resmi Burslular, http://yogm.meb.gov.tr/turkuniv.htm).

Technology Developments in Modern Countries

Education is a very strategic area for any country. Turkey has been examining modern countries' education policies and reforms and then blending modern countries' perspectives about education with Turkish culture and the principals of Ataturk. Basically, the US and modern European countries, especially Europe Union criteria, have been affecting Turkish education since the founding of the Republic of Turkey.

EU Requirements

The EU was founded by Belgium, the Federal Republic of Germany, France, Italy, Luxembourg and the Netherlands in 1950's. At that time, much of the co-operation between the six European countries was about trade and the economy. The enlargement of the EU started with the joining of Denmark, Ireland and the United Kingdom in 1973. Greece in 1981, Spain and Portugal in 1986, Austria, Finland and Sweden in 1995, and then ten more countries, Cyprus, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, the Slovak Republic, and Slovenia, joined in 2004. Currently Turkey, Romania, Bulgaria are candidate countries. After the joining of Denmark, Ireland and the U.K., the aim of EU broadened to include citizens' rights, job creation, regional development, and environmental protection. Education is one of the primary interests of governments in European countries, but the structures of education are significantly different both within and between countries. Basically, the purpose of EU's education politics regarding educational technology is to mobilize both the public and the private sectors in a drive to accelerate the use of multimedia technologies and the Internet for learning.

The EU has developed and supported many projects and programs which were suggested for implement by EU members' education systems. The "Eurydice" project, which is the information network on education developed in 1980 (since 1995, Eurydice has also been an integral part of Socrates), the "Introduction of New Information Technology" in 1983, and the "Educational Multimedia Software in the fields of Education and Training" in 1996, were some of the more significant projects. In light of these, two important policies were pursued. First was an "Action

Plan for Learning in the Information Society" policy, in 1996 aimed at a progressive interconnection of existing local, regional, and national networks incorporating new technologies; the stimulation of European educational effect in co-operation with multi-media producers and television broadcasters; the promotion of training and support for teachers and trainers integrating technology in teaching methods; the encouragement of widespread application of multimedia pedagogical practices; and, the forming of a critical mass of users, products and educational multimedia services (Commission of the European Communities, 1996). The second policy was outlined in a "White Paper: teaching and learning towards the learning society", in 1997 and promoted guidelines for future community activities in the field of education, and training for youth from 2000-2006. One of the main types of action related to educational technology was the incorporation of new information and communication technologies (ICT) and the development of co-operation networks (Commission of the European Communities, 2000).

These EU policies and programs influenced all members of EU. Although there is no European educational policy, the management and structure of general education is considered as a matter of national policy in the member countries. Consequently the EU Commission declared its first education program, Erasmus (European Community Action Scheme for the Mobility of University Students) in the field of higher education in 1987. Indeed, the general perspective of a nationwide European education was created with Erasmus, who is the 16th century Dutch philosopher. Erasmus believed that the objective of education was to understand and converse about the meaning of literature and has been required at many of schools.

Education should teach individuals tolerance that will produce international peace and unity by refusing to enter into religious disputes over education reformations. He also believed that the state was the best manager of educational policy (Verweij, 2001). The new Erasmus program has been incorporated under the Socrates program and is aimed at higher education institutions and their students and staff in all 25 Member States of the EU, the three countries of the European Economic Area (Iceland, Liechtenstein and Norway), and the three candidate countries (Bulgaria, Romania and Turkey). The purpose of the Socrates program, as a main European educational reform effort now, is to promote a European dimension of education and to improve its quality by encouraging co-operation between the participating countries, encourage access to education for everybody, and help people acquire recognized qualifications and skills.

Indeed, the issue of general education was not addressed until the European Union Treaty in 1992 in Maastricht. The purpose of the Maastricht Treaty is to encourage mobility of students and teachers to promote co-operation between educational establishments, to develop exchanges of information and experience on issues common to the education systems of the Member States, and to encourage the development of distance education (Phillips & Economou, 1999; Sprokereef, 1995).

Another crucial project is the Bologna Process launched in May 1998 by the "Declaration on Harmonization of the Architecture of the European Higher Education System". In June 1999, the 29 European Ministers of Education met in Bologna and proclaimed that Europe should be an area of higher education by 2010. The implementation of the Bologna Process is the introduction of the new system of study

courses based on two main cycles with Bachelor's and Master's degrees to develop a European Higher Education Area. This process provides the framework and the motivation for all members of EU to adopt their courses to European structure. All EU Ministries and Candidate Ministers started to encourage universities in the process of renewing their four year contract to structure their courses into semesters and modules enabling students to obtain credits in accordance with the European Credit Transfer System (ECTS). Students who acquire 180 credits normally over a period of three years may obtain a licence; 300 credits are necessary for the award of the masters. ECTS was used successfully under the Socrates-Erasmus (Council of the European Union-a, http://europa.eu.int/comm/education/policies/educ/bologna/bologna_en.html)

Another important projects is the "eLearning: designing tomorrow's education" project, accepted by 15 member countries of the EU in March, 2000. Its aim was to reconcile their policies in the field of educational technologies in order to develop intercultural exchange policy among students, teachers, and researchers. This was part of "eEurope Action Plan" approved in June 2000. The essential purpose of this program is the realization of a global action plan via fast internet access for students and teachers. This program will allow all the EU members and candidates to achieve new educational concepts and new educational technologies in different cultural perspectives (Commission of the European Communities, 2001). For that purpose, a large international educational portal called "education.com" was launched by Vivendi Universal Publishing in February, 2001. This portal was concurrently launched in the U.K., the U.S., Germany, and France. The essential purpose of this

portal is to reach three target populations, 0-12 year old children; their parents; and, teachers who will become the reference in education for the children and their parents (The Write News, 2001).

Learning to learn is one of the key indicators in recent EU reports on the quality of school education (European Commission, Directorate-General for Education and Culture, 2001). In light of this, European ministries realized that students and teachers need to improve their skills in the area of communication, and ICT is one way to help this happen. The EU commission report focused on how learning with ICT is changing in 13 countries and suggested that "central ministries and regional authorities should co-operate in gathering, analyzing and disseminating data, not only on inputs into systems such as pupil computer ratios, but also on process variables such as deployment and pupil/teacher access time and actual outcomes" (British Educational Communications and Technology Agency, 1998, p. 17). In light of the educational technology perspective, the EU needs an adequate output of scientific specialists in order to become the most dynamic and competitive knowledge-based economy in the world. The need for more scientific specialists is underlined by the conclusion of the Barcelona European Council in 2002. This is called the "Education and Training 2010" policy, and Ministers of education consented on three essential goals to be accomplished by 2010 for the benefit of the citizens and the EU as a whole: to improve the quality and effectiveness of EU education and training systems; to ensure that they are accessible to all; and, to open up education and training to the wider world. On the other hand, their long-term goal is "Europe should be the world leader in terms of the quality of its education and

training systems" (Council of the European Union-b, http://europa.eu.int/comm/education/policies/2010/et_2010_en.html).

Another big project, which has influenced Turkish education, is the EU-U.S. Cooperation Program in Higher Education and Vocational Education Training 2001-2005. In December 2000, the EU and the United States of America signed an agreement renewing the 1995-2000 cooperation programs on higher education and vocational training.

> "The program aims primarily at promoting understanding between the peoples of the European Community and the United States of America and improving the quality of their human resource development and only provides financial support to a group of EU and US higher learning institutions that form a consortium with the goal to achieve specific themes, such as realizing student exchanges. On account of this, only students belonging to universities selected can apply to their university to do a period of study in either US or in one of the EU Member States" (Council of the European Union-c, http://europa.eu.int/comm/education/programmes/eu-usa/index_en.html).

The EU perspective in education is that the education will be international; the studies will become modular and the degrees comparable. Briefly, some EU projects and programs are shown in Table 2.1.

Table 2.1: Some EU Projects and Programs

Mobility and co-operation between institutions:	
1984	Network of National Academic Recognition
1987	ERASMUS
1989/1990	European Community Course Credit Transfer System (ECTS)
1991	TEMPUS: Mobility scheme for Central and Eastern Europe
	LINGUA: Language Learning
	YOUTH for Europe
1995	SOCRATES I
	YOUTH for Europe II
2000	SOCRATES II
	Youth: Youth for Europe and European Voluntary Service

Table 2.1 *Continued*

New technologies, training and co-operation between education and industry:

1985	EUROTECNET: Program in the field of Vocational Training and Technological Change
1986	COMETT: Program on cooperation between Universities and Enterprises regarding Training in the Field of Technology
1995	LEONARDO DA VINCI-I: Force, Petra, Eurotecnet, Lingua
2000	LEONARDO DA VINCI-II

Information on education and training:

1981 EURYDICE: The Education Information Network

2000/2006 SOCRATES:

- ERASMUS; Higher Education
- COMENIUS; School Education
- GRUNDTVIG; Adult education and other educational policy
- LINGUA; Language teaching and learning
- MINERVA; Information and communication technologies
- Observation and Innovations; Educational systems and policies (Arion, Naric, Eurydice)
- Joint Actions; with other Community programs

National Policies

Many European countries education can be described as highly centralized and regulated by their Ministries of Education. This mechanism means detailed national curriculum; financial assistance, and regulations of recourses, organizations, and staffing; and, the control of work in education. The changes in this mechanism are formulated and elaborated by politics. But every European country has its own political perspectives. In an international conference on "Intelligent Computer and Communications Technology: Teaching and Learning for the 21st Century", in 1999 at University of Exeter, England, 17 countries' scientists, philosophers, and educators stated that one of the main branches relating to the role of educational technology in education is the effect of the rapid development of educational technology upon educational policy (La Velle & Nichol, 2000). Educational technology called "Information and Communications Technology (ICT)" in Europe is separated into

two opposing views: the paternalist view and the libertarian view. The paternalist view is the interventionist. The aim of the schooling is to prepare for the nation's economic success. Thus, all teachers have to be trained to teach students for this purpose. The aim of libertarians is to create opportunities to make a more individualistic culture through high-technology. The aim of schooling is to prepare the student to be an intelligent consumer and flexible worker. Although it is hard to categorize this viewpoint, it generally represents left or right-wing radical governments (Conlon, 2000).

ICT implementation in primary schools in the U.K. started around 1982. In the 1990's, there were many changes in education. These changes, new learning approaches, implementation of ICT, restructuring of the curriculum, satisfied the politicians and schools inspectors in the U.K. One aspect of the modernization efforts are new communications technologies and the implementation of educational technologies in the U.K. schools. Although the modernization in education took place after World War II and the 1950's, the new modernization project, called Centralization, was started by Labor governments in 1997 in the U.K. The U.K. governments of 1979-97 legislated centralized education as it created the conditions for students to be able to succeed in capitalist world (libertarian way). But Labor governments totally changed the U.K. educational policy. The main point of Centralization project was to present equalities in resources, opportunities and choices of provision, and underlying social justice and hierarchies in teachers, students, and educational institutions (paternalist way) (Ozga, 2002).

The current Prime Minister Tony Blair said "technology has revolutionized the way we work as it is now set to transform education. Children cannot be effective in tomorrow's world if they are trained in yesterday's skills" (Department for Education and Employment, 1997, p. 1). In light of Blair's perspective, the National Grid for Learning, involving the connection of every school and college to the Internet by 2002, and the New Opportunities Fund, training in ICT for teachers and librarians (Department for Education and Employment, 1997; Tupling, 2002), was educational projects implemented in the UK. These projects aimed to plan teacher training and provide laptop computers for senior teachers and desktop computers for classroom teachers. Department for Education and Employment (1999) declared that the ratio of pupils to computer in primary education was 107 students per computer in 1985, 25 students per computer by 1993, and around 13 students per computer in 1998 (Selwyn & Bullon, 2000). Office for Standards in Education (2001) reported that "while effective use of ICT in teaching subjects across the curriculum is increasing, good practice remains uncommon" (pp. 11).

The Minister of Youth, Education and Research of France designated in 2002, identified ten important priorities for action in French education. One of them was bringing about decentralization and improving teachers' qualifications with technology training and integrating educational technology into French curriculums. French educators believed that to increase the use of ICT in schools means a change in teachers' roles. Teachers must be able to combine collaborative work with the new technology being introduced to schools. Since 2000, ICT has been integrated in the curriculum at all levels and all subjects. The use of ICT in new programs has two

main objectives, preparing pupils for the information society and applying these technologies, and the process of learning. New initiatives, such as the multidisciplinary work at middle schools, the supervised personal projects (TPE) at secondary schools, and Electronic Knowledge Base (formerly the ENEE), in August 2001 (which is entering its initial development stage), give students a good opportunity to gain ICT knowledge. The SDTICE 2004-2006 Action Plan (Sub-Directorate of Information and Communication Technology in Education) is one of the current ICT projects, which have been grouped into 6 programs; basics and services; Incentives for the production of digital content for teaching in schools and higher education; Technologies in education: ICT uses; Training and support; Quality (awareness, evaluation and promotion, and the project "Moving Towards Change"; and, Youth and families. In September 2004, the Minister for Education, Francois Fillon, declared the newest ICT program, called "Students Laptop Program", which is addressing students' engagement in higher education (Ministry of Education, Higher Education and Research Technology Directorate, http://www.educnet.education.fr/eng).

In Germany, the role of the Ministries of Education and Cultural Affairs is to determine with regional (Länder) policies regarding ICT in the creation of particular conditions. In every federal state, schools and ministries are supported by their own regional institutes. The BLK (Bund- und Länderkommission) model project started in the mid-eighties, and was updated in spring 2000. It dealt with language-supported computer control, with a particular emphasis on the fields of motor control and vision. Since 1996, all federal states agreed the "Linking Schools to the Net" project,

has gradually provided access to the internet for all schools. The basis of integration of ICT into curriculum in Germany has been provided by projects, such as "Schulen ans Netz" of the Bundesministeriums fur Bildung und Forschung (BMBF), where many schools were able to procure modern computers and peripheral equipment. In the meantime, almost all schools were networked free of charge and have free access to Internet. In addition, regional and national promotions assist schools in the initial purchase and expansion of their integration of ICT. However, implementation of ICT in Germany is in a slow period and schools must attempt to find sponsors to provide them with financial and material support (Seeber & Weininger, 2001).

The current educational projects in other European countries have been examined by the Turkish Ministry of Education. The Swedish government declared "Farila Project" (1990) was one of the most effective within the Swedish education system. In this project, classrooms will be replaced with open areas and traditional teaching style replaced with a more collaborative learning style and all students will have access to a personal portable computer. Within this project, students spent 16% percent of the time studying with their teachers (reduced almost 42% percent) in 1995. Students had low grades in one of the schools in 1993, with the effect of this project they raised their grades and had the highest grades in 2000 (KNUT, 2000). Other projects include "Tools for Learning A National Programme for ICT in Schools in 1997" which became the "National Action Programme 1999-2001" (Ministry of Education and Science, 1998) and ELOIS (Students, Teachers and Organizations around Information Technology in School) sponsored by the Swedish National Agency of Education in 2000. The importance of these projects was their focus on

teaching with technology, rather than teaching about technology. After these projects, all subjects started to integrate the use of computers as a tool where appropriate. ICT started to be seen as a powerful tool.

In Spain, after the Franco's dictatorship, the newly democratic Spain decided to abolish the traditional elitist system of education and implement a comprehensive school system modeled after the Swedish system. Spain embarked on the reform of their educational system led by the Socialist party which implemented the new law of education, "Ley Organica de Ordenacion General Del Sistema Educativo (LOGSE)". The principle of decentralization was pursed as a key reform to enable the transformation of Spain from centralist to a strongly decentralized state. Decentralization has given more freedom to educational centers to set the curriculum in context and design its delivery because there is greater effectiveness in the administration of educational resources, including materials, technology, personnel, and financial resources. Thus, the Ministry of Education is now not sufficiently active in coordinating those matters (Beach, 2003; Lundahl, 2002; Pereyra, 2002).

Finland's most recent national plan called "Education, Training, and Research in the Information Society: A National Strategy for 2000-2004" (Finish Ministry of Education, 1999) is aimed at implementing educational technology in order to reshape the role of learning within and outside the school system. The Irish government declared that "Schools IT 2000, A Policy Framework for the New Millennium" project is the introduction of curriculum innovations to enhance learning through the use of ICT in the classroom (Online Access to Services, Information and Support, http://www.oasis.gov.ie/education/primary_education/schools_IT.html), and

was developed by cooperating with National Council for Curriculum and Assessment (NCCA), which is the body responsible for advising the Minister for Education on curriculum and assessment procedures for primary and secondary level education, in 1998. According to NCCA, all students should use ICTs in relevant curriculum contexts (National Council for Curriculum and Assessment, 1998).

Studies about Educational Technology in the Europe

There are numerous studies done in Europe in the last two decades regarding ICT. An international survey in 1985, questioned 300 students by country (50% girls and 50% boys, 12-14 years old) about their attitude toward technological concepts. Results showed that students have a rather positive attitude towards technology. Gender was significant, with girls having a more negative attitude than boys. In the concept questionnaire, students did not draw links between technology and society. There were many students who separated technology and science. Students preferred to strongly to associate skill, manual work and technology (Correard, 2001). The same survey was used in 1997/1998. The results showed that globally, students from the three countries surveyed show a real interest for technology. Seventy nine percent of English students, seventy percent of French students, and fifty two percent of the Netherlander students answered "I would want to know more about computers". However, in other countries, technological and professional education has a negative image because they are often associated with lower ability. Another question which was related to the students' views on the economic, social, and political effects of technology and showed that generally students thought technology contributes to success and its simplifies daily life. But 60% of French and 70% of Netherlanders

asserted that technology is the cause of unemployment, and 50% of French and 45 % of Netherlanders believed it increased pollution. On the other hand, 70% English, 65% French students stated that it is easy to use a computer. Gender differences were reversed in the 1997-1998 survey. Girls had a much more positive attitude than boys. Eighty percent of the students agreed that girls are completely capable of using computers. The difference between these two studies is just 12 years. But 12 years later students still show a positive attitude towards technology, and even more positive attitudes regarding computers as an educational tool (Correard, 2001).

Smeets and Mooij (2001) conducted another international survey about teaching-learning characteristics and the role of the teacher in ICT learning environments in 25 primary and secondary schools in five European countries. The results showed that ICT was used to help in traditional ways of teaching and pupil-centered ICT learning environment required a shift from traditional practice in many classrooms in order to integrate ICT. In ICT integrated pupil-centered learning environments, students are much more successful than others and teachers should become facilitators.

Selwyn and Bullon examined 267 primary children's use of ICT both in school and at home and found that although the majority of children use computers in school, and have positive attitudes towards ICT, the engagement with ICT as an educational use is not enough. Moreover, the number of children who accessed technology in their out-of-school lives varied in Wales (Selwyn & Bullon, 2000).

Williams, Coles, Wilson, Richardson, and Tuson (2000) surveyed Scottish teachers' thoughts about ICT. They found that teachers are still in the early stage of

ICT development. To be skilled and knowledgeable is a key in being effective in the implementation of ICT in teaching and learning. They found that Scottish teachers are motivated and interested in developing their own skills and knowledge.

In a survey conducted by the Reading Partnership and Book marketing (2000), 9% British children claimed to use electronic media sources exclusively. Even at the age of five, 15% of children were using the Internet or CD-ROMs and by the time they were 15, this figure had risen to 58% (McNicole, Nankivell, & Ghelani, 2002).

Tearle (2003) addressed the question of why some schools have managed to introduce widespread use of ICT into teaching and learning across the curriculum, where other schools have had much less success in the UK schools. She found that ICT was not seen as a tool for learning and schools which have had much less success could not realize the potential roles of ICT as a catalyst for social and educational change because the learning culture and vision of organization cannot be seen as whole in these schools.

U.S.

In the early 1900s, the American education had a meritocracy movement that education and educational phenomena could best be studied through the use of current scientific paradigms. Moreover, this ideology suggested that human intelligence itself could be effectively measured through the use of scientific techniques. At that time, there were limited technological tools (blackboards, desks, pencils, notebooks, basic mathematical tools) used in American schools.

By the early 1900s, many important technological inventions, such as telephones, electrical lighting, automobiles, had occurred. Electricity especially

opened a huge door in education. Teachers were able to give their lectures at night, even though many students worked at night. By the 1950s, photography, photojournalism, sound motion pictures, and radio firmly established American educational traditions. These inventions were very useful for education, because, in the 1920s and 1930s, industries were successful in convincing the educational community that film and radio were especially capable of shaping public morality, improving educational teaching perspectives, and firmly entrenching American educational goals. However, these new technologies did not turn educators away from print-based cultures (Engle, 2001). Print-based culture started with the invention of the Gutenberg press in 1492. Steinberg (1961) asserted, "The history of printing is an integral part of the general history of civilization" (p. 89). By many educational historians' accounts, the importance of the printing process is clearly confirmed in the many stages of education in the United States. American education was negatively influenced by World War II. Business interests, the scientific community, and military leaders criticized the American education system in the 1940s and 1950s. In 1958, Congress passed the National Defense of Education Act, in hopes of reconstructing the indifference of American schools towards the declining scientific and technological progress in education caused by financially driven factory-style schools. By the 1960's, network television was adopted into the U.S. life. Two-thirds of Americans reported that most of their information about the world was being gained via television. But many researchers and educators realized that the rise of the television within society left education in a poor position.

By the 1970's, science teachers began to use the overhead projector as a technological tool , which enabled them shows to diagrams, charts, or figures and more clearly indicate the analysis of a topic, through pictures. This device has now become a common type of technology used in the classroom. Slides, slide shows, and documentary videos are also very useful technological tools for teachers.

Clearly, the most important invention is the computer and now the most popular tool. Konrad Zuse invented the first computer in 1936 but it was not used until World War II in public. In addition, computer did not enter the classroom until after the 1980's. In the last decade, we have seen an explosion in computer use in education. A Nation at Risk (The United States Department of Education, National Commission On Excellence in Education**,** 1983) cited computer competence as a fourth basic skill that was both an important and empowering experience in the world in which we live. Accordingly, computer skills are needed for both formal educations as well as for one's individual life experiences (Gilder, 1993). Currently, three major national projects are underway in the United States that are designed to restructure science education and develop scientific literacy. Project 2061 (American Association for the Advancement of Science, 1994), the National Science Education Standards (National Research Council, 1996), and National Educational Technology Standards (International Society for Technology in Education, 2002) emphasize how important educational technology is and the importance of an increased awareness and interest in science for students and average citizens. According to The Office of Technology Assessment, in 1988, 95% of all American schools had one or more computers (Mistler-Jackson & Songer, 2000). There is no doubt that an increasing trend of

technology use in the U.S. educational system is occurring, especially since computers can collect, display , and summarize evidence, as a part of students experiences in science. Computers are starting to be seen as the most important tool to improve student learning (Pedersen & Totten, 2001).

Studies about Educational Technology in the U.S.

If technology is to become an integral part of K-12 and higher education, then it must also become an essential part of instructional tools and teacher preparation programs. Although educators know how important and useful technological tools are in the classroom, they still lack technology efficiency in science classes. Davis and Falba (2002) stated that traditionally, technology has not been central to the teacher preparation experience in most colleges of education. Similarly, Pedersen and Yerrick (2000) reached the same conclusion in that; inadequate preparation of technology continues to be problem. Many teachers need training and support in the use of new methods and new media, in their research. According to Czerniak and Lumpe (1995), only 16% of teachers reported using technology almost everyday and 28% reported using it several times a week. Most frequently, teachers are using technology for communication such as email (Frank & Zhao, 2003). Odom, Settlage and Pedersen (2002) found almost the same results showing small differences for telecommunication and word processing. These results would indicate that our teachers know enough information about using technology in telecommunication and word processing but they need broader understanding of how to use technology for teaching concepts.

In spite of this, the trend of using technology in schools is rapidly increasing. Brownell, Haney, and Sternberg (1997) stated that 77 percent of the teachers and building administrators have a positive attitude toward classroom technology. Odom, Settlage and Pedersen (2002) concluded "the varieties of technology that could potentially be incorporated into science instruction and teacher preparation seem to be increasing at rapid rate" in (p.397). In traditional education, science teachers rely on textbooks almost exclusively and generally a single textbook guides their curriculum (Pedersen & Totten, 2001). Simon (2001) explains clearly why technology integration is important in students learning. He created a web page with students' contributions. The course web site included many useful learning tools such as, sample problems, lecture notes, glossaries, assignments, test results, and graphics. His students stated the course web site was better than using the textbook. According to the studies conducted by Iding, Crosby, and Speitel (2002), and Rizza (2000), pre-service teachers who use computers for their own personal use were at least moderately proficient with computers, and had access to computers at schools and in individual classrooms. Also Beyerbach, Walsh, & Vannatta (2001) reported similar results for teachers who were interested in learning more about using computers and technology for instructional and educational purposes.

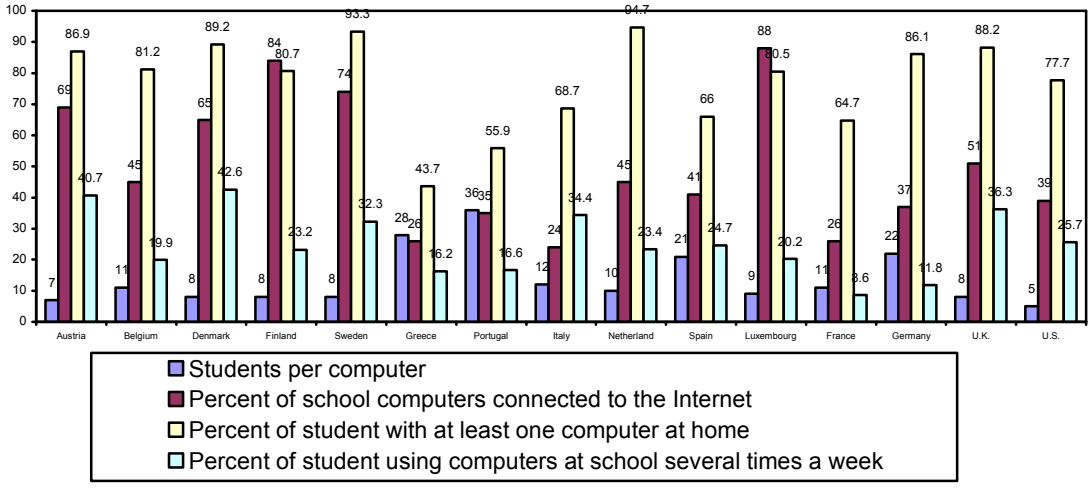
There are also negative perspectives regarding the use of technology in schools. An extensive amount of research conducted to investigate teachers' experiences about the use of technology in their instruction suggest that the majority of teachers do not feel well prepared to integrate technology into their teaching because of time that it takes to learn, plan, and implement educational technology.

Zammit (1992) found that a major obstacle to successful technology integration was the lack of teacher confidence and skill when using technology. The main problem, according to many teachers and educators, is a severe lack of resources, such as software, laptop and desktop computers, connections from the computer to the TV, digital cameras, and funding (Simon, 2001). Driscoll (2001) reviewed previous surveys and studies about technology integration by teachers and concluded that there was little consistency or consensus among groups in defining how technology was utilized in schools. In some cases, participants stated that technology could be used to enhance learning, but the majority of the subjects tended to refer to technical aspects of technology. Hannafin and Savenye (1993) listed some research-based possible explanations why teachers are hesitant to use computers. These reasons consisted of poorly designed software, doubt that computers improve learning outcomes, resentment of the computer as a competitor for student's attention, unsupportive administrators, increased time and effort required of the teacher, fear of losing control of center stage, and fear of looking stupid in front of the class. They stated that the interactive nature of the computer and its capacity to enable student-centered exploration require a fundamental shift in the role of the teacher. The teacher can no longer be an active giver of information to relatively passive learners. They pointed out that terms like manager of information, coach, guide, organizer, initiator, and diagnostician appear in the literature to define the technology-oriented teacher's new role.

The world is changing. The trends towards globalization, flexible capitalism, individualism seem to be unstoppable and educational technology has the potential to

totally change our schools. Distance education is becoming one of the ways in which education is being re-conceptualized for adult teaching and learning both in Europe and the US. The adoption and assimilation of educational technology relates to five factors: economy, effectiveness, efficiency, speed of access to data, and the pleasure it gives compared to non-ICT provision. All these five factors are closely connected to the situation, role, and identity of the European countries and the U.S. perspectives (La Velle & Nichol, 2000). Public acceptance of educational technologies stimulates and facilitates the use of educational technologies in schools and homes. The global perspective of using educational technology in schools will lead to massive teacher training, professional development and reform of primary and secondary education. The impact of educational reforms, distance education, and innovation of new educational technologies will lead with increased sensitivity toward the student, as education and training will become more dependent upon technology.

Table 2.2: Educational Statistics in Europe and the US.



SOURCES: OECD (Organization for Economic Cooperation and Development). "Education at a Glance: OECD Indicators 2002" (for students per computer). OECD-PISA (Program for International Student Assessment) Student Survey, 2000 (For other statistics). Note: These statistics represent schools where 15-year-olds were enrolled.

Technology Developments in Turkish Education and Effect of Turkish Government

In Turkey, the Minister of National Education (Milli Egitim Bakanligi, [MEB]) has power to help and to control effective use of the technology in education institutions of all levels and types. The government has sought assistance to introduce a number of projects aimed at improving the quality of education. These projects include up-grading the curricula and instructional materials, revising student achievement tests, improving the teacher training system, and increasing the research component in education.

All kinds of tools which teachers are able to use in the classroom to enhance learning are considered technology. Computers, overhead projectors, slides and slides shows, documentary videos as well as mundane technology such as blackboards are all considered technology. In the 1930's, maps, laboratory equipments and film strip projectors were some of the innovative technological teaching materials for instructional use in Turkish schools. Mostly printed instructional materials were used in the schools until the 1940's. In 1961, the Teaching Material Center was founded in Ankara. The Center of Educational Radio was founded in 1962 and radio programs were prepared for students (Alkan, 1998). Between 1950 and 1970, schools, generally used audio cassettes and overhead projectors (Hizal, 1991). However, electronic technology began with the integration of television in 1970's.

Many educators and scientists believed that television could be a very useful educational tool. A number of factors were given as to why television was believed to be useful. But, visual and audio assistance that led to more effective use of

instructional television in the science classroom was primary reason educators supported the use of television. In televised teaching, visual and audio signals are used simultaneously to transmit information and make this technology one of the most effective instruments of the instructional process (Crum, 1971; Saglik & Ozturk, January 2001).

Network television broadcasting started in the beginning of the 1970's, and in 1974, Turkey's first educational television project was developed at the Eskisehir Academy of Economic and Commercial Sciences. The success of this small educational project showed that the instruction of technologies could be used for educational purposes (McIsaac, Murphy, & Demiray, 1988). Around that time in the Turkish schools, television was used for foreign language instruction. The main objective was to support students in learning English, German, and French.

When distance education was introduced to Turkish higher education in 1974, the Turkish educational system adopted a new perspective of educational life for the Turkish people. Television and radio broadcasts were formulated, serving as a supplement to the printed materials in Anadolu University's Open educational college which was founded in 1982. Various universities' faculties worked on television and radio programs. Since then, the Anadolu University's Open educational program has been offering distance education programs to all high school graduates who could not attend conventional universities. The MEB still supports distance education, such as the educational radio program started by Turkish Radio and Television (T.R.T.), and the open lycée program for people who can not attend conventional schools or leave school early. As well, many big universities started to offer graduate programs

planned at educating professionals in the field of educational technology (Demiray & McIsaac, 1995; Usun, 2003a).

In the 1980's, the MEB began to integrate computers into schools. This declaration was the most expensive and largest educational project in the history of Turkey. The target was one million microcomputers for all schools in the next decade and this project cost approximately 600 million U.S. dollars (Fidan, 1988). In 1984, the MEB organized 48 educating programs and 2,240 teachers were educated in computer literacy and programming with the aim of educating more teachers. However, the first Computer-Aided Education (CAE) project faced three critical obstacles. First, the available software had not yet been integrated with the curriculum. Next, there was a severe shortage of suitably trained teachers. As a result of these limitations, the hardware could not be used as originally intended. Finally, a number of the potential vendors dropped out complaining of excessive bureaucracy. Although program implementation was continuing, it was at a reduced level (less than 40% of the target level) and with significantly reduced expectations (Yedekcioglu, 1996).

In the 1985, the MEB started a pilot study for the use of computers. This project was called "Computer Assisted Instruction" (CAI). At the beginning of the project, 1100 microcomputers were purchased by the government and those computers were given to 121 secondary schools for computer education at a ratio of one computer to one teacher or one computer to ten students. During the following years, vocational and secondary schools were provided with 2400 more computers. As a result of the CAI project, computers were in place in order for them to be used

as an instructional media aid for educating students. However, teachers were not knowledgeable about how to use the computers, so the computers were not used effectively. After realizing this fact, the MEB started to revise this project and instructors received computer use instructions (Metargem. (1991).

The Ministry of Education offered a new training project, called "Formator Teacher" training and used a train the trainer model to wider the impact after 1985 as part of the project. The goal of this project was to train in-service teachers as computer teachers (Akkoyunlu & Orhan, 2001). However, this project could not train enough computer teachers for the Turkish educational system and many universities and technical colleges opened computer-teaching departments that taught computer teachers the system and offered "Computer" and "Instructional Technologies and Materials Development" courses. These courses were part of the compulsory teaching certificate courses in all teacher education departments. The Higher Education Council reported that:

> Courses the teacher candidates are required to take will assist students in becoming familiar with and capable of using technologies such as computers, the Internet, multimedia, television, video, and projection equipment. Thus, it is anticipated the future teachers will to know the technology and apply it efficiently in instructional settings (Akkoyunlu & Orhan, 2001, p.30).

Beginning with the 1987-88 academic years, the MEB began to offer televised summer courses, as another pilot study, in the high schools of Denizli for students who did not or could not progress in the regular school year. Barkan and Demiray (1990) state that "Research findings indicate that with the help of television, students' learning of new concepts is improved about 30%, their attention about 35% and their perseverance about 50%" (p. 5). Before integrating television, a traditional teaching

method that has dominated Turkish education has to be dropped out from Turkish Education system. In the traditional teaching method, teacher's lectures were the primary means of transmitting new information. The use of television offered the potential of showing the student rather than just telling the student. It needs to be pointed out that the use of television as an instructional tool was not intended to replacing the teacher, but rather used as an instructional tool to enhance learning. Television just brought the world to the classroom, as had motion pictures to the people of Turkey in previous decade.

In 1989, the MEB invited private computer companies to work together for integration of computers into teaching and Turkish classrooms. With the financial support of the World Bank a project called "Computer-based Education" (CBE) was developed. Nine computer companies and the MEB signed a cooperative agreement to start this project. More than 750 teachers were trained from various Turkish schools and in 1991, more than 6,500 computers were distributed to 2,400 schools. As a result of his project, computers were not only being put into schools, but teachers were being educated on how to know them as well (Askar & Akkoyunlu, 1994).

In 1992, the MEB with the financial support of the World Bank initiated another project named Computer Experimental Schools (CES). In the CES project, 53 schools located in different regions of Turkey were to use specially equipped facilities for teaching and learning. It was also expected that a computer-mediated communication network linking these schools would provide a technological and pedagogical edge. This project was running under the control of MEB, Directorate of

Information Technology in Education. The initial aims of the Department of Information Technology in Education were to evaluate, maintain, curriculum, and training (Ozar & Askar, 1997). In order to achieve these goals, CES schools had Local Area Networks (LAN), a wide area network (WAN) connection and network based user interface software developed. With the installation of 53 schools equipment, each school had basic equipment and software to participate in a computer-mediated communications network (CMCN). CES project was a major step for the country to leap to the informatics society. The ultimate goal was to increase the interaction among schools through services like e-mail and computer conferencing, as well as provide access to online databases and electronic bulletin boards. Since the CES Project was formulated, progress has been made and it is expected that more success will be achieved in the coming years. One significant achievement is that citizens and communities have welcomed the use of technology in the schools. Ordinary Turkish citizens have had the opportunity to use computers for the first time. CES has demonstrated that information technology is a powerful tool in the teaching-learning process. This project is like a messenger giving good news for Turks and for their future education. The number of CES schools across the country was 182 in 1999 (Akkoyunlu & Orhan, 2001; Asan, 2002; Schware & Jaramillo, 2000; Yedekcioglu, 1996). Another project was Basic Education Pilot Project (BEPP) which was jointly designed and implemented by the MEB and UNICEF in 1996. CES and BEPP projects were managed together. The ultimate goal of the Basic Education Pilot Project was to realize the vision of meeting the basic learning needs of all children in Turkey. Student activity books and teachers guides books, as stated in the

BEPP monitoring indicators, and educational aids kits like globe, maps, encyclopedias, ruler's, notebooks, pencils, crayons, paints distributed to all 276 Basic Education Pilot Project schools. The MEB intended under the Basic Education Program that all basic education age students have access to computers in the learning process (Turkiye Cumhuriyeti Basbakanlik Devlet Istatistik Enstitusu [Republic of Turkey, Prime Ministry State Institute of Statistics], October, 1998) in order to attain computer literacy, support and enhance access to existing curricula and open the computer laboratories to the local community as a technology-intensive learning environment (Asan, 2002).

In 1992, the Computer-Mediated Distance Education (CMDE) project was developed between The Turkish Open University and several American universities, including the University of New Mexico, the University of Oklahoma, SUNY University, Florida State University, Arizona State University, and University of Wyoming. This project, using the Internet connection among six universities, provided an opportunity for Turkish students to practice their English skills with American students; make new friends around the world; gain access to new information; and, share their traditional classroom information with foreign friends. This project was the first step for Turkish educators to communicate with foreign universities and learn more about new instructional techniques, and methodologies and the integration of educational technology.

Within Turkey, there is a tendency toward web-based instruction programs in most open universities and other educational institutions. Some already have started to offer on-line degrees or certificate programs. For example, since 1998 Anadolu

University has provided on-line self-test opportunities for its distance learners. Anadolu University has also been trying to offer on-line alternative courses for its on-campus students, because of how flexible, effective, efficient, and appealing it is to the students. They have also established a foundation for a "virtual" university in 1998. Although the Higher Education Council's aim was to establish a virtual university in Turkey during to 2000-2001 academic years and several courses were offered on-line, sufficient data was not available regarding the effectiveness or appeal of these courses. As with Anadolu University, some other Turkish universities are opening on-line certificate and degree programs. The Middle East Technical University, for example, has several on-line certificate programs on information technology, English language, and computer skills. Like Middle East Technical University, Bilgi University (both private institutions) has been providing on-line degree program called e-MBA for almost three years. In 1996, Bilkent University and, in 2000, Istanbul University constructed a system for video-conferencing (McIsaac, 1992; Usun, July 2003a) that extend their possibilities for on-line or distance education.

Another project, Cognitive Technologies for Problem Solving and Learning, abbreviated "COG-TECH Network" and funded by the European Commission consisted of three international projects, MED-CAMPUS Project B-359 in 1993, MED-CAMPUS Project C-359 in 1995, and INCO Project 973367 in 1998-2001. The goal of these projects was to foster collaboration in the field of information technologies in education among European and Mediterranean countries, including Turkey. United Nations Educational, Scientific and Cultural Organization (UNESCO)

claimed that "The main purpose of these projects was to train teacher educators in the teacher education institutions of the Mediterranean countries to use computers as effective pedagogical tools" (UNESCO Institute for Information Technologies in Education, p. 22). The project consisted of three summer schools and six workshops that were organized in Turkey and Jordan. 110 educators from 16 countries enrolled in the summer schools and 140 teachers attended the training workshops. It was expected that these experiences would improve the teaching and learning environments and the participant would be pioneers in their own institutions by creating a community of practitioners that would acquire the skills to successfully integrate information and communication technologies (ICT). Further, it was expressed that through this project students should achieve knowledge and skills, be able to self-direct their learning under teachers' guidance, cooperate with peers to become life-long learners, and solve problems collaboratively using information and communication technologies. The evaluation of the three projects has shown that knowledge and skills were acquired during the training activities and ICT has successfully been integrated into teaching in Turkey (Orhun, July 2003).

Educational uses of the internet in Turkey are still in the infancy period. There have been a few attempts to integrate the Internet into K-12 schools and higher education institutions. In the 1990's, the first computer network connection in Turkey was established. During the first six years, several universities were dominated the use of this tool. However, since 1996, the Internet in Turkey has touched almost all sectors of life including banking, the military, education, and health professions. Although there have been many attempts to integrate the Internet into Turkish

primary and secondary school curricula since the mid-1990's, almost all of them have failed to slow working, highly bureaucratic and centralized organization of the MEB. Meriwether briefly explained how important Internet use could be for Turkish primary and secondary school students at the Turkish Second International Distance Education symposium in 1998. Meriwether said that the Internet is the greatest tool at this time for Turkish primary and secondary school students to learn both required knowledge and personal responsibility for Turkish democracy (Meriwether, 1998). Using the Internet for learning supports collaboration and cooperation between students and the Turkish government should develop such a policy for internet use that focus on students, school staff and internet providers (province/nation). Even though such a policy was suggested for the Turkish educational system, only a few private schools and institutions allowed their students to use the Internet to communicate with foreign peers or conduct searches for information related to their homework. The rest of schools focused only on preparing students for the National Student Selection Examination (OSS) to be able to attend college (Aydin & McIsaac, 2004).

After increasing basic education from five years to eight years in 1997, the MEB started to establish computer labs in at least two primary schools in every city or town during the 1998-99 school years. 2,544 primary and secondary schools in 80 cities and 921 towns received new computer labs. The MEB also plans to establish Internet connections in 2,500 primary and secondary schools. In each of these schools, technology classrooms were equipped with were computers, printers, scanners; Microsoft office software, courseware for computer literacy, courseware for

different subjects, education and entertainment courseware; electronic references; and, video, overhead projectors, TV, educational videocassettes, and transparencies. The computer companies sponsoring this project provided one year of free Internet access to 2544 schools. In addition, the people living near the schools had a chance to use Internet during the weekends. This project was also supported by the World Bank, and was called the "Project for Globalization in Education 2000". An important first step for Turkish Educational System, the goal is to continue to increase educational opportunities for all students. To ensure opportunities for all, the project was to follow the developments of the information age and to use instructional technology at each level of the education system; and, to create a society with adapted information and technology standards. The second phase of this project will add 3000 schools all with Internet capabilities. Turkey had to adopt some basic principles. In order to move towards providing opportunities for all students, Akkoyunlu and Orhan stated that "these principles are:

- to support formal education through distance education;
- to install computer labs in primary education institutions and provide access for all students to Computer Assisted Education;
- to make students and teachers computer literate; and,
- to equip schools with modern technological materials" (Akkoyunlu & Orhan, 2001, p. 30).

Another important project for the Turkish educational system is MEBNET. MEBNET is a network that provides Internet access and makes the communication between teachers and students easy. However, this project has financial problems and also lacks of the technical manpower and computer teachers to make it successfully.

So far, almost 3,000 computers labs for 25,000 computers have been set up in 2,481 schools in Turkey (Akkoyunlu, 2002).

On June 25th 1998, the Basic Education Program Loan Agreement was signed between the World Bank and the Turkish government. The World Bank gave an initial credit of 300 million US dollars for this project. After fulfilling the Basic Education Program objectives successfully, a second credit of 300 million US dollars was given. The objectives of the Basic Education Program included many activities. One of the activities is increasing the quality of basic education by renewing information technological tools. In order to update their information technology, the Basic Education Program's first objective was to build information technology classrooms in at least 2 primary education schools in 80 cities and every town. Thousands of technological tools were purchased by government for this project (Ministry of National Education, 2001).

On 10 July, 2001, the Secondary Education Project was started by the Turkish government, partly by the loans from the World Bank. The secondary Education Project will be implemented until the year 2005. This project also includes implementing information technology in secondary education. All secondary schools will be equipped with modern tools and equipment, and the goal is for information technology to be used extensively in all secondary schools (Ministry of National Education, 2001).

In attempting to be pro-active, the Turkish Government set up internet services for schools and developed The MEB web page so students can learn about their National exam results such as the Foreign Language Examination (Yabanci Dil

Sınavı, [YDS]), the Examination for Foreign Students (Yabancı Uyruklu Öğrenci Sınavı, [YÖS]), the Internship Selection Examination for Medical Doctors (Tıpta Uzmanlık Eğitimi Giriş Sınavı, [TUS]), the Foreign Language Examination for Civil Servants (Kamu Personeli Yabancı Dil Tespit Sınavı, [KPDS]), Selection Examination for Graduate Studies (Lisansüstü Eğitimi Giriş Sınavı, [LES]) and recent "state of teacher" designations can be seen. Seminars that focus on how to use the information technologies in education are being started for teachers, school directors, and personal who work in the department of education. All trainers have been provided the use of computer-based products (Ministry of National Education, 2001).

The MEB is aware of the new changes and developments in the world. Therefore, the current official objectives of the MEB are to:

- increase students achievement and quality of learning and teaching;
- improve teachers professional qualities;
- increase the productivity of the use resources; and,
- encourage the efficient use of technology in education. (Ministry of National Education, 1999).

In December 1999, Turkey became the European Union's (EU) first candidate for full membership with a predominantly Muslim population and then Turkey participated as a full member candidate at the EU summit in Nice in December 2000, and in December 2002, Turkey started a requisite 18 month preparatory period for its inclusion in the various European Union education programs. National Agency Turkey, which was established in January 2002, is responsible the necessary actions required from Turkey, and responsible the evaluation, management, and monitoring

of EU education and culture programs. Before this requisite, some Turkish universities started to examine modern countries' education policies and modified their own educational perspectives. For example, Bogazici University, Middle East Technical University and, Uludag University joined the European Universities Association in 2001, and started to make educational reforms modeled after European criterions. The higher education grade and credit system was changed. It is similar to the system used in the U.S. If student has successfully completed at least one semester at a Turkish university, he is eligible to apply for transfer to another university. For example, Uludag University and SUNNY University developed a cooperative agreement for a student exchange programs. The program provides the opportunity to earn two diplomas in the field of industrial engineering and architecture from both universities if either American or Turkish students study at least 2 years at one university and complete their last 2 years at the other university. Another example is that Bogazici, Uludag and Yildiz Technical Universities were accepted into the Quality Culture Project, which was organized by the European Universities Association.

Another big change for Turkish universities is joining the Socrates-Erasmus program. This program supports European cooperation in eight areas, which are students and teacher exchanges, curriculum development program , international program, thematic networks between departments and faculties across Europe, language courses, European credit transfer system, from school to higher education, and from new technologies to adult learners. This program addresses 16 different subject areas including teacher education. All Socrates-Erasmus higher education

activities are aimed at developing a "European Dimension" within the entire range of a university's academic program. Turkey was adopted on January 24, 2000 into the program, and will be part of the program until the end of 2006. Erasmus projects are now open to 31 countries (the 25 Member States of the European Union, the 3 European Economic Area countries, Iceland, Liechtenstein and Norway, and the 3 candidate countries, Romania, Bulgaria and Turkey. Turkey also has signed the Memorandum of Understanding on the Community Programs of Europe Union on February 26, 2002. This program, consisting of Leonardo Vinci (Vocational Education Program), Socrates, and Youth, is between the Republic of Turkey and the European Community. This program started in April, 2004 and, 1,300 students and 300 teachers from 65 Turkish universities have the opportunity to study/conduct lectures abroad within the framework of the exchange program (Clark, 2003; Council of the European Union-d, http://europa.eu.int/comm/education/programmes/socrates/erasmus/erasmus_en.htm)

Although little research has been done on these reforms efforts in Turkey, the Finance and Development magazine, which is being published by the International Monetary Fund (IMF) and the World Bank declared that the Anadolu University in Turkey is one of top ten mega universities for distance education in the world (Potashnik & Capper, 1998). Studies have also shown that the use of technological tools in Turkish schools has a positive effect on learning science. For example, Dr. Usun managed a survey on the undergraduate students' attitudes towards educational uses of the Internet. The aim of this study was to determine the attitudes of

undergraduate students toward the educational uses of the Internet. Usun found that the Turkish students believed:

- The Internet is as important as other research tools;
- Using the Internet is easer than using library;
- Using the Internet makes learning fun;
- They accessed the Internet more at school than at home; and,
- Their knowledge of the Internet is essential for surviving college.

Students most frequently said that they would access their course materials if they were on the web and indicated that they would take a required class on Internet use, if given a choice (Usun, July 2003b).

When one condenses all the projects focused on educational reform since 1923, including those that focused on technology related projects, technology integration in Turkish schools remains extremely low and computer to student ratios are extremely low (100:1). Today over 800 high schools have computer labs, representing only about 15% of the total number of schools. Over 5,000 teachers have taken in-service training from universities but Turkey is significantly behind other Organization for Economic Co-operation and Development (OECD) countries. Current OECD research, done on two hundred fifty thousand 15 years-old students from 41 countries, showed Turkey is significantly behind many other OECD countries in science and problem solving in math, reading, (Elevli, 2004, December 8). Courses for computer literacy, high-level programming and the use of databases and spreadsheets have been appended to vocational and technical high schools' curriculum. In regular high schools, courses on computer literacy and general

computing are being introduced. The MEB is also building a portfolio management information system linking 73 regional education directorates' offices with a center in Ankara to provide information on personnel, educational statistics and facilities.

The Minister of Education Dr. Huseyin Celik, declared that the Education Ministry completely changed the K-8 curriculum in 2004. The new curriculum will be implemented in pilot schools in Ankara, Bolu, Hatay, Izmir, Kocaeli and Van, for the 2004-2005 school years, in which EU standards were taken into consideration. Dr. Celik, said;

> "Yesterday with the start of the new school year, individuals will stand at the forefront and give a student-centered education. Today's paradigm, which subjects topics to white and black distinctions, is now changed. A place must be made for gray, and its tones. For the first time since the 1940's, holistic and internationally comparative programs have been prepared. The new curriculum considers not only training, but also education. The new curriculum provides eight common skills that students previously lacked: Critical thinking, solving problems, scientific research, and creative thinking, and entrepreneurship, communication, using information technologies and using Turkish skillfully. Also, "there will be no schools left without Internet access" (Cetinkaya, 2004, December 8).

The goal is to for teachers to be on the cutting edge and provide a student-centered curriculum which will focus both on as well as deeper learning and understanding. The new curriculum will provide eight common skills that students previously lacked: Critical thinking, problem solving, scientific research, and creative thinking, entrepreneurship, communication, and using information technologies. The first aim of MEB is to provide schools with internet facilities at which time there will be no schools left without Internet access. Related this aim, Dr. Celik announced that the ministry will provide 40,000 schools with internet facilities. Celik announced that "a new joint Ministry of Transport and Telekom (Turkish state owned communication

monopoly) project would provide 40,000 schools with Internet access" (2003, September 15). Because Celik thought that if we fill all the classrooms with computers, but if we don't train the teachers to use them effectively, the technology education reforms we made will lose its purpose.

The use of technology in Turkey's high school education is still at a very early stage and there is still a long way to go in this area, but Turkey is progressing in using technology in education (Arslan, October 2003; Cagiltay, 2001; Thomas & Kaptan, 1997; Yedekcioglu, 1996).

CHAPTER III

METHOD

Introduction

The purpose of this study is to examine Turkish science teachers and pre-service teachers' attitudes towards the use of technological tools in their science lessons in Turkish colleges of education in the assist of Turkish government projects, and how science education teachers, who have earned a science education degree from western countries, influence the use technology in Turkish higher education.

Description of Subjects

The purpose of the sampling is to provide methods for allowing the researcher to estimate how well the sample represents the population of the study under investigation. There are four types of subjects in this study. The first subjects are Turkish pre-service teachers whose majors are science education (655 pre-service teachers). The second group of subjects is science education faculty members who have earned their degrees from Turkish universities (62 science education faculty members). The third group of subjects is science education faculty members who have earned science education degrees from western universities and are still working at Turkish universities' departments of science education (9 science education faculty members). The final group of subjects is science education graduate students who are studying in France and the U.S. universities in science education departments and who will go back to Turkey to work in Turkish colleges of education after completion of graduate study (29 science education graduate students). Indeed, they have two options, the first option is they have to go back to Turkey and work for MEB in

Turkish universities; second option is they have to pay money, which MEB spent for their education, back, because MEB provides full scholarship to pursue for their master and doctoral degree in science education in the Western universities. Turkish pre-service teachers will be randomly selected from Turkish universities. The other subjects are limited in number, thus, all known subjects will be included in this study and will be asked to complete the technology survey.

Statistical Procedure

The study analyzes the data under a cross-section or between subjects' method with four factors: Turkish pre-service science teachers; Turkish graduate students whose majors are in science education in U.S.; Turkish science education faculty members with degrees from Turkish universities; and Turkish science education faculty members who have earned science degrees from western universities. An analysis of variance (ANOVA) was used to analyze data and "level of 0.05" established. A *p*-value less than 0.05 will indicate that there is a significant difference among the various groups.

Instruments

In an effort to ensure the validity and reliability of the survey used in this study, different surveys were combined; Pedersen and Yerrick's survey, "Technology in science teacher education: Survey of current uses and desired knowledge among science educators" (Pedersen & Yerrick, 2000) and "Metiri Group Faculty Technology Survey" (Metiri Group, 2001). Section C of the current survey is composed of the same forty-seven items from Pedersen and Yerrick's study. Section B of the current survey is composed of the same 17 and 14 items used in the Metiri

Group Faculty Technology survey. The present study calculated the Cronbach Alpha coefficient as a measure of the internal consistency reliability for each sections of the survey. Cronbach's alpha measures how well a set of items (or variables) measures a single unidimensional latent construct. When data have a multidimensional structure, cronbach's alpha will usually be low and alpha coefficient ranges in value from 0 to 1. The higher the alpha is, the more reliable the test and the lower standard error of measurement. Reliability is considered acceptable for group comparison when the coefficient exceeds Nunnally's criterion 0.7 (Nunnally, 1978). The data were analyzed using SPSS software (version 12). Validity refers to whether the instrument accurately measures what it is intended to measure.

The result of analysis showed that the reliability of section B was 0.828 (Cronbach's alpha) for Turkish faculty, 0.833 for Turkish pre-service teachers and graduate students. The reliability of section C was 0.972 (Cronbach's alpha) for all samples (Category C1: 0.867, Category C2: 0.957, Category C3: 0.886, Category C4: 0.906). Over 80% of the items had moderate or better levels of reliability.

In this study, both quantitative data sources (a technology questionnaire) and a qualitative data sources (historical data) were used. Two types of questionnaires were used, one for science education faculty (See Appendixes A, pg. 192; B, pg. 198) and the other for Turkish pre-service teachers and graduate college students (See Appendixes C, pg. 205; D, pg. 211). The modes of data collection for the surveys were providing the survey to the individual in person and via the internet. For both questionnaires the scales were 5 point Lickert-scales.

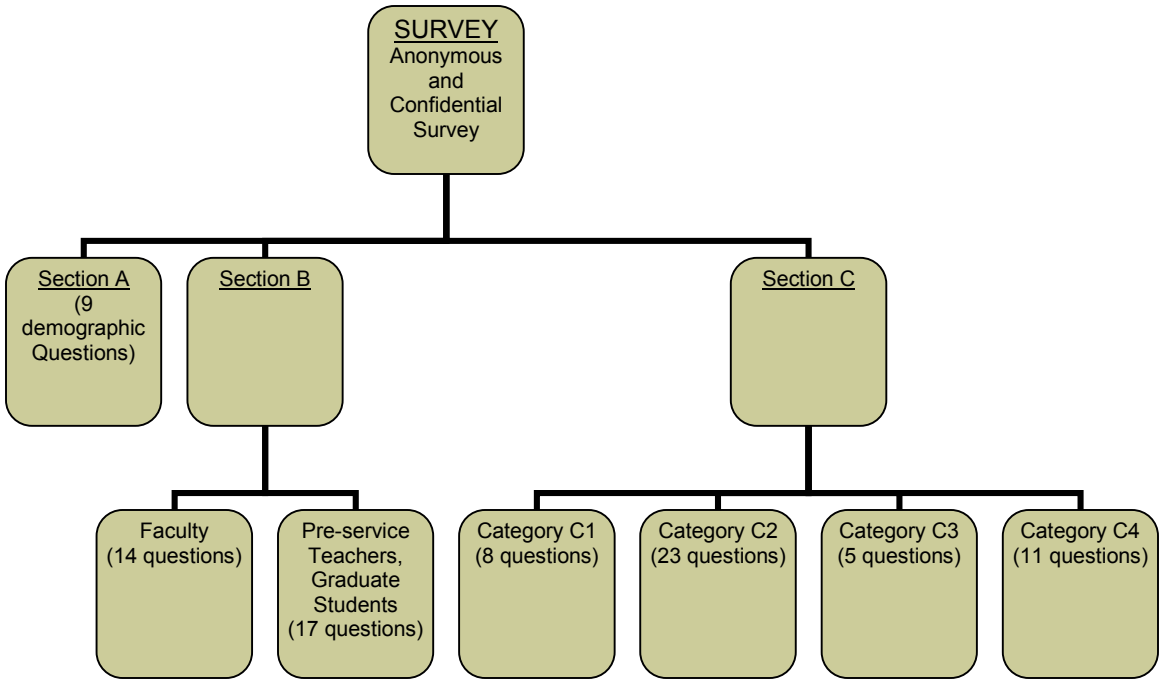
All pertinent questionnaires were translated to Turkish for this research (See Appendixes B, pg. 198; D, pg. 211). These instruments were checked by other researchers or faculty members whose mother language is Turkish and who are working and teaching at the University of Oklahoma. When agreement was reached on the final translation of the technology questionnaires, the survey was ready to be used in science education departments in Turkish colleges of education and American universities in the top fifty in nationwide (e.g., University of Oklahoma, Florida State University, University of Florida, University of Iowa, Iowa State University, Ohio State University, Purdue University, Pennsylvania State University, Indiana University, and Oregon University).

The questionnaire was an "Anonymous/Confidential Survey". No identification was included on the survey. As seen Chart 3.1 (pg. 64), the questionnaire for faculty had 3 sections related to the use of technology in science. Section A had 9 demographic questions, such as age, and gender. These are added to the questionnaires in order to disaggregate the data and examine how the variables affect subjects' attitudes toward the use of technology. Section B had 14 questions. Section C was divided in 4 categories and had 8, 23, 5, and 11 questions. The four categories for Section C are titled "Ways in which computers can be used to," and "How to use a computer in science for," "Effects of computer use on," "How to use other technology in the classroom." Respondents were asked to answer each category of section C based on the following areas "Current Knowledge," Desired Knowledge," and "My Assignments Requires or Assumes the Use of this

Technology." The final questionnaire was for pre-service teachers from Turkish colleges and Turkish graduate students from the U.S.

The questionnaire for pre-service teachers and graduate students who are studying in science education graduate program in the U.S. had 3 sections. Section A had 9 demographic questions, similar to the faulty questionnaire. Section B had 17 questions. Section C was divided into 4 categories with 8, 23, 5, and 11 different types of questions, again similar to the faculty questionnaire. As with faculty, the pre-service teachers and graduate students were asked to respond to each category based on "Current Knowledge," Desired Knowledge," and "My Assignments Requires or Assumes the Use of this Technology."

Chart 3.1: Instruments of study.



Data Collection Procedure

There are currently 34 science education departments or programs in colleges of education in Turkish universities. Since not all of these individuals could be reached; the population was divided into seven segments based on the seven geographic regions in Turkey: the Marmara region, the Aegean, the Mediterranean, Central Anatolia, Black Sea, the East Anatolia and the Southeast Anatolia regions. The Marmara region has nine universities, Aegean five, Mediterranean three, Central Anatolia eight, Black Sea three, East Anatolia five, and Southeast Anatolia region one university, all of which have science education departments. Five letters were sent electronically and by surface mail to each region. For the Aegean and East Anatolia regions there is no problem in selecting five universities since these regions have only five universities. However, for Marmara and Central Anatolian universities, universities were randomly selected and then permission letters to conduct research sent. For the remaining three regions, Mediterranean, Black Sea, and Southeast Anatolia regions, permission letters were sent to all of the universities located in those regions. A total of twenty-seven permission letters were sent to Turkish universities. In case the head or college deans did not respond to my request or would not give permission to conduct the research I sent my survey to Turkish faculties by e-mail, as many as I found their e-mail addresses, and asked to participate in my study.

Two paper and pencil questionnaires were used to collect data; the faculty technology questionnaire and the pre-service teacher technology questionnaire. Science education faculty was asked to fill out the questionnaire during personal time. Pre-service teachers were asked to fill out the questionnaire during class sessions with

permission of the teacher and department head or college dean. Before conducting the research, a letter and e-mail was sent to the colleges of education deans and science education faculty for their permission. The letter explained the purpose and importance of the research. During the class period, the written questionnaire was distributed to each student and took 20-25 minutes to complete. The same procedure was used for the faculty questionnaires. After getting permission from each of the teachers colleges' deans and each of the Turkish pre-service teacher and the faculty technology surveys were administered. This took approximately 20-25 minutes.

The other method of data collection was through a survey on the Internet. The survey was sent to graduate students who are studying in science education graduate program in the U.S. by email. The survey was placed online http://h_turkmen.tripod.com. The technology survey is on the left side of the web page. After clicking on the link, the participants have seen two different types of surveys, pre-service teacher technology survey and faculty technology survey.

The sampling method for this study was purposive since a limited number of Turkish universities were available and all science education departments and science education programs were conducted.

Risk and Limitations of Study

There were minimal risks:

- Potential time takes to fill survey out (15-25 minutes).
- Students involved with test taking may experience anxiety over taking a test.
- Permission may not be given for the study.

- There will be limited science education faculties, who have earned science education degrees from western universities.

Benefit of Study

This project showed how pre-service teachers use technology, (especially computers) the importance they place on it, and their needs for effective technology integration. All responses provided important information which will assist Turkish educators in designing education and training environment in order to help Turkish teachers learn how to use computers as tools to enhance their teaching and to improve students' learning.

Definition of Terms

Technological Tools: Instruments and equipment used in the classroom to aid in student learning or the teaching of scientific or mathematical concepts. There are many different kinds of technology in the classroom such as the overhead projectors, slides and slides projectors, documentary videos as well as everyday technology such as blackboards.

Educational Technologies: Any instrument or equipment used in the classroom to aid in teaching and learning process.

Science Education: Science education is generally based on the completion of science, science education, and education courses. In Turkish science education departments, science educators and science teachers work in the same department. Students do not have to take science courses from other departments.

Pre-service Teacher: All college of education students are university students and are preparing to be teachers.

Turkish Academic Rank: Turkish academic rank was determined on the basis of the Article 3 of the Higher Education Law No. 2547, Part Five: Teaching Faculty Members (YOK: Higher Education Act. Part Five: Teaching Faculty Members, 1981). Rank refers to Faculty levels which included "Teaching Assistant," "Instructor," "Assistant Professor," "Associate Professor," and "Professor."

CHAPTER IV

ANALYSES OF DATA AND RESULTS

Introduction

In the following pages, this report will examine the results from the surveys of Turkish faculty and students. The data analyzed were collected from surveys returned by Turkish pre-service teachers and Turkish faculty members, as well as from the limited number of questionnaires returned by graduate students studying science education in the U.S. and Turkish faculty with degrees from western universities. As mentioned in Chapters I and III, there are few Turkish graduate students in the U.S. and there are not many Turkish science education faculty, who have earned their degrees from western science education departments. These findings reflect the opinions of individual faculty and pre-service teachers in the 2004-05 academic year.

This study focused on current trends of technology implementation and use in Turkish science classes and the impact of the Turkish government sending teachers to western countries to study innovations in education. Briefly, the purpose of this study was to examine Turkish science teachers and pre-service teachers' attitudes towards the use of technology in their science lessons in Turkish schools, and how science education teachers with science education degrees from western countries influence the use of technology in Turkish higher education.

Analyses of Differences between the Groups

In this study, there were two populations from which purposive samples were selected: a) students whose majors are science education and b) Turkish faculty. The student sample was divided into a) pre-service science education teachers and b)

science education graduate students who are currently studying in the U.S. The Turkish faculty sample was divided into two groups: a) Turkish science education teachers who have earned their degrees from Turkish universities and b) Turkish science education teachers who have earned their science education degrees from western universities. The Turkish pre-service teachers were randomly selected from Turkish universities. The other subjects are limited in number; thus, all known subjects were included in this study and were asked to complete the technology survey.

The survey, "Technology Usage and Needs of Science Educators" consisted of 3 sections: section A, B, and C. From this survey, six dependent or outcome variables are identified. Four of the dependent variables come from section C of the questionnaire which all subjects completed. The remaining two dependent variables come from section B of the questionnaire which has two different forms, one for students and graduate students and the other for faculty members (see Appendixes A, pg. 192; B, pg. 198; C, pg. 205; and D, pg. 211).

A cross-sectional design was used in this study. Two different (5-point) Lickert-scale questionnaires were used in this study. "Pre-service Teacher Technology Survey, Technology Usage and Needs of Science Educators" was for Turkish pre-service teachers and graduate students in the U.S and "Faculty Technology Survey, Technology Usage and Needs of Science Educators" was for science education faculty. The four independent variables involved in this study were: a) pre-service teachers, b) graduate students in the U.S., c) Turkish science education

faculty members with degrees from Turkish universities, and d) Turkish science education faculty members with degrees from western universities.

There are two sets of data reported in this chapter. The first is demographic information about the instructional faculty members and pre-service teachers at the Turkish and American universities who responded to the survey in section A. The data gathered from respondents to the 2004-2005 academic year questionnaire (see Appendixes A, pg. 192; B, pg. 198; C, pg. 205; and D, pg. 211) reflect such items as faculty members' academic field of employment, academic rank, gender, skill, and technology/computer classes completed. In addition, pre-service teachers' gender, age, skill, and technology/computer classes completed are also reported.

The second set of data form section B and section C include faculty and pre-service teachers' knowledge of technology. All subjects were asked to respond in section C to levels of knowledge or the use of technology for their: a) "current knowledge" (K), b) "desired knowledge" (D), and c) "my assignments require or assume the use of this technology" (A). All groups were asked to respond to the 47 questions included in section C (divided into four categories), C1: "Ways in which computers can be used to," C2: "How to use a computer in science for," C3: "Effects of computer use on," and C4: "How to use other technology in the classroom" (see Appendices A, B, C, and D). Specifically respondents were asked to mark the extent of their opinion regarding each question (Current knowledge, desired knowledge, my assignments require or assume the use of this technology). The results for the 47 questions are presented in a series of tables (Tables 4.10, pg. 89; 11, pg. 97; 12, pg.

98; 14, pg. 108; 15, pg. 112; 17, pg. 124; 18, pg. 125; 20, pg. 132; and 21, pg. 134), which reflect faculty and pre-service respondents' opinions on each indicator.

The seventeen questions in section B of the survey regarding general information about use of technology asks pre-service teachers and graduate students to provide their perceptions of technology regarding "my professor," including questions 5, 6, 10, 11, and 13; "in my education courses," including questions 1 and 4; and "I," including questions 2, 3, 7, 8, 9, 12, 14, 15, 16, and 17. Indeed, these three subsections focused on what pre-service teachers and graduate students perceptions about their science curriculum (in my education courses), their teachers attitude of using technology (my professor), and themselves (I). Fourteen questions in section B of the survey asked faculty respondents to indicate their level of agreement about the use of technology for each statement. A number of tables (Tables 4.1-8, and 4.23-27) also identify variations in opinion based on differences among groups (Pre-service teachers, Graduate students, Turkish faculty members with degrees from Turkish universities, and Turkish faculty members with degrees from western universities), differences between gender, and differences among the rank of faculty on all sections of the questionnaire were examined.

The hypotheses of this study explore the effect of educational background (Turkish or western) on the use of technology in Turkish science courses. It was posited that those with a western science education have a more positive impact on the Turkish educational system. The null hypothesis for the study was that no significant difference would emerge among the four groups (faculty/students with Turkish/western background).

The next sections of this chapter detail the results of this study. Survey instrument responses from the four study samples regarding demographic data is the focus of section one. The responses to assess the four samples' views of educational technology is represented as "Indicators of Technology Questions" in the section two, which is divided into six subgroups reflecting the various sections of the survey (B: general technology statements, C1: ways in which computers can be used to, C2: how to use a computer in science for, C3: effects of computer use on, C4: how to use other technology in the classroom). The comparison of gender differences for the four study samples is represented in section three. Finally, section four addresses the issue of rank in the study samples of Turkish faculty.

Section One: Demographic Data

The first section of my findings focuses on the demographic characteristics of pre-service and faculty respondents who returned the survey "Technology Usage and Needs of Science Educators". Table 4.1 and 4.2 (pg. 76) represent the demographic data collected on the Turkish faculty groups and students groups. In this study, 655 Turkish pre-service teachers, 29 graduate students from U.S. universities, 62 Turkish faculty members with degrees from Turkish universities and 9 Turkish faculty members with degrees from western universities were surveyed. A Sample of pre-service teachers and faculty members from 9 different Turkish universities were given the surveys in Turkey and a sample of faculty from 11 different Turkish universities were given the surveys by e-mail. The 20 Turkish universities were located in seven Turkish regions, representing 5 out of 5 universities from the Marmara region, 5 out of 5 universities from the Aegean region, 1 out of 3

universities from the Mediterranean region, 3 out of 5 universities from the Central Anatolia region, 2 out of 3 universities from the Black Sea region, 3 out of 5 universities from the East Anatolia region, and 1 out of 1 university from the Southeast Anatolia region.

There are 34 science education departments or programs in colleges of education in Turkish universities. Fifty-four letters were sent to 27 different universities in seven different regions of Turkey via electronic and surface mail. Deans of colleges of education and heads of science education departments were also contacted in order to gain approval for the study and allow their pre-service science education teachers and faculty to complete the questionnaires. Nine of the 27 deans and/or heads of the science education departments who responded to the request agreed to allow the study (a 33.3% acceptance rate). Among the 64 science education faculty members who received surveys, 50 returned completed surveys. After not hearing from the other universities, the survey was also sent as an attachment and the web page address (http://h_turkmen.tripod.com) was provided, to 49 faculty members from the 18 schools whose email addresses could be located. Following this email, 21 faculty members (6 females, 15 males) from different universities responded to the survey. The total number of faculty respondents who completed the survey was 71. As seen in Table 4.3 (pg. 76), overall, 72.7 % of the female faculty returned questionnaires, while 56.5% of the male faculty responded. Female faculty also responded at higher rates (86.6%) than their male counterparts (70.6%) when given the survey in person. However, for the electronic version of the survey there were an equal number of responses (42.9%) for female and male Turkish faculty. Turkish

graduate students, who are studying science education in 14 different U.S. universities, were surveyed via email and through the web page.

In Table 4.4 (pg. 76), pre-service teachers and graduate students' response rates are reported on the basis of age. In the Turkish education system, after graduating from high school, most Turkish students are 18 years old. If a high school graduate passes the National Selection Exam (OSS) the first time, he/she will be 19 years old as a freshman, 20 as a sophomore, 21 as a junior, and 22 years old as a senior. All of the pre-service teachers were most likely juniors or seniors in higher education. Overall, 53.6 % of female pre-service teachers returned questionnaires, while a smaller percent (46.4%) of male pre-service teachers responded. Of the graduate students 75.9% were male and 24.1% were female. For the 29 U.S. graduate students responding to the survey, no one under the age of 25 responded. For those who responded 48.3% were female and 51.7% were male graduate students 25 years old and older.

Tables 4.5 and 4.6 (pg. 77) represent the rank, teaching experience, and gender of the Turkish faculty members who responded. Of the Turkish faculty members 88.7% hold the rank of Teaching Assistant, Teacher, and Assistant Professor, and are new to the science education field with less than 5 years teaching experience. This relative lack of teaching experience is not surprising since most of the science education departments in Turkey were opened within the last 6 years. For Turkish faculty who earned their degrees from western universities, 77.8 % are in the lowest faculty ranks. Two Turkish professors who earned their degrees from western universities earned elementary education Ph.D.'s, while 3 associate professors and 4

professors do not have science education degrees. Their degrees were in biology, physics, and/or chemistry. Of the 9 Turkish faculty members who earned their degrees from western universities 44.4% were female and 55.6% were male.

Table 4.7 (pg. 77) represents all four groups according to how they perceive their own level of skill and knowledge about technology (question 7 in section A). The majority of pre-service teachers (64.7%) see themselves as intermediate in terms of skill and knowledge. However, 72.4% of graduate students see themselves at the advanced level. 46.8% of Turkish faculty members with Turkish degrees see themselves at the intermediate and advance levels, and 56.6% of Turkish faculty members who earned degree from western universities see themselves as experts. There is clear difference among the four groups regarding their own perceptions of skill and knowledge level. Interestingly, males in all groups rated themselves more knowledgeable about technology with the smallest difference between females and males in both Turkish faculty groups.

Table 4.8 (pg. 78) reflects whether or not respondents had taken technology or computer classes. Interestingly, 91.8% of all Turkish pre-service teachers had taken technology or computer courses in their undergraduate studies. A very high percentage (93.1% in undergraduate level and master studies, 65.5% in Ph.D. studies) of graduate students had taken technology or computer courses at every academic level. This data would suggest that Turkish pre-service teachers and graduate students had some level of formal technology/computer instruction in their undergraduate studies. On the other hand, there was an obvious difference between Turkish faculty members with degrees from Turkish universities and western universities when

considering their formal instruction at the undergraduate, master, professional development level within the past 5 years.

Table 4.1: Science Education Faculty and Pre-Service Teachers And Their Universities.

University	# Pre-Service Teachers	# Faculty
1. Marmara University	60	6
2. Pamukkale University	76	10
3. Celal Bayar University	64	5
4. Istanbul University	67	7
5. Mugla University	91	4
6. Osmangazi University	75	6
7. Gazi University	87	4
8. Adnan Menderes University	66	3
9. Dokuz Eylul University	69	5
10. Ondokuz Mayis University	-	2
11. Ataturk University	-	5
12. Dicle University	-	1
13. Firat University	-	1
14. Hacettepe University	-	4
15. Inonu University	-	1
16. Karadeniz University	-	1
17. Mersin University	-	1
18. Sakarya University	-	2
19. Balikesir University	-	1
20. Bogazici University	-	2
TOTAL	655	71

Table 4.2: Science Education Graduate Students And Their Universities.

University	Turkish Graduate Students
1. Arizona State University	1
2. Columbia University	1
3. Florida State University	5
4. Indiana University	5
5. Iowa State University	1
6. Northwestern University	1
7. Ohio State University	2
8. Penn State University	1
9. Purdue University	5
10. Western Michigan University	1
11. University of Florida	1
12. University of Iowa	3
13. University of Oklahoma	1
14. Syracuse University	1
TOTAL	29

Table 4.3: Gender Differences Between Turkish Science Education Faculty Members.

	# Male	% Male	# Female	% Female	# Total	% Total
Turkish Faculty (by e-mail)	15/35	42.9	6/14	42.9	21/49	42.9
Turkish Faculty (by face to face)	24/34	70.6	26/30	86.6	50/64	78.1
Total Faculty	39/69	56.5	32/44	72.7	71/113	62.8

Table 4.4: Age and Gender Differences For Pre-service Teachers.

Age	Pre-service Teachers					
	Turkish Students			Graduate Students from U.S.		
	Male	Female	Total	Male	Female	Total
	# - %	# - %	# - %	# - %	# - %	# - %
Under 21	59 - 9	70 - 10.7	129 - 19.7	-	-	-
21-25	240 - 36.6	280 - 42.8	520 - 79.4	-	-	-
25-30	5 - 0.8	1 - 0.1	6 - 0.9	10 - 34.3	3 - 10.5%	14 - 48.3
Over 30	-	-	-	7 - 24.1	8 - 27.6%	15 - 51.7
Total	304 - 46.4	351 - 53.6	655	17 - 58.4	11 - 38.1	29 - 100

Table 4.5: Rank and Gender Differences For Faculty Counterparts.

	Turkish Faculties			Turkish Faculty who earned their degree from western universities		
Rank	Male	Female	Total	Male	Female	Total
	# - %	# - %	# - %	# - %	# - %	# - %
Teaching Assistant	7 - 11.3	12 - 19.3	19 - 30.6	-	1 - 11.1	1 - 11.1
Teacher	9 - 14.5	1 - 1.6	10 - 16.1	3 - 33.6	2 - 22.2	5 - 55.6
Assistant Professor	19 - 30.7	6 - 9.6	25 - 40.3	1 - 11.1	-	1 - 11.1
Associate Professor	2 - 3.2	2 - 3.2	4 - 6.5	-	-	-
Professor	2 - 3.2	2 - 3.2	4 - 6.5	-	2 - 22.2	2 - 22.2
Total	39 - 62.9	23 - 36.9	62 - 100	4 - 44.4	5 - 55.6	9 - 100

Table 4.6: Teaching Experience For Faculty Counterparts.

Rank	Turkish Faculties	Turkish Faculty who earned degree from western universities
	Average Year of Teaching	Average Year of Teaching
Teaching Assistant	3.2	2
Teacher	7.4	7
Assistant Professor	12	4
Associate Professor	14,3	-
Professor	32	20

Table 4.7: Skill and Gender for Groups.

Skill	Turkish Pre-service Teachers			Graduate Student		
	Male	Female	Total	Male	Female	Total
	# - %	# - %	# - %	# - %	# - %	# - %
Non-user	3 - 1	7 - 1.9	10 - 1.5	-	-	-
Novice	41 - 13.5	81 - 23.2	122 - 18.6	-	-	-
Intermediate	200 - 65.8	224 - 63.8	432 - 64.7	6 - 27.3	3 - 42.9	7 - 24.2
Advanced	59 - 19.4	37 - 10.5	96 - 14.7	15 - 68.2	4 - 57.1	21 - 72.4
Expert	1 - 0.3	2 - 0.6	3 - 0.5	1 - 4.5	-	1 - 3.4
TOTAL	304	351	655	22	7	29
	Turkish Faculty			Turkish Faculty who earned degree from western universities		
	Male	Female	Total	Male	Female	Total
	# - %	# - %	# - %	# - %	# - %	# - %
Non-user	-	-	-	-	-	-
Novice	2 - 5.2	-	2 - 3.2	-	-	-
Intermediate	18 - 46.1	11 - 47.8	29 - 46.8	-	-	-
Advanced	18 - 46.1	11 - 47.8	29 - 46.8	-	4 - 80	4 - 44.4
Expert	1 - 2.6	1 - 5.4	2 - 3.2	4 - 100	1 - 20	5 - 56.6
TOTAL	39	23	62	4	5	9

Table 4.8: Technology or Computer Classes Demographic Data.

Technology or computer classes	Pre-service Teachers				Faculty			
	Turkish Students		Graduate Students		Turkish Faculty with degrees from Turkish universities		Turkish Faculty who earned degree from western universities	
Level	#	%	#	%	#	%	#	%
High School	183	27.9	2	6.9	9	14.5	1	11.1
Undergraduate courses	601	91.8	27	93.1	29	46.8	8	88.9
Master's courses	-	-	27	93.1	14	22.6	7	77.8
Doctoral courses	-	-	19	65.5	10	16.1	1	11.1
Within the past 5 years	-	-	25	86.2	19	30.6	5	55.6
Workshop	225	34.4	16	55.2	33	53.2	6	66.7

Section Two: Indicators of Technology as Elicited by Questions in the Groups

In the "Technology Usage and Needs of Science Educators" questionnaire, all hypotheses were tested according to the null hypothesis, which assumes there is no difference between the mean of groups. If the difference between the means was zero, *Ho* was not rejected.

Ho: $\delta = \mu 1. \mu 2 = 0$.

If there was a statistically significant difference between the means, the *Ho* was rejected and *Hα* was accepted.

Hα: $\delta = \mu 1. \mu 2 < 0$.

The One-Way Analysis of Variance (one independent variable with two or more than two levels) and the Post Hoc analysis (Tukey) were conducted to determine at which level the differences occurred.

Section B of Questionnaire: Level of agreement about use of technology For Students

Section B of the questionnaire is related to general information about educational technology and use of technology in science courses. This section

included three different subsections which focused on respondents perceptions of technology. The subsections are “my professor,” including questions 5, 6, 10, 11, and 13, which focused on what Turkish pre-service teachers and graduate students think about teachers attitudes on use of educational technology; “in my education courses,” including questions 1 and 4, which focused on what Turkish pre-service teachers and graduate students think about science curriculum; and “I,” including questions 2, 3, 7, 8, 9, 12, 14, 15, 16, and 17, which focused on what Turkish pre-service teachers and graduate students learned. In order to compare scores of pre-service teachers and graduate students, a one-way ANOVA was applied.

Descriptive statistics for each group are reported (number in each group, means of each group, standard deviations) in Table 4.9 (pg. 84). The total mean for the questions regarding “My professor” was 3.343 for pre-service teachers and 3.788 for graduate students; for responses to “In my education courses” the total mean score was 3.383 for pre-service teachers and 3.879 for graduate students; for responses to “I” the total mean score was 3.464 for the pre-service teachers and 4.190 for graduate students. Mean scores showed that there was a difference between the two groups regarding their perceptions of technology. It can be clearly said that graduate students report having a much better knowledge of educational technology than pre-service teachers.

The F-ratio column tells us precisely how much more of the variation in the independent variable (groups) is explained by the dependent variable (responses for category B of questionnaire) than is due to random, unexplained variation. A large proportion indicates a significant effect in each group. According to the F-ratio

(F = variance between groups / variance within groups) and *p* value there was no statistically significant difference between pre-service teachers and graduate students on, "When planning how to use technology for instruction, I refer to and base my selections on current research regarding the effectiveness of those technologies" (question B2), "In my education courses, I received lots of information about the effective use of technology as a learning tool for students" (question B4), and "My professors regularly guide student use of technology during class" (question B6).

The evidence regarding differences between these two groups can be obtained from the F-ratio. When the F-ratio is greater than 1 it indicates that the difference between groups is much larger. The larger the F-ratio the greater the differences. The *p* value must be smaller than α value or the null-hypothesis cannot be rejected since the *p* value is the probability that the hypothesis you are testing accounts for the data observed. More accurately the *p* is the probability that the differences between your data and the hypothesis are due to chance. When *p* approaches 1.0 you become surer of the hypothesis. As p approaches 0.0 you begin to have doubts or reject the hypothesis. A 5% α value error was set prior to analysis and as seen in the Sig. column of Table 4.9 (pg. 84),

- F (1,682) = .000, .985 > .05 for question B2,
- F (1,682) =.134, .714 > .05 for question B4,
- F (1,682) =.096, .757 > .05 for question B6.

Thus, all *p* values were bigger than α value ($p > 0.05$) and the variation in these statements between the samples of two groups was 0.00, 0.134, and 0.96 times greater than the variation within samples. The tables of the F-distribution tell us we

do not have greater than 95% confidence and less than 5% confidence in the null hypothesis of no effect. That means I can not reject the null hypothesis.

As seen in Table 4.9 (pg. 84), there were no statistically significant differences between groups of students on "When planning how to use technology for instruction, I refer to and base my selections on current research regarding the effectiveness of those technologies" (question B2), "In my education courses, I received lots of information about the effective use of technology as a learning tool for students" (question B4), and "My professors regularly guide student use of technology during class" (question B6). The mean scores for questions B2 (pre-service teachers 3.3252; graduate students 3.2414), B4 (pre-service teachers 3.6244; graduate students 3.6207), and B6 (pre-service teachers 3.5374; graduate students 3.5862) are very close for both groups. The total mean of pre-service teachers was 3.419. The total mean of graduate students was 4.079. The largest mean differences in section B questionnaire were "My professors use technology to manage student assessment, e.g., using spreadsheets, electronic grade books, or handheld computers/PDA's to record and manage assessment data" (question B13), which is in the subsection "My professor"; "In my education courses, I was taught to incorporate technology within lesson plans and curriculum designs" (question B1), which is in the subsection "In my education courses"; and "I am prepared to use technology to support my own professional growth through activities such as online learning, research and collaborative projects" (question B16), which is in the subsection "I" (Table 4.9, pg. 84). Within this same section, 3% of the graduate students and 5.85% of the pre-service teachers chose "does not apply" option for all 17 questions.

Summary

This section examined the differences between Turkish pre-service teachers and graduate students perceptions about the use of technology. When comparing Turkish pre-service teachers and graduate students total mean scores, graduate students were consistently higher than the mean scores of pre-service teachers in "current knowledge," "desired knowledge" and "my assignments require or assume the use of this technology." Thus, it appears that Turkish universities need to get more engaged in the use of educational technology in order to improve access to the information and enable students to draw on skills, habits, and subject matter knowledge for informed participation in the intellectual and civic life of Turkish society, like western countries. One of the explanations of why Turkish graduate students had more knowledge about the use of educational technology compared to Turkish pre-service teachers is that American universities are further along in implementing educational technology in their classrooms and engaging students in understanding the value of technology in teaching. Turkish pre-service students appeared to be one or two steps behind Turkish graduate students. These western educated Turkish graduate students will come back to Turkey and have the potential to make a strong positive impact on the Turkish education system.

Table 4.9: Means, Standard Deviation and One-Way ANOVA for Section B of Questionnaire for Pre-service Teachers (group 1) and Graduate Students (group 2).
G: Groups, M: Mean, SD: Standard Deviation, F: F-ratio, Sig.: Significance, T: Total.

Does not Apply: 1, Strongly Disagree: 2, Disagree: 3, Agree: 4, Strongly Agree: 5 points.

Questions	G	M	SD	F	Sig.
B1. In my education courses, I was taught to incorporate technology within lesson plans and curriculum designs.	1	3.441	.827	47.595	.000
	2	4.517	.688		
	T	3.487	.850		
B2. When planning how to use technology for instruction, I refer to and base my selections on current research regarding the effectiveness of those technologies.	1	3.624	1.038	.000	.985
	2	3.621	1.178		
	T	3.624	1.043		
B3. I am comfortable planning lessons and curriculum that involve student use of technology during learning.	1	3.953	.874	16.691	.000
	2	4.621	.494		
	T	3.981	.872		
B4. In my education courses, I received lots of information about the effective use of technology as a learning tool for students.	1	3.325	1.217	.134	.714
	2	3.241	1.154		
	T	3.322	1.206		
B5. My professors regularly use technology as a teaching tool.	1	3.312	.899	5.862	.016
	2	3.724	.883		
	T	3.329	.901		
B6. My professors regularly guide student use of technology during class.	1	3.537	.828	.096	.757
	2	3.586	.907		
	T	3.540	.831		
B7. I am well prepared to use technology as a teaching tool.	1	3.286	.814	47.851	.000
	2	4.345	.614		
	T	3.330	.834		
B8. I am well prepared to guide student use of technology in classes I teach or when I teach.	1	3.460	.826	46.069	.000
	2	4.517	.688		
	T	3.504	.848		
B9. I have strategies for using technology to individualize instruction and meet the needs of diverse learners.	1	3.321	.987	26.167	.000
	2	4.276	.922		
	T	3.361	1.002		
B10. My professors use technology to individualize instruction and meet the needs of diverse learners	1	3.173	.957	4.388	.037
	2	3.552	.870		
	T	3.189	.956		
B11. My professors' model strategies for managing technology-supported learning.	1	3.278	1.040	8.655	.003
	2	3.862	1.187		
	T	3.303	1.052		
B12. I am prepared to manage technology-supported learning.	1	3.466	.793	12.548	.000
	2	4.000	.845		
	T	3.488	.802		
B13. My professors use technology to manage student assessment, e.g., using spreadsheets, electronic grade books, or handheld computers / PDA's to record and manage assessment data.	1	3.415	1.002	17.773	.000
	2	4.207	.620		
	T	3.449	1.002		

Table 4.9 *Continued*

Questions	G	M	SD	F	Sig.
B14. I have strategies for using technology to manage student assessment.	1	3.347	1.052	15.862	.000
	2	4.138	.915		
	T	3.380	1.058		
B15. I am prepared to regularly use technology to communicate and collaborate with peers in the field of education.	1	3.504	.948	22.465	.000
	2	4.345	.553		
	T	3.540	.950		
B16. I am prepared to use technology to support my own professional growth through activities such as online learning, research and collaborative projects.	1	3.325	.942	40.703	.000
	2	4.448	.506		
	T	3.373	.954		
B17. As appropriate to my field, I am prepared to consider social, ethical and legal implications of technology use in my lessons.	1	3.359	.873	36.161	.000
	2	4.345	.614		
	T	3.401	.886		

Section B of Questionnaire: Level of agreement about use of technology

For Faculty

There are two Turkish faculty groups in this study, Turkish faculty members with degrees from Turkish universities and Turkish faculty members with degrees from western universities. This section of the questionnaire included 14 different questions related to educational technology. A one-way ANOVA was used to examine differences between Turkish faculty members with degrees from Turkish universities and Turkish faculty members with degrees from western universities. Descriptive statistics for both groups are reported in Table 4.10 (pg. 89).

For these comparisons, a *p* value is 0.05 or smaller would indicate significant differences in mean scores between the two groups. For questions B4, B5, B6, B7, B8, B9, B11, B12, and B13, the *p* value was less than .05 and significant differences existed between the two groups. However, the results also indicated that there was no statistically significant difference between faculty groups for questions B1, B2, B3, B10, and B14.

- F (1,682) = .673, .415 > .05 for B1, "When designing my own lessons, I regularly include educational technologies where appropriate."
- F (1,682) =3.556, .063 > .05 for B2, "When selecting educational technologies, I refer to, and base my selections on, current research on their effectiveness."
- F (1,682) =1.810, .183 > .05 for B3, "I am comfortable planning for class sessions that involve student use of technology during instruction."
- F (1,682) = 2.028, .159 > .05 for B10, "I regularly use technology to communicate and collaborate with peers (e.g. email, threaded discussion boards, listserv, chat)."
- F (1,682) =1.815, .182 > .05 for B14, "As appropriate, I address social, ethical and legal implications of technology use with my students."

For all section B questions, the total mean score for Turkish faculty members with degrees from western universities was 4.626. In comparison, the total mean of Turkish faculty members with degrees from Turkish universities was 3.884. The largest mean difference for the level of agreement about the use of technology was question B6, "I have strategies for using technology to individualize instruction and meet the needs of diverse learners." Although 6.2% Turkish faculty members with degrees from Turkish universities selected the "does not apply" option for at least one question, none of the Turkish faculty members with degrees from western universities selected the "does not apply" and "strongly disagree" options for any of the 14 questions. All Turkish faculty members with degrees from western universities selected either agree or strongly agree about technology and the use of technology in

courses. In all 14 questions, the mean scores of Turkish faculty members with degrees from western universities were higher than their Turkish faculty counterparts, except question B10, "I regularly use technology to communicate and collaborate with peers (e.g. email, threaded discussion boards, listserv, and chat)." On this question, the mean score of Turkish faculty members with degrees from Turkish universities was higher than Turkish faculty members with degrees from western universities

Summary

This section focused on level of agreement regarding the use of technology between Turkish faculty members with degrees from Turkish universities and from western universities. Turkish faculty members with degrees from western universities had more responses of agree or strongly agree regarding technology and the use of technology in courses. There were no statistically significant differences between faculty groups for questions B1, "When designing my own lessons, I regularly include educational technologies where appropriate," B2, "When selecting educational technologies, I refer to, and base my selections on, current research on their effectiveness," B3, "I am comfortable planning for class sessions that involve student use of technology during instruction," B10, "I regularly use technology to communicate and collaborate with peers (e.g. email, threaded discussion boards, listserv, and chat)," and B14, "As appropriate, I address social, ethical and legal implications of technology use with my students." The response to these questions would suggest that both groups of faculty see themselves using educational technology at a similar level as they apply current research and knowledge to engage students in using technology and for planning class sessions. The data also suggests

that both faculty groups use technology for communicating with their peers. The remaining questions (those reflecting statistically significant differences) provide details regarding the use of technology within their classrooms and are related to a deeper understanding of educational technology. Turkish faculty members with degrees from western universities had larger mean scores than Turkish faculty members with degrees from Turkish universities. One explanation of why Turkish faculty members with degrees from western universities had more knowledge about the use of educational technology than Turkish faculty members with degrees from Turkish universities is that western education has progressed more rapidly in implementing educational technology in their classrooms which has deepened their (Turkish faculty with degrees from western universities) understanding of the value of technology in teaching (e.g., Project 2061, National Educational Technology Standards, EURYDICE: The Education Information Network, ERASMUS). As the number of Turkish faculty members who are exposed to western universities increase in Turkey, there will be greater potential to impact and change the Turkish educational system in a positive way.

Table 4.10: Means, Standard Deviation and One-Way ANOVA For Section B of Questionnaire for Turkish Faculty Members With Degrees From Turkish Universities (group 3), and Turkish Faculty Members With Degrees From Western Universities (group 4).
G: Group, M: Mean, SD: Standard Deviation, F: F-ratio, Sig: Significance, T: Total.

Does not Apply: 1, Strongly Disagree: 2, Disagree: 3, Agree: 4, Strongly Agree: 5 points.

Questions	G	M	SD	F	Sig.
B1. When designing my own lessons, I regularly include educational technologies where appropriate.	3	4.161	.995	.673	.415
	4	4.444	.727		
	T	4.197	.965		
B2. When selecting educational technologies, I refer to, and base my selections on, current research on their effectiveness.	3	3.807	.989	3.566	.063
	4	4.444	.527		
	T	3.887	.964		
B3. I am comfortable planning for class sessions that involve student use of technology during instruction.	3	3.903	.918	1.810	.183
	4	4.333	.707		
	T	3.958	.901		
B4. I have strategies for assessing student learning in technology-rich learning environments.	3	3.387	1.259	6.128	.016
	4	4.444	.527		
	T	3.521	1.241		
B5. I regularly use technology to enhance learning in my classroom.	3	3.903	.970	5.146	.026
	4	4.668	.707		
	T	4.000	.9711		
B6. I have strategies for using technology to individualize instruction and meet the needs of diverse learners.	3	3.468	1.067	13.110	.001
	4	4.778	.441		
	T	3.634	1.099		
B7. I am comfortable teaching with technology and have adequate classroom management strategies for technology-supported learning.	3	3.855	.989	7.303	.009
	4	4.778	.667		
	T	3.972	.999		
B8. I use technology to assess and analyze student progress e.g. using spreadsheets, grade books, or handheld computers/PDA's to record and manage assessment data.	3	3.774	.876	14.118	.000
	4	4.889	.333		
	T	3.916	.906		
B9. I have strategies for assessing student products created using technology.	3	3.919	1.029	6.041	.016
	4	4.778	.441		
	T	4.028	1.014		
B10. I regularly use technology to communicate and collaborate with peers (e.g. email, threaded discussion boards, listserv, and chat).	3	4.436	.668	2.028	.159
	4	4.111	.333		
	T	4.394	.643		
B11. I regularly use technology to increase my own professional productivity (word processing, spreadsheets, end note, PowerPoint, etc.).	3	4.258	.809	5.294	.024
	4	4.889	.333		
	T	4.338	.792		
B12. I have developed my own electronic portfolio.	3	3.597	1.016	11.731	.001
	4	4.778	.441		
	T	3.747	1.038		

Table 4.10 *Continued*

Questions	G	M	SD	F	Sig.
B13. I have a personal technology plan that guides my own technology-related professional development.	3	3.419	1.064	11.542	.001
	4	4.667	.707		
	T	3.578	1.104		
B14. As appropriate, I address social, ethical and legal implications of technology use with my students.	3	4.500	.594	1.815	.182
	4	4.778	.441		
	T	4.535	.581		

Section C of Questionnaire

Section C of questionnaire was divided into four categories, C1, C2, C3, and C4. For each category subjects were asked respond to the questions based on: "Current knowledge (K)", "Desired knowledge (D)", and "My assignments require or assume the use of this technology (A)." A one-way ANOVA and Post Hoc-Tukey analysis were used to examine differences between groups for these questions.

Category C1 of Questionnaire: "Ways in which computers can be used to"

Table 4.11 reflects the data from 8 questions in section C1, named "Ways in which computers can be used to."

For "current knowledge" (K), there was no statistically significant difference among the four groups for question K8, though there were significant differences among the four groups for all other questions. Post hoc analysis indicated that the graduate students' group had the highest mean total score (3.521) for all C1 questions; Turkish faculty members with degrees from western universities had the second highest mean total score (3.305); Turkish faculty with degrees from Turkish universities had third highest mean total score (3.199); and the pre-service teachers' group had the lowest mean total score (2.630) for all C1 questions. Although there was no statistically significant difference among the four groups for question K8, all

of the groups' mean scores for question 8 (which related to distance education) were the lowest of all of the questions in category C1.

For "desired knowledge" (D), there was no significant difference among groups for questions D2, D4, D6, and D8, but there were significant differences among groups for the other questions. All groups indicated a need to know (at a high or advance level) more information about "Ways in which computers can be used to" (Category C1). Turkish faculty members with degrees from western universities had the highest mean total score for all questions (4.625). Graduate students had the second highest mean total score (4.435) and pre-service students and faculty with degrees from Turkish universities group had the lowest mean total scores (4.395 and 4.244, respectively) for all questions.

For "my assignments require or assume the use of this technology" (A), there was no significant difference among the groups for question A1 though there were significant differences among the groups for all other questions. The pre-service teachers (2.812) and graduate students (2.806) had similar mean total scores for all questions. Turkish faculty members with degrees from Turkish universities also had similar total mean scores (2.996) for all questions. Turkish faculty with degrees from western universities had the highest total mean scores (4.152) for all questions in section C1.

- F (3,751) = 2.499, .058 > .05 for question C8,
- F (3,751) = 1.866, .134 > .05 for question D2,
- F (3,751) = 1.676, .171 > .05 for question D4,
- F (3,751) = 2.439, .063 > .05 for question D6,

- F (3,751) = 2.334, .073 > .05 for question D8,
- F (3,751) = 1.515, .209 > .05 for question A1.

As seen in Table 4.11 (pg. 97), these four groups had different levels of current knowledge about "Ways in which computers can be used to." The total mean score of pre-service teachers was 2.630 in the "current knowledge" subsection. Within "current knowledge," the highest mean score for a single question was 2.974 (question K5). Contrary, the lowest mean score for a single question was 2.041 (question K8). Graduate students' total mean score was 3.521 with the highest mean score for a single question of 4.552 (question K1) and the lowest mean score for a single question of 2.379 (question K8). The total mean score of Turkish faculty members with degrees from Turkish universities was 3.199. The highest mean score for a single question was 3.887 (question K2) and the lowest mean score for a single question was 2.177 (question K8). The total mean for Turkish faculty members who earned their degrees from western universities was 3.305. The highest mean score for a single question was 4.222 (question K2) and the lowest mean score for a single question was 1.444 (question C8).

In the "desired knowledge," the four groups indicated that they want to have higher and/or advance levels of knowledge about "Ways in which computers can be used to." Their levels of "desired knowledge" were the same in questions D2, D4, D6 and D8. Very interestingly, all groups wanted to know less about the question D5, "Entertain oneself (games)." The mean scores were from highest to lowest, 4.625 (Turkish faculty members with degrees from western universities), 4.435 (Turkish graduate student in the US), 4.395 (Turkish pre-service teacher), and 4.244 (Turkish

faculty members with degrees from Turkish universities). Although computers were not used as educational tools for pre-service teachers, evidence would indicate that they realize that computers are not just for playing games.

For "my assignments require or assume the use of this technology," the total mean score for pre-service teachers was 2.812. Within this subsection the highest mean score for a single question was 3.504 (question A1). Contrary, the lowest mean score for a single question was 1.739 (question A8). The total mean score for graduate students was 2.806. The highest mean score for a single question was 3.793 (question A1) and the lowest mean score for a single question was 1.862-1.897 (questions A5 and A8). The total mean score for Turkish faculty members with degrees from Turkish universities was 2.996. The highest mean score for a single question was 3.435 (question A1) and the lowest mean score for a single question was 2.339 (question A8). The total mean score for Turkish faculty members with degrees from western universities was 4.152. The highest mean score for a single question was 4.667 (question A6) and the lowest mean score for a single question was 2.111 (question A8).

The Post Hoc-Tukey Honest Significant Difference (HSD) test is based on the standardized maximum difference between the means. For each Post Hoc-Tukey HSD test, the "Mean Difference" column gives a comparison of each mean to every other mean. The significance ("Sig.") indicates if a mean difference is significant. The asterisk highlights means that are significantly different. There are four samples and six possible paired comparisons (comparisons between individual means) that can be performed. The Post Hoc-Tukey HSD test showed that there were

statistically significant differences among all groups. As seen in Tables 4.12 (pg. 98) and Table 4.13 (pg. 101), there was a pattern among groups. There were statistically significant differences between pre-service teachers (group 1) and graduate students (group 2); pre-service teachers (group 1) and Turkish faculty members with degrees from Turkish universities (group 3); pre-service teachers (group 1) and Turkish faculty members who earned their degrees from western universities (group 4) in all questions for "current knowledge," except question K8, "Teach students at a distance."

There was a similar pattern for "my assignments require or assume the use of this technology." Differences were found between pre-service teachers (group 1) and Turkish faculty members who earned their degrees from western universities (group 4); graduate students (group 2) and Turkish Faculty members with degrees from Turkish universities (group 3); Turkish Faculty members with degrees from Turkish universities (group 3) and Turkish Faculty members who earned their degrees from western universities (group 4) for the following questions: "statistical analysis and research" (question A3), "Class management (develop syllabi, track grades)" (question A4), entertain oneself (games)" (question A5), "deliver individual learning (computer aided learning)" (question A6), and "design of instructional materials" (question A7). The largest difference among all groups was between pre-service teachers (group 1) and Turkish faculty members who earned their degrees from western universities (group 4) in Category C1, "Ways in which computers can be used to."

Summary

The mean scores of Turkish pre-service teachers, Turkish graduate students, and Turkish faculty members with degrees from Turkish universities proved to be very similar. However, Turkish faculty members with degrees from western universities mean scores indicated differences from all other groups. Although all four groups had their lowest mean scores on the same question (question A8), "Teach students at a distance," Turkish pre-service teachers, Turkish graduate students, and Turkish faculty members with degrees from Turkish universities had their highest mean scores in question A1, "Composing / writing papers (Word processing)," while Turkish faculty with degrees from western universities had their highest mean score in question A6, "Deliver individual learning (computer aided learning)." Question 5, "Entertain oneself (games)," had the lowest mean score for graduate students and Turkish faculty with degrees from Turkish universities, but the highest mean score for pre-service teachers.

Using the following as a definition of range: 1.000 to 1.999 is "very low," from 2.000 to 2.999 is "low," from 3.000 to 3.999 "medium," 4.000 to 4.999 "high," and 5.000 "advanced" level, the pre-service teachers group's current knowledge was in the "low" range, with all remaining groups' current knowledge in the "medium" range. All four groups' total mean scores were in the high range in the "desired knowledge." For "my assignments require or assume the use of this technology" all four groups' total mean scores were in the "seldom" range, except Turkish faculty members with degrees from western universities ("often" range).

For “current knowledge” and “my assignments require or assume the use of this technology,” differences were found among all four groups for all but one question. Graduate students and Turkish faculty members with degrees from western universities acknowledged computers can be used in many ways and Turkish pre-service teachers had the lowest total mean score for C1 of the questionnaire. Thus, the data would indicate that the computers may not be seen as a viable teaching tool for Turkish pre-service teachers. “Teaching students at distance,” (primarily providing instruction while the students and faculty members are at different places) is a specialized educational field and all four groups indicated a need to receive further instruction in this area.

Table 4.11: Means, Standard Deviation, F, Significance Level (α=.05) and One-Way ANOVA for "Ways in which computers can be used to" (Category C1) for Pre-service Teachers (group 1), Graduate Students (group 2), Turkish Faculty Members With Degrees From Turkish Universities (group 3), and Turkish Faculty Members With Degrees From Western Universities (group 4).
Q: Questions, G: Groups, M: Mean, SD: Standard Deviation, T: Total.
K: Current knowledge, D: Desired Knowledge, A: My Assignments Require or Assume the Use of This Technology.

QUESTION
1) Composing/writing papers (Word processing), 2) Personal record keeping, 3) Statistical analysis and research, 4) Class management (develop syllabi, track grades), 5) Entertain oneself (games).

		(K): Very Low:1, Low:2, Medium:3, High:4, Advanced:5 points				(D): Very Low:1, Low:2, Medium:3, High:4, Advanced:5 points				(A): Never:1, Seldom:2, Sometimes:3, Often:4, Usually:5 points			
Q	G	M	SD	F	Sig	M	SD	F	Sig	M	SD	F	Sig
1	1	2.875	.907	48.81	.000	4.548	.664	3.533	.015	3.504	.953	1.515	.209
	2	4.552	.506			4.862	.518			3.793	.774		
	3	3.661	.904			4.597	.613			3.436	.861		
	4	4.000	.000			5.000	.000			3.889	.333		
	T	3.017	.971			4.570	.655			3.514	.936		
2	1	2.944	.999	30.88	.000	4.521	.695	1.866	.134	3.131	1.093	4.937	.002
	2	3.966	.499			4.414	.628			3.414	.682		
	3	3.887	.851			4.581	.588			3.145	1.084		
	4	4.222	.441			5.000	.000			4.444	1.130		
	T	3.076	1.025			4.527	.682			3.159	1.088		
3	1	2.412	.9472	24.04	.000	4.408	.693	4.221	.006	2.864	1.135	6.554	.000
	2	3.207	.940			4.690	.541			2.793	1.567		
	3	3.161	.909			4.532	.620			2.790	1.147		
	4	3.889	.333			5.000	.000			4.556	.882		
	T	2.522	.982			4.436	.683			2.876	1.166		
4	1	2.686	1.013	38.36	.000	4.565	.676	1.676	.171	2.908	1.172	5.993	.000
	2	4.000	.756			4.586	.780			2.862	1.187		
	3	3.694	.841			4.468	.671			2.952	1.047		
	4	4.000	.000			5.000	.000			4.556	1.014		
	T	2.834	1.057			4.563	.677			2.930	1.173		
5	1	2.974	1.128	9.987	.000	3.823	1.07	17.25	.000	2.595	1.248	16.06	.000
	2	2.862	.639			3.828	.658			1.862	.953		
	3	2.419	1.124			2.839	1.24			3.258	1.039		
	4	1.444	.882			3.111	.333			4.444	1.130		
	T	2.906	1.131			3.734	1.20			2.644	1.257		

Table 4.11 *Continued*

QUESTION 6) Deliver individual learning (computer aided learning). 7) Design of instructional materials, 8) Teach students at a distance.													
		(K): Very Low:1, Low:2, Medium:3, High:4, Advanced:5 points				(D): Very Low:1, Low:2, Medium:3, High:4, Advanced:5 points				(A): Never:1, Seldom:2, Sometimes:3, Often:4, Usually:5 points			
Q	G	M	SD	F	Sig	M	SD	F	Sig	M	SD	F	Sig
6	1	2.554	1.040	21.18	.000	4.563	.620	2.439	.063	2.823	1.102	8.629	.000
	2	3.724	.649			4.448	.828			2.759	.872		
	3	3.177	.950			4.436	.692			2.919	1.091		
	4	3.667	.707			4.111	.333			4.667	.707		
	T	2.664	1.058			4.543	.634			2.850	1.106		
7	1	2.560	1.010	24.46	.000	4.550	.613	3.363	.018	2.937	1.181	6.333	.000
	2	3.483	.634			4.276	1.07			3.069	.458		
	3	3.419	1.033			4.484	.741			3.129	1.048		
	4	3.778	.441			5.000	.000			4.556	1.014		
	T	2.681	1.042			4.539	.647			2.978	1.162		
8	1	2.041	.991	2.499	.058	4.182	.925	2.334	.073	1.739	.883	8.548	.000
	2	2.379	.942			4.379	.677			1.897	.939		
	3	2.177	1.064			4.016	1.09			2.339	1.227		
	4	1.444	.882			4.778	.441			2.111	.782		
	T	2.060	.998			4.183	.931			1.799	.931		

Table 4.12. Multiple Comparisons-Tukey HSD for "Ways in which computers can be used to" (Category C1) for Pre-service Teachers (group 1), Graduate Students (group 2), Turkish Faculty Members With Degrees From Turkish Universities (group 3), and Turkish Faculty Members With Degrees From Western Universities (group 4). K: Current knowledge, D: Desired Knowledge, A: My assignments require or assume the use of this technology, Q: Questions, G: Groups, MD: Mean Difference

Q	G	G	Sig	Q	G	G	Sig	Q	G	G	Sig
K1	1	2	.000	D1	1	2	.055	A1	1	2	.362
		3	.000			3	.943			3	.947
		4	.001			4	.165			4	.610
	2	1.	.000		2	1.	.055		2	1.	.362
		3	.000			3	.269			3	.324
		4	.365			4	.945			4	.993
	3	1	.000		3	1	.943		3	1	.947
		2	.000			2	.269			2	.324
		4	.710			4	.306			4	.525
	4	1	.001		4	1	.165		4	1	.610
		2	.365			2	.945			2	.993
		3	.710			3	.306			3	.525

*The mean difference is significant at the .05 level.

Table 4.12 *Continued*

Q	G	G	Sig	Q	G	G	Sig	Q	G	G	Sig
K2	1	2	.000	D2	1	2	.841	A2	1	2	.513
		3	.000			3	.911			3	1.00
		4	.001			4	.154			4	.002
	2	1.	.000		2	1.	.841		2	1.	.513
		3	.984			3	.696			3	.686
		4	.899			4	.109			4	.060
	3	1	.000		3	1	.911		3	1	1.00
		2	.984			2	.696			2	.686
		4	.767			4	.310			4	.004
	4	1	.001		4	1	.154		4	1	.002
		2	.899			2	.109			2	.060
		3	.767			3	.310			3	.004
K3	1	2	.000	D3	1	2	.127	A3	1	2	.988
		3	.000			3	.511			3	.963
		4	.000			4	.047			4	.000
	2	1.	.000		2	1.	.127		2	1.	.988
		3	.996			3	.731			3	1.00
		4	.228			4	.628			4	.000
	3	1	.000		3	1	.511		3	1	.963
		2	.996			2	.731			2	1.00
		4	.132			4	.215			4	.000
	4	1	.000		4	1	.047		4	1	.000
		2	.228			2	.628			2	.000
		3	.132			3	.215			3	.000
K4	1	2	.000	D4	1	2	.998	A4	1	2	.997
		3	.000			3	.701			3	.992
		4	.000			4	.222			4	.000
	2	1.	.000		2	1.	.998		2	1.	.997
		3	.512			3	.864			3	.986
		4	1.00			4	.377			4	.001
	3	1	.000		3	1	.701		3	1	.992
		2	.512			2	.864			2	.986
		4	.820			4	.122			4	.001
	4	1	.000		4	1	.222		4	1	.000
		2	1.00			2	.377			2	.001
		3	.820			3	.122			3	.001
K5	1	2	.952	D5	1	2	1.000	A5	1	2	.009
		3	.001			3	.000			3	.000
		4	.000			4	.192			4	.000
	2	1.	.952		2	1.	1.000		2	1.	.009
		3	.288			3	.000			3	.000
		4	.005			4	.292			4	.000
	3	1	.001		3	1	.000		3	1	.000
		2	.288			2	.000			2	.000
		4	.067			4	.890			4	.033
	4	1	.000		4	1	.192		4	1	.000
		2	.005			2	.292			2	.000
		3	.067			3	.890			3	.033

*The mean difference is significant at the .05 level.

Table 4.12 *Continued*

Q	G	G	Sig	Q	G	G	Sig	Q	G	G	Sig
K6	1	2	.000	D6	1	2	.773	A6	1	2	.990
		3	.000			3	.425			3	.910
		4	.006			4	.144			4	.000
	2	1.	.000		2	1.	.773		2	1.	.990
		3	.081			3	1.000			3	.914
		4	.999			4	.502			4	.000
	3	1	.000		3	1	.425		3	1	.910
		2	.081			2	1.000			2	.914
		4	.533			4	.476			4	.000
	4	1	.006		4	1	.144		4	1	.000
		2	.999			2	.502			2	.000
		3	.533			3	.476			3	.000
K7	1	2	.000	D7	1	2	.113	A7	1	2	.931
		3	.000			3	.869			3	.593
		4	.002			4	.159			4	.000
	2	1.	.000		2	1.	.113		2	1.	.931
		3	.992			3	.477			3	.996
		4	.865			4	.017			4	.004
	3	1	.000		3	1	.869		3	1	.593
		2	.992			2	.477			2	.996
		4	.744			4	.112			4	.003
	4	1	.002		4	1	.159		4	1	.000
		2	.865			2	.017			2	.004
		3	.744			3	.112			3	.003
K8	1	2	.282	D8	1	2	.676	A8	1	2	.802
		3	.738			3	.536			3	.000
		4	.278			4	.223			4	.621
	2	1.	.282		2	1.	.676		2	1.	.802
		3	.804			3	.304			3	.141
		4	.067			4	.674			4	.928
	3	1	.738		3	1	.536		3	1	.000
		2	.804			2	.304			2	.141
		4	.165			4	.099			4	.899
	4	1	.278		4	1	.223		4	1	.621
		2	.067			2	.674			2	.928
		3	.165			3	.099			3	.899

*The mean difference is significant at the .05 level.

Table 4. 13. Summary of Multiple Comparison Mean Differences. C1: "Ways in which computers can be used to."

Statement	Current Knowledge (K)						Desired Knowledge (D)						My assignments require or assume the use of this technology (A)					
	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
1) Composing / writing papers (Word processing).	*	*	*	*														
2) Personal record keeping.	*	*	*												*			*
3) Statistical analysis and research.	*	*	*						*						*	*		*
4) Class management (develop syllabi, track grades).	*	*	*												*	*		*
5) Entertain one-self (games).		*	*		*			*		*			*	*	*	*	*	*
6) Deliver individual learning (computer aided learning).	*	*	*												*	*		*
7) Design of instructional materials.	*	*	*								*				*	*		*
8) Teach students at a distance.														*				

Asterisks (*) indicate significant ($p < .05$) difference among four groups: Categories of comparisons are as follows: 1-pre-service teachers versus graduate students, 2- pre-service teachers versus Turkish faculty members with degrees from Turkish universities, 3- pre-service teachers versus Turkish faculty members who earned their degrees from western universities 4- graduate students versus Turkish Faculty members with degrees from Turkish universities 5- Graduate students versus Turkish Faculty members who earned their degrees from western universities 6- Turkish Faculty members with degrees from Turkish universities versus Turkish Faculty members who earned their degrees from western universities.

Category C2 of Questionnaire: "How to use a computer in science for"

The mean scores in Category C2 for each level of knowledge (current knowledge, desired knowledge, and my assignments require or assume the use of this technology) were different for each group, except for questions D1, D2, D4, D5, D9, D19, and D20 in "desired knowledge" and the mean scores of questions A11, A16 in "My assignments require or assume the use of this technology." There were no statistically significant differences among the four groups for questions D1, D2, D4, D5, D9, D20, A11, and A16. There were no differences among groups that

represented systematic effects (e.g., social, economical) for these questions D1, D2, D4, D5, D9, D20, A11, and A16. For the rest of questions, there were statistically significant differences among all groups (Table 4.15, pg. 112).

- F (3,751) = 2.152, .092 > .05 for question D1, Library search services (data collection using peripherals)"
- F (3,751) = .518, .670 > .05 for question D2, "Database storage of lab data"
- F (3,751) = 1.794, .147 > .05 for question D4, "Graphing"
- F (3,751) = 1.800, .146 > .05 for question D5, "Computer assisted instruction"
- F (3,751) = 2.051, .105 > .05 for question D9, "Science-technology-society issues"
- F (3,751) = 2.130, .095 > .05 for question D19, "Web browsers - Basic functionality and efficiency (e.g. Netscape, Internet explorer)"
- F (3,751) = 1.094, .351 > .05 for question D20, "Web search techniques"
- F (3,751) = 2.128, .095 > .05 for question A11, "Databases (e.g. Access, FileMaker)"
- F (3,751) = 1.593, .190 > .05 for question A16, "Web publishing (e.g. Dream Weaver, Page-Mill, Navigator, Web-CT or similar)."

For "current knowledge" regarding the various purposes for using computers within science instruction, the total mean score for pre-service teachers was 2.394. For "current knowledge" the highest mean score for a single question was 3.185 (question 12). The lowest mean score for single question was 1.524 (question 23). Graduate students' total mean for "current knowledge" was 3.610. The highest mean score for a single question was 4.862 (question 12). The lowest mean score for single

question was 2.448 (question 23). For Turkish faculty members with degrees from Turkish universities, the total mean score for "current knowledge" was 2.951. The highest and lowest mean score for a single question was 4.000 (question 12) and 1.991 (question 23). In comparison, Turkish faculty members who earned their degrees from western universities the total mean score for "current knowledge" was 3.256 with the highest mean score 5.000 for questions 11, 12, 13. The lowest mean score for a single question was 2.000 (question 23).

For questions on the various purposes for using computers within science instruction, "desired knowledge" total mean scores of pre-service teachers was 4.367, for graduate students 4.430, for Turkish faculty members with degrees from Turkish universities 4.237, and for Turkish faculty members with degrees from western universities 4.372. All of these mean scores reflect that all groups wanted to know more information about various purposes for using computers within science instruction.

For "my assignments require or assume the use of this technology," the total mean score of pre-service teachers was 2.538. For all pre-service teachers the highest mean score for a single question was 3.771 (question 1) and the lowest mean score for a single question was 1.776 (question 23). Graduate students' total mean score for "my assignments require or assume the use of this technology" was 2.898. The highest mean score for the graduate students' on a single question was 4.241 (question 1). The lowest mean score for a single question was 1.896 (question 18). The total mean score of Turkish faculty members with degrees from Turkish universities was 2.824 and the highest mean score for a single question was 3.694

(questions 12). Contrary, the lowest mean score for a single question was 2.097 (question 23). Finally, the mean score for Turkish faculty members with degrees from western universities was 3.372. While the highest mean score for a single question was 4.778 (questions 12) and the lowest mean score for a single question was 1.333 (question 23).

The Post Hoc-Tukey HSD test showed that there was a statistically significant difference among all groups. As seen in Tables 4.15 (pg. 112) and Table 4.16 (pg. 118), there were some distinct patterns regarding these differences among groups. The first patterns observed were the differences between pre-service teachers and graduate students, pre-service teachers and Turkish faculty members with degrees from Turkish universities, in all question of "current knowledge," except for questions K2, "Database storage of lab data;" K5, "Computer assisted instruction;" K7, "Individualized instruction;" and K10, "Spreadsheets (e.g. Excel)." Another pattern observed was the differences between pre-service teachers and graduate students, pre-service teachers and Turkish faculty members with degrees from Turkish universities, and pre-service teachers and Turkish faculty members who earned their degrees from western universities in for questions K1, "Library search services (data collection using peripherals);" K3, "Demonstrations and modeling;" K9, "Science-technology-society issues;" K12, "E-mail;" K13, "Communication tools (e.g. list-servers, chat, discussion boards);" K14, "PowerPoint, Astound;" K17, "Video editing software (e.g. iMovie, Adobe Premiere);" K18, "Graphic peripherals (e.g. Scanners, digital cameras);" K21, "Technologies specific to your field (e.g. probe-ware in the sciences, geographic information systems in the social sciences);"

and K22, “Data analysis software (e.g. SPSS, SAS, other statistics or analysis software).”

There was a similar pattern in the “my assignments require or assume the use of this technology.” The pattern found between pre-service teachers (group 1) and Turkish faculty members who earned their degrees from western universities (group 4), graduate students (group 2) and Turkish Faculty members with degrees from Turkish universities (group 3), Turkish Faculty members with degrees from Turkish universities (group 3) and Turkish Faculty members who earned their degrees from western universities (group 4) for questions A5, “Computer assisted instruction;” A6, “Problem solving;” A7, “Individualized instruction;” A9, “Science-technology-society issues;” A13, “Communication tools (e.g. list-servers, chat, discussion boards);” A17, “Video editing software (e.g. iMovie, Adobe Premiere);” A18, “Graphic peripherals (e.g. Scanners, digital cameras);” and A20, “Web search techniques.” The largest differences observed among all groups were between pre-service teachers and graduate students, pre-service teachers and Turkish faculty members who have earned their degrees from Turkish universities in the Category C2, “How to use a computer in science for.”

Summary

The responses showed that there were significant differences between all groups. This would indicate that the gap between current and “desired knowledge” was substantial for many computer-based applications within science teaching. Similar mean scores were found in three subsections of Category C2, “How to use a computer in science for.” A number of statistically significant differences in the

means were between pre-service teachers and graduate students. The graduate students and Turkish faculty members with degrees from western universities had the highest mean scores in "current knowledge" and "my assignments require or assume the use of this technology," but all groups' mean scores were similar for "desired knowledge." Like Category C1, "Ways in which computers can be used to," all groups wanted to know much more information about various purposes for using computers within science instruction. Question 23, "Creation and/or use of streaming media," had the lowest mean score and question 12, "Email," had the highest mean for all groups in "current knowledge." Communication was the tool that had the highest mean for "current knowledge."

Range definitions for mean scores are 1.000 to 1.999 "very low" knowledge, from 2.000 to 2.999 "low" knowledge, 3.000 to 3.999 "medium" knowledge, 4.000 to 4.999 "high" knowledge, and 5.000 "advanced" knowledge. Pre-service teachers and Turkish faculty members with degrees from Turkish universities were both in the low range for knowledge. Graduate students and Turkish faculty members with degrees from western universities were in the medium range for "current knowledge." But all groups' mean scores were in the high range for "desired knowledge." Accordingly the range definitions for "my assignments require or assume the use of this technology" are 1.000 to 1.999 "never," 2.000 to 2.999 "seldom," 3.000 to 3.999 "sometimes," 4.000 to 4.999 "often," and 5.000 "usually." All groups fell in the "seldom" range in the "my assignments require or assume the use of this technology."

Another important set of questions addressed using technology, computers and the Internet to enhance teaching and learning. Creating websites and learning

advanced web programming, such as Web publishing (e.g., Dream Weaver, Page-Mill, Navigator, Web-CT or other similar programs), other multimedia authoring software (e.g., Author-ware, Hyper-studio, Macromedia), and Video editing software (e.g., iMovie, Adobe Premiere), were of lowest interest to Turkish pre-service teachers and Turkish faculty members with degrees from Turkish universities. The exception was for "web search techniques" (question 20).

The responses in Category C2, "How to use a computer in science for," revealed a need to better understand how computers might be used as scientific research tools, such as library search, gathering and storing data, modeling and demonstrating, analyzing and communicating findings.

Table 4.14: Means, Standard Deviation, F, Significance Level (α=.05) and One-Way ANOVA for "How to use a computer in science for" (Category C2) for Pre-service Teachers (group 1), Graduate Students (group 2), Turkish Faculty Members With Degrees From Turkish Universities (group 3), and Turkish Faculty Members With Degrees From Western Universities (group 4).
Q: Questions, G: Groups, M: Mean, SD: Standard Deviation, T: Total.
K: Current knowledge, D: Desired Knowledge, A: My Assignments Require or Assume the Use of This Technology.

QUESTIONS

1. Library search services (data collection using peripherals). 2. Database storage of lab data. 3. Demonstrations and modeling. 4. Graphing. 5. Computer assisted instruction.

		(K): Very Low:1 Low:2 Medium:3 High:4 Advanced:5 points				(D): Very Low:1 Low:2 Medium:3 High:4 Advanced:5 points				(A): Never:1 Seldom:2 Sometimes:3 Often:4 Usually:5 points			
Q	G	M	SD	F	Sig	M	SD	F	Sig	M	SD	F	Sig
1	1	3.081	1.03	21.61	.000	4.534	.651	21.61	.000	3.371	1.17	6.134	.000
	2	4.276	.455			4.690	.660			4.241	.435		
	3	3.726	1.04			4.597	.613			3.194	1.05		
	4	4.000	.000			5.000	.000			3.222	.667		
	T	3.191	1.05			4.551	.646			3.388	1.15		
2	1	2.174	1.08	43.22	.000	4.359	.769	43.22	.000	2.518	1.18	8.434	.000
	2	4.069	.704			4.448	.870			3.414	.825		
	3	3.161	1.10			4.307	.879			2.758	1.04		
	4	2.333	.707			4.111	.333			1.556	1.33		
	T	2.330	1.15			4.355	.778			2.560	1.10		
3	1	2.350	1.05	44.66	.000	4.380	.704	44.66	.000	2.635	1.13	5.457	.001
	2	4.103	.618			4.621	.622			3.345	.670		
	3	3.048	1.17			4.258	.829			2.968	1.10		
	4	4.556	.882			4.889	.333			2.333	1.00		
	T	2.501	1.13			4.385	.713			2.686	1.12		
4	1	2.527	1.11	8.707	.000	4.383	.701	8.707	.000	2.785	1.13	3.997	.008
	2	3.172	.929			4.276	.841			2.621	1.12		
	3	3.129	1.17			4.419	.667			2.903	1.05		
	4	2.222	.667			4.889	.333			1.556	1.33		
	T	2.597	1.12			4.388	.710			2.774	1.13		
5	1	2.765	1.02	3.298	.020	4.544	.669	3.298	.020	2.971	1.17	7.133	.000
	2	2.897	.618			4.448	.870			2.690	.712		
	3	3.161	1.10			4.419	.915			2.968	1.10		
	4	3.111	.333			4.111	.333			4.667	1.00		
	T	2.807	1.01			4.525	.699			2.981	1.16		

Table 4.14 *Continued*

QUESTIONS 6. Problem solving. 7. Individualized instruction. 8. Analysis of lab data. 9. Science-technology-society issues. 10. Spreadsheets (e.g., Excel). 11. Databases (e.g., Access, filemaker).													
		(K): Very Low:1 Low:2 Medium:3 High:4 Advanced:5 points				(D): Very Low:1 Low:2 Medium:3 High:4 Advanced:5 points				(A): Never:1 Seldom:2 Sometimes:3 Often:4 Usually:5 points			
Q	G	M	SD	F	Sig	M	SD	F	Sig	M	SD	F	Sig
6	1	2.638	.996	17.37	.000	4.512	.656	17.37	.000	2.820	1.16	9.055	.000
	2	3.655	.814			4.655	.721			2.966	1.12		
	3	2.919	.874			4.323	.805			2.806	.846		
	4	4.111	.333			5.000	.000			4.778	.667		
	T	2.718	1.01			4.507	.672			2.847	1.16		
7	1	2.760	.965	13.03	.000	4.519	.665	13.03	.000	2.997	1.13	9.350	.000
	2	3.172	.966			3.862	.990			2.586	.568		
	3	3.355	.943			4.484	.695			3.065	.921		
	4	4.000	.000			5.000	.000			4.778	.667		
	T	2.840	.981			4.497	.692			3.008	1.11		
8	1	2.260	.983	29.63	.000	4.373	.785	29.63	.000	2.519	1.09	6.643	.000
	2	3.690	.471			4.103	.860			3.379	.775		
	3	3.000	.958			4.210	.926			2.548	.881		
	4	2.333	1.00			2.667	1.323			2.111	.333		
	T	2.376	1.02			4.329	.830			2.550	1.07		
9	1	2.811	.977	15.10	.000	4.486	.699	15.10	.000	2.986	1.07	7.659	.000
	2	3.552	.632			4.517	.871			2.862	.875		
	3	3.355	.889			4.387	.662			3.016	1.03		
	4	4.000	.000			5.000	.000			4.667	.707		
	T	2.898	.981			4.485	.701			3.004	1.07		
10	1	2.959	1.06	18.75	.000	4.484	.756	18.75	.000	2.997	1.13	2.953	.032
	2	4.345	.670			4.828	.539			3.345	1.23		
	3	3.194	1.14			4.290	.930			2.887	1.13		
	4	3.889	.333			5.000	.000			3.889	.333		
	T	3.042	1.08			4.487	.766			3.012	1.13		
11	1	1.983	1.04	13.97	.000	4.317	.805	13.97	.000	2.342	1.16	2.128	.095
	2	3.035	1.09			4.414	.907			2.552	.985		
	3	2.548	1.21			3.984	1.09			2.177	1.06		
	4	2.000	.500			3.333	.707			3.111	.333		
	T	2.070	1.08			4.282	.845			2.346	1.14		

Table 4.14 *Continued*

QUESTIONS 12. Email. 13. Communication tools (e.g., List-servers, chat, discussion boards...). 14. PowerPoint, Astound. 15. Other multimedia authoring software (e.g., Author-ware, Hyper-studio, Macromedia). 16. Web publishing (e.g., Dream weaver, page-mill, navigator, web-CT or similar). 17. Video editing software (e.g., iMovie, adobe premiere).													
		(K): Very Low:1 Low:2 Medium:3 High:4 Advanced:5 points				(D): Very Low:1 Low:2 Medium:3 High:4 Advanced:5 points				(A): Never:1 Seldom:2 Sometimes:3 Often:4 Usually:5 points			
Q	G	M	SD	F	Sig	M	SD	F	Sig	M	SD	F	Sig
12	1	3.185	1.21	32.95	.000	4.412	.798	32.95	.000	2.951	1.25	18.58	.000
	2	4.862	.516			4.793	.559			3.966	.981		
	3	4.000	1.01			4.597	.586			3.694	1.01		
	4	5.000	.000			5.000	.000			4.778	.441		
	T	3.338	1.24			4.449	.777			3.073	1.26		
13	1	2.802	1.20	9.152	.000	4.289	.840	9.152	.000	2.701	1.21	10.54	.000
	2	3.759	.577			4.552	.686			3.276	.882		
	3	2.758	1.14			4.032	1.01			3.081	1.19		
	4	2.000	1.07			4.222	.441			4.556	1.01		
	T	2.829	1.16			4.277	.849			2.776	1.22		
14	1	2.889	1.23	27.32	.000	4.432	.787	27.32	.000	2.786	1.16	17.71	.000
	2	4.552	.632			4.862	.516			3.793	.819		
	3	3.387	1.25			4.419	.897			3.242	1.24		
	4	4.889	.333			5.000	.000			4.778	.667		
	T	3.017	1.27			4.454	.789			2.886	1.19		
15	1	1.853	1.03	23.95	.000	4.227	.877	23.95	.000	2.105	1.13	2.931	.033
	2	3.379	.494			4.379	.903			2.207	.620		
	3	2.323	1.10			3.919	.980			2.371	1.16		
	4	2.222	.441			4.889	.333			3.000	.500		
	T	1.955	1.07			4.216	.889			2.142	1.12		
16	1	1.846	1.06	16.52	.000	4.229	.925	16.52	.000	2.044	1.11	1.593	.190
	2	3.138	.990			4.207	.774			2.172	1.04		
	3	2.258	1.06			3.936	1.05			2.355	1.10		
	4	2.333	.707			4.778	.667			2.111	.333		
	T	1.935	1.09			4.211	.932			2.076	1.10		
17	1	1.895	1.04	16.90	.000	4.295	.886	16.90	.000	2.076	1.09	14.85	.000
	2	2.759	.912			4.172	1.20			2.000	.378		
	3	2.371	1.04			3.935	1.04			2.274	1.12		
	4	3.556	1.01			4.111	.333			4.444	1.13		
	T	1.987	1.07			4.258	.913			2.118	1.11		

Table 4.14 *Continued*

QUESTIONS: 18. Graphic peripherals (e.g., Scanners, digital cameras). 19. Web browsers - Basic functionality and efficiency (e.g., Netscape, Internet explorer). 20. Web search techniques. 21. Technologies specific to your field (e.g., Probe-ware in the sciences, geographic information systems in the social sciences). 22. Data analysis software (e.g., SPSS, SAS, other statistics or analysis software). 23. Creation and/or use of streaming media.													
		(K): Very Low:1 Low:2 Medium:3 High:4 Advanced:5 points				(D): Very Low:1 Low:2 Medium:3 High:4 Advanced:5 points				(A): Never:1 Seldom:2 Sometimes:3 Often:4 Usually:5 points			
Q	G	M	SD	F	Sig	M	SD	F	Sig	M	SD	F	Sig
18	1	2.008	1.08	16.33	.000	4.342	.833	16.33	.000	2.036	1.09	10.44	.000
	2	2.690	.930			4.172	.966			1.896	.724		
	3	2.855	1.33			4.226	.948			2.435	1.11		
	4	3.000	.000			2.667	1.32			3.778	.441		
	T	2.115	1.12			4.306	.873			2.085	1.09		
19	1	2.288	1.20	31.67	.000	4.359	.815	31.67	.000	2.505	1.27	4.319	.005
	2	4.207	.559			4.724	.591			2.931	.884		
	3	3.081	1.16			4.290	.982			2.935	1.11		
	4	2.556	1.13			4.222	.441			3.333	.707		
	T	2.431	1.24			4.366	.822			2.567	1.25		
20	1	2.360	1.17	29.32	.000	4.362	.812	29.32	.000	2.498	1.21	7.949	.000
	2	4.276	.591			4.552	1.24			2.897	1.57		
	3	2.968	1.27			4.226	.999			2.903	1.16		
	4	2.556	1.13			4.222	.441			4.111	.333		
	T	2.486	1.22			4.356	.846			2.566	1.22		
21	1	1.896	.965	47.92	.000	4.319	.843	47.92	.000	2.122	1.11	2.936	.033
	2	3.690	1.14			4.448	.870			2.689	1.44		
	3	2.548	1.16			4.177	.950			2.339	1.20		
	4	3.889	.333			5.000	.000			2.333	1.00		
	T	2.042	1.07			4.321	.851			2.164	1.14		
22	1	1.571	.821	106.6	.000	4.173	.953	106.6	.000	1.826	.983	11.49	.000
	2	3.310	.967			3.897	1.47			2.689	1.29		
	3	2.807	1.19			4.274	.908			2.323	1.05		
	4	4.667	.707			5.000	.000			2.333	.707		
	T	1.776	1.03			4.180	.973			1.906	1.02		
23	1	1.524	.791	16.14	.000	4.109	.961	16.14	.000	1.776	.959	3.823	.010
	2	2.448	.827			4.276	.882			2.138	.953		
	3	1.919	1.11			3.742	1.17			2.097	1.22		
	4	2.000	.000			2.444	.882			1.333	.707		
	T	1.597	.843			4.066	.997			1.811	.987		

Table 4.15. Multiple Comparisons-Tukey HSD for "How to use a computer in science for" (Category C2) for Pre-service Teachers (group 1), Graduate Students (group 2), Turkish Faculty Members With Degrees From Turkish Universities (group 3), and Turkish Faculty Members With Degrees From Western Universities (group 4). K: Current knowledge, D: Desired Knowledge, A: My assignments require or assume the use of this technology, Q: Questions, G: Groups, MD: Mean Difference

Q	G	G	Sig	Q	G	G	Sig	Q	G	G	Sig
K1	1	2	.000	D1	1	2	.000	A1	1	2	.000
		3	.000			3	.002			3	.645
		4	.034			4	.307			4	.980
	2	1.	.000		2	1.	.000		2	1.	.000
		3	.073			3	.022			3	.000
		4	.890			4	.478			4	.089
	3	1	.000		3	1	.002		3	1	.645
		2	.073			2	.022			2	.000
		4	.871			4	.993			4	1.00
	4	1	.034		4	1	.307		4	1	.980
		2	.890			2	.478			2	.089
		3	.871			3	.993			3	1.00
K2	1	2	.000	D2	1	2	.583	A2	1	2	.000
		3	.000			3	.886			3	.399
		4	.970			4	.138			4	.064
	2	1.	.000		2	1.	.583		2	1.	.000
		3	.001			3	.919			3	.058
		4	.000			4	.588			4	.000
	3	1	.000		3	1	.886		3	1	.399
		2	.001			2	.919			2	.058
		4	.129			4	.297			4	.019
	4	1	.970		4	1	.138		4	1	.064
		2	.000			2	.588			2	.000
		3	.129			3	.297			3	.019
K3	1	2	.000	D3	1	2	.930	A3	1	2	.005
		3	.000			3	.958			3	.112
		4	.000			4	.779			4	.851
	2	1.	.000		2	1.	.930		2	1.	.005
		3	.000			3	.850			3	.435
		4	.668			4	.669			4	.082
	3	1	.000		3	1	.958		3	1	.112
		2	.000			2	.850			2	.435
		4	.000			4	.896			4	.381
	4	1	.000		4	1	.779		4	1	.851
		2	.668			2	.669			2	.082
		3	.000			3	.896			3	.381

*The mean difference is significant at the .05 level.

Table 4.15 *Continued*

Q	G	G	Sig	Q	G	G	Sig	Q	G	G	Sig
K4	1	2	.011	D4	1	2	.280	A4	1	2	.868
		3	.000			3	.566			3	.858
		4	.843			4	.142			4	.006
	2	1.	.011		2	1.	.280		2	1.	.868
		3	.998			3	.105			3	.679
		4	.108			4	.755			4	.063
	3	1	.000		3	1	.566		3	1	.858
		2	.998			2	.105			2	.679
		4	.097			4	.062			4	.005
	4	1	.843		4	1	.142		4	1	.006
		2	.108			2	.755			2	.063
		3	.097			3	.062			3	.005
K5	1	2	.901	D5	1	2	.855	A5	1	2	.567
		3	.016			3	.981			3	1.00
		4	.734			4	.145			4	.000
	2	1.	.901		2	1.	.855		2	1.	.567
		3	.646			3	.804			3	.703
		4	.944			4	.106			4	.000
	3	1	.016		3	1	.981		3	1	1.00
		2	.646			2	.804			2	.703
		4	.999			4	.247			4	.000
	4	1	.734		4	1	.145		4	1	.000
		2	.944			2	.106			2	.000
		3	.999			3	.247			3	.000
K6	1	2	.000	D6	1	2	.889	A6	1	2	.904
		3	.133			3	.538			3	1.00
		4	.000			4	.252			4	.000
	2	1.	.000		2	1.	.889		2	1.	.904
		3	.005			3	.998			3	.923
		4	.612			4	.585			4	.000
	3	1	.133		3	1	.538		3	1	1.00
		2	.005			2	.998			2	.923
		4	.004			4	.603			4	.000
	4	1	.000		4	1	.252		4	1	.000
		2	.612			2	.585			2	.000
		3	.004			3	.603			3	.000
K7	1	2	.107	D7	1	2	.669	A7	1	2	.198
		3	.000			3	.146			3	.967
		4	.001			4	.131			4	.000
	2	1.	.107		2	1.	.669		2	1.	.198
		3	.832			3	.121			3	.212
		4	.108			4	.530			4	.000
	3	1	.000		3	1	.146		3	1	.967
		2	.832			2	.121			2	.212
		4	.234			4	.024			4	.000
	4	1	.001		4	1	.131		4	1	.000
		2	.108			2	.530			2	.000
		3	.234			3	.024			3	.000

*The mean difference is significant at the .05 level.

Table 4.15 *Continued*

Q	G	G	Sig	Q	G	G	Sig	Q	G	G	Sig
K8	1	2	.000	D8	1	2	.000	A8	1	2	.000
		3	.000			3	.980			3	.997
		4	.996			4	.151			4	.659
	2	1.	.000		2	1.	.000		2	1.	.000
		3	.009			3	.000			3	.003
		4	.001			4	.000			4	.009
	3	1	.000		3	1	.980		3	1	.997
		2	.009			2	.000			2	.003
		4	.215			4	.144			4	.653
	4	1	.996		4	1	.151		4	1	.659
		2	.001			2	.000			2	.009
		3	.215			3	.144			3	.653
K9	1	2	.000	D9	1	2	.296	A9	1	2	.926
		3	.000			3	.428			3	.997
		4	.001			4	.000			4	.000
	2	1.	.000		2	1.	.296		2	1.	.926
		3	.796			3	.937			3	.916
		4	.607			4	.000			4	.000
	3	1	.000		3	1	.428		3	1	.997
		2	.796			2	.937			2	.916
		4	.231			4	.000			4	.000
	4	1	.001		4	1	.000		4	1	.000
		2	.607			2	.000			2	.000
		3	.231			3	.000			3	.000
K10	1	2	.000	D10	1	2	.995	A10	1	2	.364
		3	.331			3	.715			3	.884
		4	.041			4	.127			4	.086
	2	1.	.000		2	1.	.995		2	1.	.364
		3	.000			3	.842			3	.271
		4	.664			4	.270			4	.585
	3	1	.331		3	1	.715		3	1	.884
		2	.000			2	.842			2	.271
		4	.245			4	.068			4	.062
	4	1	.041		4	1	.127		4	1	.086
		2	.664			2	.270			2	.585
		3	.245			3	.068			3	.062
K11	1	2	.000	D11	1	2	.082	A11	1	2	.766
		3	.000			3	.222			3	.697
		4	1.000			4	.181			4	.184
	2	1.	.000		2	1.	.082		2	1.	.766
		3	.168			3	.009			3	.461
		4	.049			4	.934			4	.571
	3	1	.000		3	1	.222		3	1	.697
		2	.168			2	.009			2	.461
		4	.459			4	.045			4	.099
	4	1	1.000		4	1	.181		4	1	.184
		2	.049			2	.934			2	.571
		3	.459			3	.045			3	.099

*The mean difference is significant at the .05 level.

Table 4.15 *Continued*

Q	G	G	Sig	Q	G	G	Sig	Q	G	G	Sig
K12	1	2	.000	D12	1	2	.930	A12	1	2	.000
		3	.000			3	.014			3	.000
		4	.000			4	.003			4	.000
	2	1.	.000		2	1.	.930		2	1.	.000
		3	.006			3	.102			3	.754
		4	.990			4	.004			4	.301
	3	1	.000		3	1	.014		3	1	.000
		2	.006			2	.102			2	.754
		4	.078			4	.129			4	.062
	4	1	.000		4	1	.003		4	1	.000
		2	.990			2	.004			2	.301
		3	.078			3	.129			3	.062
K13	1	2	.000	D13	1	2	.046	A13	1	2	.056
		3	.992			3	.273			3	.080
		4	.022			4	.106			4	.000
	2	1.	.000		2	1.	.046		2	1.	.056
		3	.001			3	.670			3	.887
		4	.000			4	.896			4	.027
	3	1	.992		3	1	.273		3	1	.080
		2	.001			2	.670			2	.887
		4	.047			4	.459			4	.003
	4	1	.022		4	1	.106		4	1	.000
		2	.000			2	.896			2	.027
		3	.047			3	.459			3	.003
K14	1	2	.000	D14	1	2	.357	A14	1	2	.000
		3	.010			3	.103			3	.016
		4	.000			4	.996			4	.000
	2	1.	.000		2	1.	.357		2	1.	.000
		3	.000			3	.033			3	.145
		4	.884			4	.737			4	.113
	3	1	.010		3	1	.103		3	1	.016
		2	.000			2	.033			2	.145
		4	.003			4	.922			4	.001
	4	1	.000		4	1	.996		4	1	.000
		2	.884			2	.737			2	.113
		3	.003			3	.922			3	.001
K15	1	2	.000	D15	1	2	.021	A15	1	2	.963
		3	.003			3	.999			3	.275
		4	.703			4	.136			4	.079
	2	1.	.000		2	1.	.021		2	1.	.963
		3	.000			3	.059			3	.914
		4	.016			4	.967			4	.242
	3	1	.003		3	1	.999		3	1	.275
		2	.000			2	.059			2	.914
		4	.993			4	.162			4	.387
	4	1	.703		4	1	.136		4	1	.079
		2	.016			2	.967			2	.242
		3	.993			3	.162			3	.387

*The mean difference is significant at the .05 level.

Table 4.15 *Continued*

Q	G	G	Sig	Q	G	G	Sig	Q	G	G	Sig
K16	1	2	.000	D16	1	2	.802	A16	1	2	.927
		3	.018			3	.044			3	.145
		4	.514			4	.116			4	.998
	2	1.	.000		2	1.	.802		2	1.	.927
		3	.001			3	.095			3	.881
		4	.189			4	.430			4	.999
	3	1	.018		3	1	.044		3	1	.145
		2	.001			2	.095			2	.881
		4	.997			4	.012			4	.925
	4	1	.514		4	1	.116		4	1	.998
		2	.189			2	.430			2	.999
		3	.997			3	.012			3	.925
K17	1	2	.000	D17	1	2	.999	A17	1	2	.982
		3	.003			3	.082			3	.511
		4	.000			4	.293			4	.000
	2	1.	.000		2	1.	.999		2	1.	.982
		3	.342			3	.564			3	.671
		4	.181			4	.373			4	.000
	3	1	.003		3	1	.082		3	1	.511
		2	.342			2	.564			2	.671
		4	.007			4	.054			4	.000
	4	1	.000		4	1	.293		4	1	.000
		2	.181			2	.373			2	.000
		3	.007			3	.054			3	.000
K18	1	2	.006	D18	1	2	.894	A18	1	2	.901
		3	.000			3	.016			3	.027
		4	.034			4	.932			4	.000
	2	1.	.006		2	1.	.894		2	1.	.901
		3	.907			3	.653			3	.115
		4	.878			4	.998			4	.000
	3	1	.000		3	1	.016		3	1	.027
		2	.907			2	.653			2	.115
		4	.982			4	.949			4	.003
	4	1	.034		4	1	.932		4	1	.000
		2	.878			2	.998			2	.000
		3	.982			3	.949			3	.003
K19	1	2	.000	D19	1	2	.723	A19	1	2	.272
		3	.000			3	.736			3	.046
		4	.906			4	.000			4	.195
	2	1.	.000		2	1.	.723		2	1.	.272
		3	.000			3	.993			3	1.00
		4	.001			4	.000			4	.831
	3	1	.000		3	1	.736		3	1	.046
		2	.000			2	.993			2	1.00
		4	.593			4	.000			4	.806
	4	1	.906		4	1	.000		4	1	.195
		2	.001			2	.000			2	.831
		3	.593			3	.000			3	.806

*The mean difference is significant at the .05 level.

Table 4.15 *Continued*

Q	G	G	Sig	Q	G	G	Sig	Q	G	G	Sig
K20	1	2	.000	D20	1	2	.088	A20	1	2	.303
		3	.000			3	.923			3	.057
		4	.958			4	.960			4	.000
	2	1.	.000		2	1.	.088		2	1.	.303
		3	.000			3	.088			3	1.00
		4	.001			4	.377			4	.042
	3	1	.000		3	1	.923		3	1	.057
		2	.000			2	.088			2	1.00
		4	.750			4	.996			4	.027
	4	1	.958		4	1	.960		4	1	.000
		2	.001			2	.377			2	.042
		3	.750			3	.996			3	.027
K21	1	2	.000	D21	1	2	.637	A21	1	2	.042
		3	.000			3	.620			3	.476
		4	.000			4	.961			4	.945
	2	1.	.000		2	1.	.637		2	1.	.042
		3	.000			3	.317			3	.514
		4	.952			4	.737			4	.843
	3	1	.000		3	1	.620		3	1	.476
		2	.000			2	.317			2	.514
		4	.001			4	1.00			4	1.00
	4	1	.000		4	1	.961		4	1	.945
		2	.952			2	.737			2	.843
		3	.001			3	1.00			3	1.00
K22	1	2	.000	D22	1	2	.853	A22	1	2	.000
		3	.000			3	.591			3	.001
		4	.000			4	.080			4	.430
	2	1.	.000		2	1.	.853		2	1.	.000
		3	.046			3	.488			3	.361
		4	.000			4	.322			4	.786
	3	1	.000		3	1	.591		3	1	.001
		2	.046			2	.488			2	.361
		4	.000			4	.034			4	1.00
	4	1	.000		4	1	.080		4	1	.430
		2	.000			2	.322			2	.786
		3	.000			3	.034			3	1.00
K23	1	2	.000	D23	1	2	.437	A23	1	2	.210
		3	.000			3	.859			3	.067
		4	.034			4	.054			4	.536
	2	1.	.000		2	1.	.437		2	1.	.210
		3	.073			3	.307			3	.998
		4	.890			4	.015			4	.139
	3	1	.000		3	1	.859		3	1	.067
		2	.073			2	.307			2	.998
		4	.871			4	.154			4	.129
	4	1	.034		4	1	.054		4	1	.536
		2	.890			2	.015			2	.139
		3	.871			3	.154			3	.129

*The mean difference is significant at the .05 level.

Table 4.16: Summary of Multiple Comparison Mean Differences. C2: How to use a computer in science for.

Statement	Current Knowledge (K)						Desired Knowledge (D)						My assignments require or assume the use of this technology (A)					
	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
1) Library search services (data collection using peripherals).	*	*	*											*		*		
2) Database storage of lab data.	*				*	*												
3) Demonstrations and modeling.	*	*	*	*		*						*	*					
4) Graphing.	*	*													*			*
5) Computer assisted instruction.		*													*		*	*
6) Problem solving.	*	*		*		*						*			*		*	*
7) Individualized instruction.		*	*				*			*	*				*		*	*
8) Analysis of lab data	*	*		*	*				*		*	*	*			*	*	
9) Science-technology-society issues.	*	*	*									*			*		*	*
10) Spreadsheets (e.g., Excel).	*		*	*			*	*	*		*							
11) Databases (e.g., Access, FileMaker).	*	*			*	*	*			*		*						
12) Email.	*	*	*	*			*						*	*	*			
13) Communication tools (e.g., List-servers, chat, discussion boards…).	*	*	*	*	*					*					*		*	*
14) PowerPoint, Astound.	*	*	*	*		*	*						*	*	*			*
15) Other multimedia authoring software (e.g., Author-ware, hyper-studio, macromedia).	*	*		*	*			*				*						
16) Web publishing (e.g., Dream weaver, page-mill, navigator, web-CT or similar)	*	*		*														
17) Video editing software (e.g., iMovie, adobe premiere).	*	*	*		*			*							*		*	*
18) Graphic peripherals (e.g., Scanners, digital cameras).	*	*	*						*		*	*		*	*		*	*

Table 4.16 *Continued*

Statement	Current Knowledge (K)						Desired Knowledge (D)						My assignments require or assume the use of this technology (A)					
	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
19) Web browsers – Basic functionality and efficiency (e.g., Netscape, Internet explorer)	*	*		*	*									*				
20) Web search techniques.	*	*		*	*										*		*	*
21) Technologies specific to your field (e.g. Probe-ware in the sciences, geographic information systems in the social sciences, etc.).	*	*	*	*		*						*	*					
22) Data analysis software (e.g. SPSS, SAS, other statistics or analysis software).	*	*	*		*	*					*		*	*				
23) Creation and/or use of streaming media	*	*		*				*	*		*	*						

Asterisks (*) indicate significant ($p < .05$) difference among four groups: Categories of comparisons are as follows: 1-pre-service teachers versus graduate students, 2- pre-service teachers versus Turkish faculty members with degrees from Turkish universities, 3- pre-service teachers versus Turkish faculty members who earned their degrees from western universities 4- graduate students versus Turkish Faculty members with degrees from Turkish universities 5- Graduate students versus Turkish Faculty members who earned their degrees from western universities 6- Turkish Faculty members with degrees from Turkish universities versus Turkish Faculty members who earned their degrees from western universities.

Category C3 of Questionnaire: "Effects of computer use on"

The results of Category C3, "Effects of computer use on," showed that there were statistically significant differences among all four groups, except for questions D3, D4, D5, A2, and A3. Thus, all four groups had different levels of current knowledge about the "Effect of computer use on."

- F (3,751) = 1.784, .149 > .05 for question D3,
- F (3,751) = 2.333, .073 > .05 for question D4,
- F (3,751) = 1.572, .195 > .05 for question D5,

- F (3,751) = 2.276, .079 > .05 for question A2,
- F (3,751) = 1.791, .141 > .05 for question A5.

For "current knowledge" regarding the various effects of computer use on science instruction, the total mean score for pre-service teachers was 2.863. For pre-service teachers the highest mean score for a single question was for 3.159 (question 3) and the lowest mean score for a single question was 2.612 (question 1). The total mean score for graduate students was 3.752. For graduate students the highest mean score for a single question was 4.172 (question 4) and the lowest mean score for a single question was 3.448 (question 2). The total mean score of Turkish faculty members with degrees from Turkish universities was 3.458. The highest mean score for a single question was 3.667 (question 4) and the lowest mean score for a single question was 3.048 (question 1). The total mean for Turkish faculty members who earned their degrees from western universities was 4.489. The highest and lowest mean scores for questions was 4.889 (questions 3 and 4) and 4.000 (questions 2 and 5).

For "desired knowledge," all four groups indicated that they desire more knowledge about the "Effects of computer use on." Their levels of desired knowledge were the same for questions D3, D4, and D5. Turkish faculty members who earned their degrees from western universities indicated a desire to know more than other groups about "classroom management" (D1), but less than other groups about "class preparation" (D3).

In the "my assignments require or assume the use of this technology," the total mean score for pre-service teachers was 3.034. The highest mean score for a single

question was 3.302 (question 3) and the lowest mean score for a single question was 2.780 (question 1). Graduate students' total mean score was 3.407. The highest and lowest mean scores for a single question was 3.655 (question 4) and 2.931 (question A2). The total mean score of Turkish faculty members with degrees from Turkish universities was 3.025 and the highest mean score for a single question was 3.371 (question A3). The lowest mean score was 2.694 (question A1) for Turkish faculty members with degrees from Turkish universities. The total mean for Turkish faculty members who earned their degrees from western universities was 3.622 with a 4.778 (question A3) as the highest mean score for a single question and the 2.333 (question A2) the lowest mean score for a single question.

The Post Hoc-Tukey HSD test showed that there were statistically significant differences among all groups. As seen in Tables 4.18 (pg. 125) and Table 4.19 (pg. 126), there were some patterns among group differences. The first pattern indicates differences among and between pre-service teachers and graduate students; pre-service teachers and Turkish faculty members with degrees from Turkish universities; pre-service teachers and Turkish Faculty members with degrees from western universities; Turkish faculty members with degrees from Turkish universities and Turkish Faculty members with degrees from western universities. All of these differences were observed for "current knowledge" and the following questions: "Classroom management" (question K1), "Class presentations" (question K3), and "Professional presentations" (question K4). Another pattern observed under "current knowledge" was between pre-service teachers and graduate students; pre-service teachers and Turkish faculty members with degrees from Turkish universities; pre-

service teachers and Turkish Faculty members with degrees from western universities for questions K1, “Classroom management,” K3, “Class presentations,” K4, “Professional presentations,” and K5, “Time management.”

There was a similar pattern for “my assignments require or assume the use of this technology.” The pattern was found between pre-service teachers and Turkish faculty members who earned their degrees from western universities; graduate students and Turkish Faculty members with degrees from western universities; Turkish Faculty members with degrees from Turkish universities and Turkish Faculty members who earned their degrees from western universities for questions A1, “Classroom management,” and A3, “Class presentations.” Interestingly, no significant difference was found between graduate students and Turkish faculty members with degrees from Turkish universities in any of the questions for Category C3, “Effects of computer use on.”

Summary

Knowledge about computers’ effects on classroom management, presentation, and preparation for class all produced varying mean differences. Graduate students and Turkish faculty members with degrees from western universities indicated that they had more knowledge than the other two groups about computers’ effects on classroom activities. Many of the differences noted among the means were between pre-service teachers and Turkish faculty members with degrees from western universities, which is not surprising.

Using the previously defined ranges, it is apparent that pre-service teachers’ current knowledge was in the “low” range. Although the graduate students and

Turkish faculty members with degrees from Turkish universities' current knowledge was in the "medium" range, Turkish faculty members who earned their degrees from western universities was in the "high" range. All groups' total mean scores were in the "high" range for "desired knowledge." Within the "my assignments require or assume the use of this technology" all groups fell within the "sometimes" range.

Interestingly, pre-service teachers and Turkish faculty members with degrees from Turkish universities not only have nearly the same highest knowledge mean score for the "class preparation" (question A3) and the same lowest score for the "classroom management" (question A1) in the "my assignments require or assume the use of this technology," but also the same highest/lowest scores for the same questions (K3 and K1) in the "current knowledge." Results show that Turkish pre-service teachers' current knowledge of "effects of computer use on" was within the "medium" range. Perhaps, this indicates that computer-based strategies were simply unknown and/or poorly understood by the teachers of this group.

Table 4.17: Means, Standard Deviation, F, Significance Level (α=.05) and One-Way ANOVA for "Effects of computer use on" (Category C3) for Pre-service Teachers (group 1), Graduate Students (group 2), Turkish Faculty Members With Degrees From Turkish Universities (group 3), and Turkish Faculty Members With Degrees From Western Universities (group 4).
Q: Questions, G: Groups, M: Mean, SD: Standard Deviation, T: Total.
K: Current knowledge, D: Desired Knowledge, A: My Assignments Require or Assume the Use of This Technology.

QUESTIONS

1) Classroom management, 2) Class preparation, 3) Class presentations, 4) Professional presentations, 5) Time management.

		(A): Never:1, Seldom:2, Sometimes:3, Often:4, Usually:5 points				(K): Very Low:1, Low:2, Medium:3, High:4, Advanced:5 points				(D): Very Low:1, Low:2, Medium:3, High:4, Advanced:5 points			
Q	G	M	SD	F	Sig	M	SD	F	Sig	M	SD	F	Sig
1	1	2.612	1.011	23.08	.000	4.449	.776	3.540	.014	2.780	1.194	8.196	.000
	2	3.552	.632			4.586	.628			3.276	1.306		
	3	3.048	.965			4.226	.838			2.694	1.223		
	4	4.667	.707			5.000	.000			4.556	1.014		
	T	2.709	1.036			4.442	.776			2.809	1.216		
2	1	2.963	1.053	8.054	.000	4.640	.587	4.641	.003	3.131	1.149	2.276	.079
	2	3.448	.686			4.621	.622			2.931	1.132		
	3	3.419	1.033			4.387	.732			2.919	1.013		
	4	4.000	.000			4.222	.441			2.333	.707		
	T	3.032	1.049			4.613	.604			3.097	1.137		
3	1	3.159	1.066	17.26	.000	4.635	.666	1.784	.149	3.302	1.109	2.276	.001
	2	4.000	.756			4.621	.562			3.621	1.208		
	3	3.661	.974			4.500	.621			3.371	1.075		
	4	4.889	.333			5.000	.000			4.778	.441		
	T	3.253	1.077			4.628	.656			3.337	1.116		
4	1	2.699	1.144	38.78	.000	4.576	.742	2.333	.073	2.909	1.218	4.463	.004
	2	4.172	.658			4.828	.539			3.655	.974		
	3	3.677	1.068			4.500	.763			3.161	1.204		
	4	4.889	.333			5.000	.000			3.333	.7070		
	T	2.862	1.199			4.584	.735			2.964	1.212		
5	1	2.882	1.057	13.02	.000	4.574	.697	1.572	.195	3.049	1.190	1.791	.147
	2	3.586	.825			4.552	.783			3.552	1.270		
	3	3.484	.971			4.419	.821			2.984	1.079		
	4	4.000	.000			4.222	.441			3.111	.333		
	T	2.972	1.061			4.556	.710			3.063	1.181		

Table 4.18. Multiple Comparisons-Tukey HSD for "Effects of computer use on" (Category C3) for Pre-service Teachers (group 1), Graduate Students (group 2), Turkish Faculty Members With Degrees From Turkish Universities (group 3), and Turkish Faculty Members With Degrees From Western Universities (group 4). K: Current knowledge, D: Desired Knowledge, A: My assignments require or assume the use of this technology, Q: Questions, G: Groups, MD: Mean Difference

Q	G	G	Sig	Q	G	G	Sig	Q	G	G	Sig
K1	1	2	.000	D1	1	2	.785	A1	1	2	.124
		3	.006			3	.132			3	.956
		4	.000			4	.146			4	.000
	2	1.	.000		2	1.	.785		2	1.	.124
		3	.111			3	.162			3	.136
		4	.018			4	.497			4	.027
	3	1	.006		3	1	.132		3	1	.956
		2	.111			2	.162			2	.136
		4	.000			4	.026			4	.000
	4	1	.000		4	1	.146		4	1	.000
		2	.018			2	.497			2	.027
		3	.000			3	.026			3	.000
K2	1	2	.065	D2	1	2	.998	A2	1	2	.788
		3	.005			3	.009			3	.495
		4	.015			4	.162			4	.155
	2	1.	.065		2	1.	.998		2	1.	.788
		3	.999			3	.308			3	1.00
		4	.501			4	.303			4	.511
	3	1	.005		3	1	.009		3	1	.495
		2	.999			2	.308			2	1.00
		4	.394			4	.868			4	.469
	4	1	.015		4	1	.162		4	1	.155
		2	.501			2	.303			2	.511
		3	.394			3	.868			3	.469
K3	1	2	.000	D3	1	2	.999	A3	1	2	.427
		3	.002			3	.407			3	.966
		4	.000			4	.346			4	.000
	2	1.	.000		2	1.	.999		2	1.	.427
		3	.473			3	.845			3	.747
		4	.116			4	.427			4	.031
	3	1	.002		3	1	.407		3	1	.966
		2	.473			2	.845			2	.747
		4	.006			4	.141			4	.002
	4	1	.000		4	1	.346		4	1	.000
		2	.116			2	.427			2	.031
		3	.006			3	.141			3	.002

*The mean difference is significant at the .05 level

Table 4.18 *Continued*

Q	G	G	Sig	Q	G	G	Sig	Q	G	G	Sig
K4	1	2	.000	D4	1	2	.269	A4	1	2	.006
		3	.000			3	.865			3	.396
		4	.000			4	.311			4	.721
	2	1.	.000		2	1.	.269		2	1.	.006
		3	.201			3	.194			3	.263
		4	.335			4	.927			4	.897
	3	1	.000		3	1	.865		3	1	.396
		2	.201			2	.194			2	.263
		4	.013			4	.224			4	.978
	4	1	.000		4	1	.311		4	1	.721
		2	.335			2	.927			2	.897
		3	.013			3	.224			3	.978
K5	1	2	.002	D5	1	2	.998	A5	1	2	.111
		3	.000			3	.356			3	.976
		4	.007			4	.452			4	.999
	2	1.	.002		2	1.	.998		2	1.	.111
		3	.972			3	.841			3	.141
		4	.722			4	.616			4	.761
	3	1	.000		3	1	.356		3	1	.976
		2	.972			2	.841			2	.141
		4	.502			4	.864			4	.990
	4	1	.007		4	1	.452		4	1	.999
		2	.722			2	.616			2	.761
		3	.502			3	.864			3	.990

*The mean difference is significant at the .05 level.

Table 4. 19: Summary of Multiple Comparison Mean Differences. C3: Effects of computer use on.

Statement	Current Knowledge (K)						Desired Knowledge (D)						My assignments require or assume the use of this technology (A)					
	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
1) Classroom management.	*	*	*		*	*						*			*		*	*
2) Class preparation.		*						*										
3) Class presentations.	*	*	*			*									*		*	*
4) Professional presentations.	*	*	*			*							*					
5) Time management.	*	*	*															

Asterisks (*) indicate significant ($p < .05$) difference among four groups: Categories of comparisons are as follows: 1-pre-service teachers versus graduate students, 2- pre-service teachers versus Turkish faculty members with degrees from Turkish universities, 3- pre-service teachers versus Turkish faculty members who earned their degrees from western universities 4- graduate students versus Turkish Faculty members with degrees from Turkish universities 5- Graduate students versus Turkish Faculty members who earned their degrees from western universities 6- Turkish Faculty members with degrees from Turkish universities versus Turkish Faculty members who earned their degrees from western universities.

Category C4 of Questionnaire: "How to use other technology in the classroom"

The responses for Category C4 showed that no statistically difference among the four groups for "Hypermedia" (question D5).

- F (3,751) = 2.229, .084 > .05 for question D5.

However, there were significant differences among the four groups for the remaining questions. This would indicate that all four groups had different levels of current knowledge about "How to use other technology in the classroom." For pre-service teachers the total mean score was 2.973. Within this group the highest mean score for a single question was 3.932 (question K8) and the lowest mean score for a single question was 1.929 (question K3). Graduate students' total mean score was 3.720 with the highest and lowest mean scores of 4.483 (question K6) and 2.310 (question K3), respectively. The total mean score for Turkish faculty members with degrees from Turkish universities was 3.098. The highest mean score for a single question was 4.097 (question K5) and the lowest mean score for a single question was 2.129 (question K3). As well, the total mean for Turkish faculty members who earned their degrees from western universities was 3.818 with their highest mean score for a single question being 5.000 (question K5) and the lowest mean score of 1.556 (question K8).

For "desired knowledge," all four of the groups mean scores were over 4.000 which would indicate that they desire to have a higher level of knowledge about "How to use other technology in the classroom". Pre-service teachers, the highest scoring group, indicated a need to know more than the other three groups.

In the "my assignments require or assume the use of this technology," the total mean score of pre-service teachers was 2.887. Within this group the highest mean score for a single question was 3.695 (question 5) and the lowest mean score for a single question was 2.108 (question 3). Graduate students' total mean score was 2.708 with the highest mean score for a single question being 3.690 (questions 5, 6) and the lowest mean score of 1.655 (question A3). The total mean score for Turkish faculty members with degrees from Turkish universities was 2.886. Their highest mean score for a single question was 3.887 (question A5) and their lowest mean score was 2.065 (question A3). The total mean score for Turkish faculty members who earned their degrees from western universities was 4.303. The highest mean score for a single question was 4.889 (question A5) and the lowest mean score was 2.222 (question A11).

The Post Hoc-Tukey HSD test showed that there were statistically significant differences among all groups. As seen in Tables 4.21 (pg. 134) and Table 4.22 (pg. 137), there were some patterns among the groups. The first apparent pattern was the difference between pre-service teachers and Turkish Faculty members with degrees from western universities; graduate students and Turkish Faculty members with degrees from western universities; and Turkish faculty members with degrees from Turkish universities and Turkish Faculty members with degrees from western universities for questions K1, K2, K3, K4, K5, K6, K7, K8, and K9 (current knowledge). Interestingly, there was a statistically significant difference between graduate students and Turkish faculty members with degrees western universities in all questions for "current knowledge." Another pattern observed was the differences

between pre-service teachers and Turkish faculty members with degrees from Turkish universities; Turkish faculty members with degrees from Turkish universities and Turkish Faculty members with degrees from western universities in all questions for "desired knowledge."

A similar pattern in the "my assignments require or assume the use of this technology" was observed between pre-service teachers and Turkish Faculty members with degrees from western universities; graduate students and Turkish Faculty members with degrees from western universities; and Turkish faculty members with degrees from Turkish universities and Turkish Faculty members with degrees from western universities in all questions, except "others" (question A11). Interestingly, no significant difference was found between graduate students and Turkish faculty members with degrees from Turkish universities in any of the questions for Category C4, "How to use other technology in the classroom" (Table 4.21, pg. 134; 4.22, pg. 137).

Summary

Differences were found among all groups in the "current knowledge," "desired knowledge" and "my assignments require or assume the use of this technology," except for question D5 "Overhead projector." A higher number of statistically significant differences among the means were between pre-service teachers and graduate students. One reason for these differences may be that the universities responding (both American and Turkish) may not have the same technological tools. Therefore, individuals would have different experiences and hence differences in opinions about their own use of available technological tools.

Another possibility is that faculty members and/or students may have had different minor fields of study; for example, a student who is in biology may know more about the microscope and use it more frequently than a student who is a physic major.

Using the previously defined ranges, I found that, although pre-service teachers' current knowledge was in the "low" range and the other three groups' current knowledge was in the "medium" range. All groups' total mean scores were in the "high" range for "desired knowledge." Within the "my assignments require or assume the use of this technology" all groups' means were in the "seldom" range, except for Turkish faculty members with degrees from western universities ("often" range).

Interestingly, respondents had a high current knowledge for calculator (question K8), overhead projectors (question K5), and slides (question K6). Also, all groups except Turkish faculty members who earned their degrees from western universities agreed that interactive video (question K3) was the least used technological tool. Perhaps, this is because interactive videos are rather new; and new technologies, like computers, hypermedia, and digital cameras are not yet well integrated into the Turkish educational system. However, all groups responding wanted to know more about these technological tools.

Although the calculator was the most used educational tool for the pre-service teachers, graduate students, and Turkish faculty members who earned their degrees from Turkish universities, it was the lowest for Turkish faculty members who earned their degrees from western universities. For "My assignments require or assume the use of this technology," Turkish faculty members who earned their degrees from

western universities had the highest mean score. This would indicate that students in their classes may be using educational technology regularly. However, Turkish pre-service teacher responses do not concur with this assessment. The mean score (2.887) for pre-service teachers and Turkish faculty members with degrees from Turkish universities (2.886) was very similar. Graduate students who are currently studying in the U.S. and Turkish pre-service teachers reported that they were required to use educational technology at about the same level in their assignments, (2.708 and 2.887 respectively). However, there was no difference between Turkish pre-service teachers and graduate students in the use of educational technology in their assignments. It appears that both groups are required to use educational technology at the same level, "seldom" or "never" (Table 4.20, pg. 134).

Table 4.20: Means, Standard Deviation, F, Significance Level (α=.05) and One-Way ANOVA for "How to use other technology in the classroom" (Category C4) for Pre-service Teachers (group 1), Graduate Students (group 2), Turkish Faculty Members With Degrees From Turkish Universities (group 3), and Turkish Faculty Members With Degrees From Western Universities (group 4).
Q: Questions, G: Groups, M: Mean, SD: Standard Deviation, T: Total.
K: Current knowledge, D: Desired Knowledge, A: My Assignments Require or Assume the Use of This Technology.

QUESTIONS

1) Video, 2) Film, 3) Interactive video, 4) Hypermedia, 5) Overhead projector, 6) Slides.

		(K): Very Low:1, Low:2, Medium:3, High:4, Advanced:5 points				(D): Very Low:1, Low:2, Medium:3, High:4, Advanced:5 points				(A): Never:1, Seldom:2, Sometimes:3, Often:4, Usually:5 points			
Q	G	M	SD	F	Sig	M	SD	F	Sig	M	SD	F	Sig
1	1	2.815	1.06	11.42	.000	4.331	.753	4.873	.002	2.504	1.11	13.82	.000
	2	3.241	.912			4.310	.967			2.966	1.12		
	3	2.903	1.18			4.016	.878			2.565	1.11		
	4	4.778	.667			4.889	.333			4.778	.667		
	T	2.862	1.09			4.311	.776			2.554	1.14		
2	1	2.933	1.11	4.100	.007	4.412	.777	9.122	.000	2.568	1.19	10.84	.000
	2	2.897	.724			4.310	.967			2.621	.942		
	3	2.661	1.16			3.887	.907			2.468	1.11		
	4	4.000	.000			4.778	.441			4.778	.667		
	T	2.922	1.10			4.370	.806			2.588	1.19		
3	1	1.929	.941	11.88	.000	4.305	.868	13.09	.000	2.108	1.13	17.48	.000
	2	2.310	.712			4.000	.964			1.655	.814		
	3	2.129	1.09			3.629	1.15			2.065	1.10		
	4	3.667	.707			4.889	.333			4.667	.707		
	T	1.982	.965			4.245	.915			2.180	1.15		
4	1	1.973	1.07	14.97	.000	4.318	.848	3.764	.011	2.350	1.23	4.457	.004
	2	2.655	1.01			4.138	1.33			2.000	1.07		
	3	2.452	1.17			4.000	.868			2.468	1.21		
	4	3.778	.441			4.778	.441			3.667	.707		
	T	2.06	1.01			4.290	.874			2.36	1.23		
5	1	3.707	.962	11.84	.000	4.628	.615	2.229	.084	3.695	1.04	4.604	.003
	2	4.310	.541			4.828	.468			3.690	1.04		
	3	4.097	.882			4.516	.718			3.890	.889		
	4	5.000	.000			4.889	.333			4.890	.333		
	T	3.777	.958			4.629	.618			3.720	1.03		
6	1	3.438	1.07	14.71	.000	4.646	.577	8.491	.000	3.431	1.11	5.112	.002
	2	4.483	.575			4.759	.577			3.690	.93		
	3	3.677	1.17			4.258	.991			3.323	1.184		
	4	4.889	.333			4.889	.333			4.778	.667		
	T	3.515	1.09			4.621	.628			3.448	1.17		
7	1	3.392	1.09	6.535	.000	4.605	.619	13.24	.000	3.249	1.17	17.55	.000
	2	3.621	.820			4.207	1.24			1.931	1.19		
	3	3.581	1.06			4.097	1.05			3.210	1.10		
	4	4.889	.333			4.889	.333			4.778	.667		
	T	3.434	1.08			4.551	.711			3.213	1.20		

Table 4.20 *Continued*

QUESTIONS 8) Calculators, 9) Microscope, 10) Digital cameras, 11) Others.													
		(K): Very Low:1, Low:2, Medium:3, High:4, Advanced:5 points				(D): Very Low:1, Low:2, Medium:3, High:4, Advanced:5 points				(A): Never:1, Seldom:2, Sometimes:3, Often:4, Usually:5 points			
Q	G	M	SD	F	Sig	M	SD	F	Sig	M	SD	F	Sig
8	1	3.932	.952	21.18	.000	4.612	.681	19.98	.000	3.599	1.14	2.691	.045
	2	4.241	.690			4.345	.897			3.310	.850		
	3	3.597	1.12			4.097	1.11			3.242	1.04		
	4	1.556	1.33			3.222	.667			3.222	.667		
	T	3.886	1.00			4.543	.762			3.554	1.12		
9	1	3.731	.882	7.247	.000	4.702	.576	27.32	.000	3.579	1.03	26.61	.000
	2	3.276	1.03			4.000	1.36			2.000	1.195		
	3	3.403	1.49			3.968	1.38			3.274	1.176		
	4	4.667	1.00			4.778	.441			4.778	.441		
	T	3.698	.964			4.616	.754			3.507	1.097		
9	1	3.731	.882	7.247	.000	4.702	.576	27.32	.000	3.579	1.03	26.61	.000
	2	3.276	1.03			4.000	1.36			2.000	1.195		
	3	3.403	1.49			3.968	1.38			3.274	1.176		
	4	4.667	1.00			4.778	.441			4.778	.441		
	T	3.698	.964			4.616	.754			3.507	1.097		
10	1	2.296	1.12	22.54	.000	4.501	.797	20.20	.000	2.189	1.157	20.31	.000
	2	3.897	.900			4.552	.784			2.897	1.081		
	3	2.871	1.26			4.097	1.13			2.629	1.12		
	4	2.444	.882			2.556	1.13			4.778	.441		
	T	2.407	1.17			4.446	.864			2.283	1.19		
11	1	2.556	1.04	13.83	.000	4.456	.788	32.37	.000	2.484	1.095	3.299	.020
	2	3.793	1.05			4.310	1.17			3.035	1.085		
	3	2.710	.965			3.677	1.11			2.710	.982		
	4	2.333	.707			2.444	.882			2.222	.441		
	T	2.613	1.05			4.363	.888			2.521	1.086		

Table 4.21. Multiple Comparisons-Tukey HSD for "How to use other technology in the classroom" (Category C4) for Pre-service Teachers (group 1), Graduate Students (group 2), Turkish Faculty Members With Degrees From Turkish Universities (group 3), and Turkish Faculty Members With Degrees From Western Universities (group 4). K: Current knowledge, D: Desired Knowledge, A: My assignments require or assume the use of this technology, Q: Questions, G: Groups, MD: Mean Difference

Q	G	G	Sig	Q	G	G	Sig	Q	G	G	Sig
K1	1	2	.150	D1	1	2	.999	A1	1	2	.126
		3	.925			3	.011			3	.976
		4	.000			4	.136			4	.000
	2	1.	.150		2	1.	.999		2	1.	.126
		3	.491			3	.325			3	.376
		4	.001			4	.201			4	.000
	3	1	.925		3	1	.011		3	1	.976
		2	.491			2	.325			2	.376
		4	.000			4	.008			4	.000
	4	1	.000		4	1	.136		4	1	.000
		2	.001			2	.201			2	.000
		3	.000			3	.008			3	.000
K2	1	2	.998	D2	1	2	.906	A2	1	2	.995
		3	.244			3	.000			3	.917
		4	.020			4	.517			4	.000
	2	1.	.998		2	1.	.906		2	1.	.995
		3	.775			3	.084			3	.937
		4	.042			4	.412			4	.000
	3	1	.244		3	1	.000		3	1	.917
		2	.775			2	.084			2	.937
		4	.004			4	.009			4	.000
	4	1	.020		4	1	.517		4	1	.000
		2	.042			2	.412			2	.000
		3	.004			3	.009			3	.000
K3	1	2	.147	D3	1	2	.274	A3	1	2	.139
		3	.386			3	.000			3	.991
		4	.000			4	.210			4	.000
	2	1.	.147		2	1.	.274		2	1.	.139
		3	.829			3	.253			3	.359
		4	.001			4	.046			4	.000
	3	1	.386		3	1	.000		3	1	.991
		2	.829			2	.253			2	.359
		4	.000			4	.000			4	.000
	4	1	.000		4	1	.210		4	1	.000
		2	.001			2	.046			2	.000
		3	.000			3	.000			3	.000

*The mean difference is significant at the .05 level.

Table 2.21 *Continued*

Q	G	G	Sig	Q	G	G	Sig	Q	G	G	Sig
K4	1	2	.004	D4	1	2	.696	A4	1	2	.432
		3	.004			3	.031			3	.886
		4	.000			4	.392			4	.007
	2	1.	.004		2	1.	.696		2	1.	.432
		3	.832			3	.895			3	.322
		4	.031			4	.216			4	.002
	3	1	.004		3	1	.031		3	1	.886
		2	.832			2	.895			2	.322
		4	.003			4	.059			4	.031
	4	1	.000		4	1	.392		4	1	.007
		2	.031			2	.216			2	.002
		3	.003			3	.059			3	.031
K5	1	2	.004	D5	1	2	.319	A5	1	2	1.00
		3	.010			3	.526			3	.490
		4	.000			4	.587			4	.003
	2	1.	.004		2	1.	.319		2	1.	1.00
		3	.743			3	.112			3	.827
		4	.218			4	.994			4	.012
	3	1	.010		3	1	.526		3	1	.490
		2	.743			2	.112			2	.827
		4	.036			4	.327			4	.031
	4	1	.000		4	1	.587		4	1	.003
		2	.218			2	.994			2	.012
		3	.036			3	.327			3	.031
K6	1	2	.000	D6	1	2	.772	A6	1	2	.606
		3	.326			3	.000			3	.883
		4	.000			4	.646			4	.002
	2	1.	.000		2	1.	.772		2	1.	.606
		3	.004			3	.002			3	.454
		4	.747			4	.946			4	.050
	3	1	.326		3	1	.000		3	1	.883
		2	.004			2	.002			2	.454
		4	.008			4	.023			4	.001
	4	1	.000		4	1	.646		4	1	.002
		2	.747			2	.946			2	.050
		3	.008			3	.023			3	.001
K7	1	2	.676	D7	1	2	.014	A7	1	2	.000
		3	.549			3	.000			3	.994
		4	.000			4	.614			4	.001
	2	1.	.676		2	1.	.014		2	1.	.000
		3	.998			3	.895			3	.000
		4	.011			4	.050			4	.000
	3	1	.549		3	1	.000		3	1	.994
		2	.998			2	.895			2	.000
		4	.004			4	.008			4	.001
	4	1	.000		4	1	.614		4	1	.001
		2	.011			2	.050			2	.000
		3	.004			3	.008			3	.001

*The mean difference is significant at the .05 level

Table 2.21 *Continued*

Q	G	G	Sig	Q	G	G	Sig	Q	G	G	Sig
K8	1	2	.322	D8	1	2	.221	A8	1	2	.524
		3	.047			3	.000			3	.077
		4	.000			4	.000			4	.747
	2	1.	.322		2	1.	.221		2	1.	.524
		3	.016			3	.437			3	.993
		4	.000			4	.000			4	.997
	3	1	.047		3	1	.000		3	1	.077
		2	.016			2	.437			2	.993
		4	.000			4	.005			4	1.00
	4	1	.000		4	1	.000		4	1	.747
		2	.000			2	.000			2	.997
		3	.000			3	.005			3	1.00
K9	1	2	.058	D9	1	2	.000	A9	1	2	.000
		3	.048			3	.000			3	.126
		4	.019			4	.989			4	.004
	2	1.	.058		2	1.	.000		2	1.	.000
		3	.934			3	.997			3	.000
		4	.001			4	.024			4	.000
	3	1	.048		3	1	.000		3	1	.126
		2	.934			2	.997			2	.000
		4	.001			4	.009			4	.000
	4	1	.019		4	1	.989		4	1	.004
		2	.001			2	.024			2	.000
		3	.001			3	.009			3	.000
K10	1	2	.000	D10	1	2	.988	A10	1	2	.007
		3	.001			3	.002			3	.021
		4	.980			4	.000			4	.000
	2	1.	.000		2	1.	.988		2	1.	.007
		3	.000			3	.073			3	.728
		4	.004			4	.000			4	.000
	3	1	.001		3	1	.002		3	1	.021
		2	.000			2	.073			2	.728
		4	.713			4	.000			4	.000
	4	1	.980		4	1	.000		4	1	.000
		2	.004			2	.000			2	.000
		3	.713			3	.000			3	.000
K11	1	2	.000	D11	1	2	.794	A11	1	2	.037
		3	.673			3	.000			3	.395
		4	.917			4	.000			4	.888
	2	1.	.000		2	1.	.794		2	1.	.037
		3	.000			3	.005			3	.540
		4	.001			4	.000			4	.200
	3	1	.673		3	1	.000		3	1	.395
		2	.000			2	.005			2	.540
		4	.734			4	.000			4	.586
	4	1	.917		4	1	.000		4	1	.888
		2	.001			2	.000			2	.200
		3	.734			3	.000			3	.586

* The mean difference is significant at the .05 level.

Table 4.22. Summary of Multiple Comparison Mean Differences. C4: How to use other technology in the classroom.

Statement	Current Knowledge (K)						Desired Knowledge (D)						My assignments require or assume the use of this technology (A)					
	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
1) Video.			*		*	*		*				*			*		*	*
2) Film.			*		*	*		*				*			*		*	*
3) Interactive video.			*		*	*		*			*	*			*		*	*
4) Hypermedia.	*	*	*		*	*		*							*		*	*
5) Overhead.	*	*	*			*									*		*	*
6) Slides.	*		*	*	*	*		*		*		*			*			*
7) Concrete Manipulative models (Photographs...).			*		*	*	*	*				*	*		*	*	*	*
8) Calculator.		*	*	*	*	*		*	*		*	*						
9) Microscope.		*	*		*	*	*	*			*	*	*		*	*	*	*
10) Digital camera.	*	*		*	*			*	*		*	*	*	*	*		*	*
11) Others.	*			*	*			*	*	*	*	*	*					

Asterisks (*) indicate significant ($p < .05$) difference among four groups: Categories of comparisons are as follows: 1-pre-service teachers versus graduate students, 2- pre-service teachers versus Turkish faculty members with degrees from Turkish universities, 3- pre-service teachers versus Turkish faculty members who earned their degrees from western universities 4- graduate students versus Turkish Faculty members with degrees from Turkish universities 5- Graduate students versus Turkish Faculty members who earned their degrees from western universities 6- Turkish Faculty members with degrees from Turkish universities versus Turkish Faculty members who earned their degrees from western universities.

Section Three: Indicators of Technology as Elicited by Questions on Gender

Section B of Questionnaire

The results of one-way ANOVA test showed that there were no statistically significant differences between male and female pre-service teachers for most B questions, except for question B4, "In my education courses, I received lots of information about the effective use of technology as a learning tool for students;" B7, "I am well prepared to use technology as a teaching tool;" B15, "I am prepared to regularly use technology to communicate and collaborate with peers in the field of education;" B16, and "I am prepared to use technology to support my own professional growth through activities such as online learning, research and collaborative projects." No statistical differences were found between male and

female graduate students, except for question B12, "I am prepared to manage technology-supported learning." The mean scores of female pre-service teachers and graduate students were less than male pre-service teachers and graduate students on these questions.

On the other hand, there was almost no statistical difference on questions for male and female Turkish faculty members who earned their degrees from western universities in section B of questionnaire. The only statistical differences found between male and female Turkish faculty members who earned their degrees from western universities were for questions B10, "I regularly use technology to communicate and collaborate with peers (e.g., email, threaded discussion boards, listserv, chat);" and B11, "I regularly use technology to increase my own professional productivity (word processing, spreadsheets, end note, PowerPoint)." The mean scores of female Turkish faculty members with degrees from Turkish and western universities were less than male Turkish faculty members with degrees from Turkish and western universities on these questions.

Section C of Questionnaire

Category C1 of Questionnaire: Ways in which computers can be used to

Although there were no statistically significant differences between male and female graduate students in Category C1, there were statistically significant differences between male and female pre-service teachers in "Composing/writing papers (Word processing);" (questions K1) and "Statistical analysis and research" (question K3) for "current knowledge." Questions D5, "Entertain oneself (games);" D6, "Deliver individual learning (computer aided learning);" and D8, "Teach students

at a distance" all were statistically different for "desired knowledge," and "Composing/writing papers (Word processing)" (question A1); "Personal record keeping" (question A2); "Statistical analysis and research" (question A3); "Deliver individual learning(computer aided learning)" (question A6); "Design of instructional materials" (question A7); and "Teach students at a distance" (question A8) for "My assignments require or assume the use of this technology." The mean scores of female pre-service teachers were less than male pre-service teachers on these questions.

There was virtually no statistically significant differences between male and female Turkish faculty members with degrees from western universities. Differences were found between male and female Turkish faculties who earned their degrees from Turkish universities on question K1, "Composing/writing papers (Word processing)," for "current knowledge;" D2, "Personal record keeping;" and D4, "Class management (develop syllabi, track grades)" for "desired knowledge." The mean scores of female Turkish faculty members were less than male Turkish faculty members for all questions.

Category C2 of Questionnaire: How to use a computer in science for

There were statistically significant differences between male and female pre-service teachers on questions for "current knowledge," except for K1, "Library search services (data collection using peripherals);" K3, "Demonstrations and modeling;" K7, "Individualized instruction;" K14, "PowerPoint, Astound," and K20, "Web search techniques" for "current knowledge." For questions D9, "Science-technology-society issues" for "desired knowledge;" A8, "Analysis of lab data;" A11, "Databases (e.g., Access, FileMaker);" A15, "Other multimedia authoring software

(e.g., Author-ware, Hyper-studio, Macromedia);" A16, "Web publishing (e.g., Dream Weaver, Page-Mill, Navigator, Web-CT or similar);" A17, "Video editing software (e.g., iMovie, Adobe Premiere);" A18, "Graphic peripherals (e.g., Scanners, digital cameras);" and A23, "Creation and/or use of streaming media" were all statistically different with female pre-service teachers' mean scores being less than male pre-service teachers when responding to "My assignments require or assume the use of this technology."

There were statistically significant differences between male and female graduate students for "Other multimedia authoring software (e.g., Author-ware, Hyper-studio, Macromedia)" (questions K15) and "Video editing software (e.g., iMovie, Adobe Premiere)" (question K17) for "current knowledge" but no difference was found for "desired knowledge" and "my assignments require or assume the use of this technology." The mean scores for female graduate students were less than male graduate students in all questions.

Few statistically significant differences were found between male and female Turkish faculty members who earned their degrees from western universities. The only differences noted between male and female Turkish faculty members who earned their degrees from Turkish universities were on question K14, "PowerPoint, Astound" for "current knowledge," questions D1, "Library search services (data collection using peripherals);" D7, "Individualized instruction;" and D9, "Science-technology-society issues" for "desired knowledge," and questions A20, "Web search techniques" and A23, "Creation and/or use of streaming media" for "my assignments require or assume the use of this technology." In all cases the mean

scores for female Turkish faculty members were less than male Turkish faculty members on these questions.

Category C3 of Questionnaire: Effects of computer use on

There were statistically significant differences between male and female pre-service teachers on questions K1 “Classroom management,” K2, “Class preparation,” K3, “Class presentations,” and K4, “Professional presentations” for “current knowledge” and question D3, “Class presentations” for “desired knowledge.” No statistically differences were found in the “my assignments require or assume the use of this technology” subgroup. The mean scores for female pre-service teachers were less than male pre-service teachers on these questions.

Difference between male and female graduate students on question D1 “Classroom management” for “desired knowledge” were found. However, no statistically significant differences were found for “current knowledge” and the “my assignments require or assume the use of this technology.” The mean scores for female graduate students were less than male graduate students on these questions.

No statistically significant differences were found between male and female Turkish faculty members with degrees from western universities for “current knowledge,” “desired knowledge,” and “My assignments require or assume the use of this technology.” Statistically significant differences were found between male and female Turkish faculty members with degrees from Turkish universities on questions K2, “Class preparation” and K3, “Class presentations” for “current knowledge” and D1, “Classroom management,” D2, “Class preparation,” and D3, “Class presentations” for “desired knowledge.” For each of these questions the mean scores

for female Turkish faculty members were less than male Turkish faculty members in these questions.

Category C4 of Questionnaire: How to use other technology in the classroom

There was a statistically significant difference between male and female pre-service teachers on question K9, "Microscope" for "current knowledge," questions A8 "Calculators" for "my assignments require or assume the use of this technology;" but no statistically significant difference for "desired knowledge." The mean scores of female pre-service teachers were less than male pre-service teachers on these questions.

There were statistically significant differences between male and female graduate students on questions K1, "Video," K2, "Film," K3, "Interactive video," K4, "Hypermedia," K10 "Digital camera," and K11, "Others" (question K11) for "current knowledge;" on questions A2, "Film," A3, "Interactive video" A4, "Hypermedia," and A10, "Digital camera" for "my assignments require or assume the use of this technology;" but no statistically significant difference for "desired knowledge." The mean scores of female graduate students were less than male graduate students in these questions.

No statistically significant differences were found between male and female Turkish faculty members with degrees from western universities for "current knowledge," "desired knowledge," and "My assignments require or assume the use of this technology." Statistically significant differences were found between male and female Turkish faculty members with degrees from Turkish universities on questions K6, "Slides" and K7, "Concrete Manipulative models (Photographs...)" for "current

knowledge" and D6, "Slides" for "desired knowledge." The mean scores of female Turkish faculty members were less than male Turkish faculty members in these questions.

Summary

Technology has been seen as a masculine domain (Butler, 2000; Henwood, 2000; Schumacher & Morahan-Martin, 2001). Yet, few gender differences emerged from the results of the technology usage and needs of science educators' questionnaire. The group showing the most of differences between males and females were pre-service teachers and the Turkish faculty members with degrees from Turkish universities. The smallest mean differences between males and females were graduate students. No statistically significant differences were found between males and female Turkish faculty members with degrees from western universities.

The results of the "current knowledge" study showed that "How to use a computer in science for" (Category C2) had the largest number of questions showing differences between male and female responses. Particularly interesting, was the small differences between males and females for "desired knowledge" and largest differences for "current knowledge.

Table 23: Summary of Gender Differences.
Group 1: Pre-service teachers, Group 2: Graduate students, Group 3: Turkish faculty members with degrees from Turkish universities, Group 4: Turkish faculty members with degrees from western universities, C1: Ways in which computers can be used to, C2: How to use a computer in science for, C3: Effects of computer use on, C4: How to use other technology in the classroom, K: Current Knowledge, D: Desired Knowledge, A: My assignments require or assume the use of this technology,

Section		Group 1	Group 2	Group 3	Group 4
		Questions	Questions	Questions	
B		4, 7, 15, 16	12	10, 11	-
C1	K	1, 3	-	1	-
	D	5, 6, 8	-	2, 4	-
	A	1, 2, 3, 6, 7, 8	-	-	-
C2	K	2, 4, 5, 6, 8, 9, 10, 11, 12, 13, 15, 16, 17, 18, 19, 21, 22, 23	15, 17	14	-
	D	9	-	1, 7, 9	-
	A	8, 11, 15, 16, 17, 18, 23	-	20, 23	-
C3	K	1, 2, 3, 4,	-	2, 3	-
	D	3	1	1, 2, 3	-
	A	-	-	-	-
C4	K	9	1, 2, 3, 4, 10, 11	6, 7	-
	D	-	-	6	-
	A	8	2, 3, 4, 10	-	-

Note: On all questions listed under groups, male mean scores were higher and significantly different than female mean scores.

Section Four: Indicators of Technology as Elicited by Questions on the Rank of Faculty Groups

Turkish academic rank consists of five ranks, "Teaching Assistant," "Instructor," "Assistant Professor," "Associate Professor," and "Professor." The rank of faculty may play an important role regarding technology usage in preparing science teachers.

Section B of Questionnaire

The results of one-way ANOVA test showed no statistically significant differences for faculty ranks on most questions, except "I am comfortable planning for class sessions that involve student use of technology during instruction" (question B3). According to the results of the Multiple Comparison-Tukey HSD test for section B, Turkish faculty members with degrees from Turkish universities and those from

western universities were not statistically different for most questions, except for the comparison ranks of "Teaching Assistant and Instructor" on question B3, "I am comfortable planning for class sessions that involve student use of technology during instruction."

Section C of Questionnaire

Category C1 of Questionnaire: Ways in which computers can be used to

As seen Table 4.24, few statistically significant differences between faculty ranks were observed in Category C1, except for questions K5 and A5 "Entertain oneself (games)." The Multiple Comparison-Tukey HSD test for Category C1 showed that Turkish faculty members with degrees from Turkish universities and those from western universities were not statistically different for most questions in section C1, except for the comparison of "Teaching Assistant and Assistant Professor;" "Teaching Assistant and Professor" on question K5, "Entertain oneself (games)" (current knowledge); comparison of "Instructor and Assistant Professor" on question A5, "Entertain oneself (games)" (desired knowledge).

Table 4. 24. Summary of Multiple Comparison Mean Differences with Faculty Rank. C1: Ways in which computers can be used to.

	Current Knowledge (K)										Desired Knowledge (D)										My Assignments Require or Assume the Use of This Technology (A)									
Q	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10
1																														
2																														
3																														
4																														
5		*		*																					*					
6																														
7																														
8																														

Asterisks (*) indicate significant ($p < .05$) difference between five ranks; 1-Teaching Assistant versus Instructor, 2- Teaching Assistant versus Assistant Professor, 3- Teaching Assistant versus Associate Professor, 4- Teaching Assistant versus Professor, 5- Instructor versus Assistant Professor,

6- Instructor versus Associate Professor, 7- Instructor versus Professor, 8- Assistant Professor versus Associate Professor, 9- Assistant Professor versus Professor, 10- Associate Professor versus Professor.

Category C2 of Questionnaire: How to use a computer in science for.

There were statistically significant differences between the ranks of faculty on questions K4, "Graphing," K13, "Communication tools (e.g., list-servers, chat, discussion boards)," K19, "Web browsers - Basic functionality and efficiency (e.g. Netscape, Internet explorer)," and K20, "Web search techniques" for "current knowledge;" questions D16, "Web publishing (e.g., Dream Weaver, Page-Mill, Navigator, Web-CT or similar)," D18, "Graphic peripherals (e.g., Scanners, digital cameras)," and D20, "Web search techniques" for "desired knowledge;" and questions A7, "Individualized instruction," A9, "Science-technology-society issues," A10, "Spreadsheets (e.g., Excel)," A13, "Communication tools (e.g. list-servers, chat, discussion boards)," A15, "Other multimedia authoring software (e.g. Author-ware, Hyper-studio, Macromedia)," and A17, "Video editing software (e.g. iMovie, Adobe Premiere" for "my assignments require or assume the use of this technology."

The Multiple Comparison-Tukey HSD test for Category C2 showed, Turkish faculty members with degrees from Turkish universities and from western universities were not statistically significant different from each other for most questions in Category C2. The results showed that the most differences for faculty rank was for "Teaching Assistant and Instructor" for "current knowledge;" "Instructor and Assistant Professor" for "desired knowledge;" and "Teaching Assistant and Instructor," "Instructor and Assistant Professor" for "my assignments require or assume the use of this technology" (Table 4.25).

Table 4.25. Summary of Multiple Comparison Mean Differences with Faculty Rank. C2: Ways in which computers can be used to.

	Current Knowledge (K)										Desired Knowledge (D)										My Assignments Require or Assume the Use of This Technology (A)									
Q	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10
1																														
2																														
3																														
4					*																									
5																														
6																														
7																														
8																														
9																					*				*	*				
10																											*		*	
11																														
12																														
13	*			*																					*					
14																														
15																					*									
16															*															
17																					*				*					
18														*																
19	*																													
20	*			*										*					*											
21																														
22																														
23																														

Asterisks (*) indicate significant ($p < .05$) difference between five ranks; 1-Teaching Assistant versus Instructor, 2- Teaching Assistant versus Assistant Professor, 3- Teaching Assistant versus Associate Professor, 4- Teaching Assistant versus Professor, 5- Instructor versus Assistant Professor, 6- Instructor versus Associate Professor, 7- Instructor versus Professor, 8- Assistant Professor versus Associate Professor, 9- Assistant Professor versus Professor, 10- Associate Professor versus Professor.

Category C3 of Questionnaire: Effects of computer use on.

There were few statistically significant differences between the ranks of faculty in Category C3, except for questions A1, "Classroom management" and A3, "Class presentations" for "my assignments require or assume the use of this technology" subgroup.

The Multiple Comparison-Tukey HSD for Category C3 showed that Turkish faculty members with degrees from Turkish universities and from western

universities were not statistically different from each other in Category C3, except questions A1, "Classroom management" and A3, "Class presentations." The results' also showed that differences occurred between "Instructor and Assistant Professor" in Category C3 (Table 4.26).

Table 4. 26. Summary of Multiple Comparison Mean Differences with Faculty Rank. C3: Ways in which computers can be used to.

	Current Knowledge (K)										Desired Knowledge (D)										My Assignments Require or Assume the Use of This Technology (A)									
Q	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10
1																					*				*					
2																														
3																									*					
4																														
5																														

Asterisks (*) indicate significant ($p < .05$) difference between five ranks; 1-Teaching Assistant versus Instructor, 2- Teaching Assistant versus Assistant Professor, 3- Teaching Assistant versus Associate Professor, 4- Teaching Assistant versus Professor, 5- Instructor versus Assistant Professor, 6- Instructor versus Associate Professor, 7- Instructor versus Professor, 8- Assistant Professor versus Associate Professor, 9- Assistant Professor versus Professor, 10- Associate Professor versus Professor.

Category C4 of Questionnaire: How to use other technology in the classroom.

There were statistically significant differences between faculty ranks of on questions K1, "Video," K3, "Interactive video," K6, "Slides," and K8, "Calculators" for "current knowledge;" question D10, "Digital camera," for "desired knowledge;" and questions A1, "Video," A2, "Film," A3 "Interactive video," and A4, "Hypermedia" for "my assignments require or assume the use of this technology."

The Multiple Comparison-Tukey HSD test for Category C4 showed that the groups were not statistically significant different from each other on most questions in Category C4. The results indicated that when differences did occur it was primarily among "Teaching Assistants and Instructors," "Instructors and Assistant Professors,"

and “Instructors and Associate Professors.” Most differences were found in the “my assignments require or assume the use of this technology” (Table 4.27).

Table 4. 27. Summary of Multiple Comparison Mean Differences with Faculty Rank. C4: Ways in which computers can be used to.

	Current Knowledge										Desired Knowledge										My Assignments Require or Assume the Use of This Technology									
Q	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10
1	*				*					*											*					*				*
2																					*				*	*				
3										*											*				*	*				
4						*															*				*					
5																														
6																														
7																														
8	*																													
9																														
10											*				*															
11																														

Asterisks (*) indicate significant ($p < .05$) difference between five ranks; 1-Teaching Assistant versus Instructor, 2- Teaching Assistant versus Assistant Professor, 3- Teaching Assistant versus Associate Professor, 4- Teaching Assistant versus Professor, 5- Instructor versus Assistant Professor, 6- Instructor versus Associate Professor, 7- Instructor versus Professor, 8- Assistant Professor versus Associate Professor, 9- Assistant Professor versus Professor, 10- Associate Professor versus Professor.

Summary

The results of the study would indicate that the rank of faculty may impact educational outcomes which focus specifically on how to use of computer technology in the classroom. There were few statistically significant differences among the different ranks of faculty in on same of the questions. The primary differences were found when comparing “Instructors and Assistant Professors.” Interestingly, the lowest mean difference between faculty rank was for “desired knowledge” with the largest difference in “my assignments require or assume the use of this technology.”

CHAPTER V

CONCLUSIONS, RECOMMENDATIONS, AND SUGGESTIONS FOR FURTHER INVESTIGATION

Introduction

As previously stated, the purpose of this study was to describe, examine, analyze, and better understand the Turkish government's policy regarding the access and implementation of educational technology into the Turkish education system and the views of Turkish faculty, Turkish pre-service science education teachers, and graduate science education students on educational technology. In this study, Turkish faculty members who earned their degrees from western universities and graduate students from the U.S. represent a modern perspective of educational technology. Turkish faculty members with degrees from Turkish universities and Turkish pre-service science education teachers represent the general perspective of Turkish education. In this chapter, the conclusions to the research questions posed in Chapter III will be presented:

1. What are Turkish science teachers' perceptions on using technological tools in science courses?
2. What are Turkish science education pre-service teachers' perceptions on using technological tools in science courses?
3. What are the differences in perceptions on using technological tools in science courses among Turkish faculty members (who have been working in science education departments in Turkish universities), Turkish faculty members (who have earned a science education degree from western

countries and have been working in Turkish universities), Turkish pre-service teachers in the Turkish universities, and master and PhD students' (who are currently studying in the western countries)?

In this chapter, major themes and results will be discussed. In the process, the three research questions guiding this study will be answered. First, I will discuss the Turkish government's policy regarding the integration of educational technology into the Turkish education system. Second, based on the results and findings of my study I will draw conclusions about what Turkish educators and students know about educational technology and their specific needs. Next, based on the results and findings of the study recommendations will be made regarding issues related to Turkish faculty and educators' use of educational technology in their science courses. Finally, areas for further study will be presented.

Turkish Government's Policies and Efforts on the Integration of Educational Technology into Turkish Education System

Turkish people have had the right to go abroad to pursue academic training and education since the founding of the Turkish Republic in 1923. The Minister of National Education (MEB) has made great efforts in modernizing the national educational system. In addition, governmental initiatives have made technology one of the major foci of educational policies and reforms in Turkey. These reforms support the use of technology in science classrooms and the overall integration of educational technology into the Turkish educational system. These policies and reforms, such as the Computer-Aided Education (CAE) project, the Computer Assisted Instruction (CAI) project, the Formator Teacher Training project, the

Computer-Based Education (CBE) project, the Computer Experimental Schools (CES) project, the Basic Education Pilot Project (BEPP), the Computer-Mediated Distance Education (CMDE) project, and Cognitive Technologies for Problem Solving and Learning (COG-TECH Network), were influenced by the U.S., European Union, and specific European countries (Great Britain, France, and Germany). Based on the current efforts in these countries, Turkey continues to shape and to modernize its educational system, especially in the areas of learning theories, curriculum development, and educational technology. Some projects have played a larger role in shaping the Turkish education system than other projects such as: Science for All Americans; Project 2061 (American Association for the Advancement of Science, 1990), Benchmarks for Science Literacy (American Association for the Advancement of Science, 1994), National Science Education Standards (National Research Council, 1996), Eurydice (1980), Introduction of New Information Technology (1983), Educational Multimedia Software in the fields of Education and Training (1996), Socrates I-II (1995-2000), Maastricht Treaty (1992). These reform efforts from western countries are an important part of the contemporary reform efforts of Turkish science education.

According to Law 1416 (1929), the government of Turkey distributes to students (based on nation-wide exams) scholarships/sponsorships to study abroad. Students who are sponsored by the government are required and encouraged to pursue particular fields identified as need areas by the government. Science education is one of the fields in which Turkey currently lacks a sufficient amount of educated professionals. Of course, changes in Turkey's economic and social structures,

technology, and globalization are all considered by political entities as they identify the need areas for fields of study and in determining the educational priorities. Those who are sponsored by the government are expected to graduate within a specified time frame and return to Turkey and request an appointment by the Ministry of Education to be appointed a teaching assignment. The Turkish government expects students to bring with them western knowledge, and training and skills in science and technology. Although there are no studies in literature examining Law 1416's effectiveness and the impact on the country's development, the main purpose of sending students to other countries is to achieve greater efficiency in the Turkish education system and faster growth in Turkey's development. Over the past few decades, the Ministry of Education (MEB) has become interested in the impact of technological tools on traditional science classroom pedagogy, which has generally been didactic and teacher-centered. The government concluded that integrating technology into traditional teaching was not effective; thus, they addressed the use of technology in classrooms by encouraging the use of real-world problems in teaching the subject of inquiry-based teaching methods in which technological tools can present potential changes in the way academics teach and students learn science.

Conclusions

The findings of this study will be presented according to three perspectives: a) Turkish faculty members, b) students, and c) Turkish government. The mean scores from the four samples (Turkish pre-service teachers, graduate students who are studying in the U.S, Turkish faculty members with degrees from Turkish universities and Turkish faculty members with degrees from western universities) related to: a)

"General knowledge about educational technology" (Section B), b) "Ways in which computers can be used to" (Category C1), c) "How to use a computer in science for" (Category C2), d) "Effects of computer use on" (Category C3), and e) "How to use other technology in the classroom" (Category C4) were examined.

Using a one-way analysis of variance (ANOVA) and a post hoc test for multiple comparisons (Tukey HSD test), significant differences were found among these groups. The results indicated that there are more similarities between pre-service teachers and Turkish faculty members with degrees from Turkish universities and between the responses for graduate students and Turkish faculty members with degrees from western universities. In comparison, the groups of pre-service teachers and Turkish faculty members with degrees from Turkish universities had lower mean scores than graduate students and Turkish faculty members with degrees from western universities (see Tables 4.12, pg. 98; 4.13, pg. 101; 4.15, pg. 112; 4.16, pg. 118; 4.18, pg. 125; 4.19, pg. 126; 4.21, pg. 134; and 4.22, pg. 137). This is a very important finding because this could directly reflect how teachers teach using technology. This also has a direct impaction how students learn to use technology. It would be difficult for most students to learn about technology if their teachers are not knowledgeable about, and using technology effectively. Teachers must also be able to prepare students to adapt to the changes in culture. New technological skills are required for full participation in the 21st century. Because technology is prevalent in nearly all Turkish activities, the Turkish people expect it to be used to enhance student achievement and prepare future citizens.

The results would indicate that pre-service teachers and Turkish faculty members with degrees from Turkish universities have similar knowledge regarding technology. In fact, pre-service teachers' knowledge was the lowest among all groups indicating they may not be prepared with skills necessary to succeed in the 21st century. This is not surprising since the faculty that teaches them had similar perspectives and knowledge regarding technology. The mean scores for Turkish faculty members with degrees from Turkish universities were lower and significantly different than Turkish faculty members with degrees from western universities and graduate students (see Tables 4.10, pg. 89; 4.11, pg. 97; 4.14, pg. 108; 4.17, pg. 124; and 4.20, pg. 132). It would seem that Turkish faculty members with degrees from Turkish universities need to get more involved in implementing educational technology in their classrooms. The results from this study corroborate Cagiltay, Cakiroglu, Cagiltay, and Cakiroglu, (2001) study which found similar results about Turkish teachers' view of using computers in education.

There might be many reasons for why this group of Turkish faculty members is one step behind where they need to be. They might lack the time and motivation to learn technology skills or use technology. Technology could be very intimidating for many because learning how to use new technology always requires new learning, especially in the current rapidly changing educational system. In comparison, Turkish faculty members with degrees from western universities have very different perspectives on how technology can be used to support and enhance learning (see the mean scores for categories C1, C2, C3, and C4 in Tables 4.10, pg. 89; 4.11, pg. 97; 4.14, pg. 108; 4.17, pg. 124; and 4.20, pg. 132). It appears their experiences with and

about technology has greatly impacted their knowledge and attitudes toward technology. Based on this, it seems that these individuals, Turkish faculty members with degrees from western universities could have a positive impact on the use of educational technology within the Turkish education system. Their exposure to a western education system that has implemented technology in a more effective and systemic manner has changed the way they view technology in a classroom setting. As well, Turkish graduate students from the American universities could also have a similar positive impact on the use of educational technology when they return to Turkey. Their mean scores were higher than Turkish pre-service teachers and Turkish faculty members with degrees from Turkish universities (see categories C1, C2, C3, and C4 in Tables 4.10, pg. 89; 4.11, pg. 97; 4.14, pg. 108; 4.17, pg. 124; and 4.20, pg. 132). Turkish faculty members with degrees from Turkish universities must become more informed about educational technology and become more involved in integrating technology in their classrooms, since Turkish pre-service teachers indicate a relative lack of technology integration in their educational experiences (see Tables 4.11, pg. 97; 4.14, pg. 108; 4.17, pg. 124; and 4.20, pg. 132). Turkey needs more science education faculty members using technology to improve the learning environment for their students. In turn, their students (pre-service teachers) will improve the learning environments for their K-12 students. By improving the learning environment through technology, students achievement can be positively impacted, which is supported by two decades of research in western countries (Conlon, 2000: Correard, 2001; Hopson, Simms, & Knezek, 2002; Pedersen, & Totten, 2001;

Pedersen, & Yerrick, 2000; Scardamalia, Bereiter, McLean, Swallow, & Woodruff, 1989).

The results of this study showed that Turkish faculty members (educated in Turkey), who taught in public or private K-12 schools or universities (Section A, question 3), do not have enough information about how useful educational technology can be and they indicate an inadequacy in their preparation to use computers and other technological tools in their classroom (see Tables 4.10, pg. 89; 4.11, pg. 97; 4.14, pg. 108; 4.17, pg. 124; and 4.20, pg. 132). In some cases, Turkish faculty members (educated in Turkey), who taught in public or private K-12 schools or universities, work with Turkish faculty members with degrees from western universities. However, they still are not using the available educational technology on a regular basis (see Tables 4.10, pg. 89; 4.11, pg. 97; 4.14, pg. 108; 4.17, pg. 124; and 4.20, pg. 132). A lack of effective leadership and a lack of confidence to try technology integration themselves may be the primary reasons why technology integration is not being accomplished. Munday, Windham, and Stamper (1991) and Davies (2001) found that older teachers lack the confidence to use technology and prefer not to change their teaching style. It is not enough to purchase the equipment, it is also important to have support and be empowered to become effective learners themselves. As an example, in this study many universities have computer rooms for students and offer technology courses. Almost every faculty member in Turkey has a personal desktop or laptop computer (Turkmen & Pedersen, 2005; Usun, July 2003b). Yet, the results showed that Turkish faculty members with degrees from Turkish

universities did not use educational technology in their classrooms (Tables 4.11, pg. 97; 4.14, pg. 108; 4.17, pg. 124; and 4.20, pg. 132).

Turkish pre-service teachers used technology "seldom or sometimes" in their assignments. These same pre-service teachers indicated that they knew very little about technology and technology use for teaching. It would seem that they are not being taught how to integrate technology within their preparation programs. Indeed, as previously mentioned, Turkish faculty members with Turkish degrees do not have the knowledge about the effective use of technology and innovations in technology to provide a sound understanding to their students. The results of this study indicate that Turkish faculty members with degrees from Turkish universities gave assignments that "seldom" require technology (see Tables 4.11, pg. 97; 4.14, pg. 108; 4.17, pg. 124; and 4.20, pg. 132). That is, Turkish pre-service teachers do not have to use technology in their assignments. It seems obvious that if pre-service teachers do not use technology as they are taught, they would not know enough about how to integrate it into their own teaching. In comparison, Turkish faculty members with degrees from western universities gave assignments that "often or usually" required technology.

Results also showed that pre-service teachers in Turkish universities have the lowest mean scores in "current knowledge" and "my assignments require or assume the use of this technology" subsections of educational technology usage and needs of science education (Tables 4.11, pg. 97; 4.14, pg. 108; 4.17, pg. 124; and 4.20, pg. 132). While the limited use of technologies, especially computers, in classrooms cannot be attributed solely to pre-service teacher education; schools, colleges, and

departments of education, must recognize that Turkish pre-service teacher programs are lagging behind in meeting the needs of Turkish children vis-à-vis the development of technological competency. The positive effects of technology are well known including the impact of technology on development due to the interactive nature of software and the Internet (Mistler-Jackson & Songer, 2000; Varis, 2004; Zammit, 1992). Even with this knowledge, pre-service or new teachers are exposed to teacher educators that do not sufficiently model the appropriate use of computers for instructional purposes in science courses. The tendency in Turkey is to focus on the older and simpler instructional applications of computer technology (e.g., computer assisted instruction, word processing) and older educational technologies (e.g., overhead projectors, calculators, slides) (Tables 4.11, pg. 97; 4.14, pg. 108; 4.17, pg. 124; and 4.20, pg. 132). Less exposure is given to and practice with newer, more sophisticated tools (e.g., electronic networks, hypermedia, digital cameras, integrated media, and problem-solving applications). Not only are children missing an opportunity to become technologically literate, but they are also missing opportunities for the development of higher-order thinking and problem-solving skills (Dillon & Gabbard, 1998; Underwood, Cavendish, Dowling, Fogelman, & Lawson, 1996).

Turkish officials have communicated a belief that there is a pressing need to substantially increase the amount and quality of instruction teachers receive about technology (Akunal, 1992; Akkoyunlu, 2002; Arslan, October, 2003; Aydin & McIsaac, 2004). However, several obstacles must be overcome in order to infuse new technology into teacher education programs. They include: (a) the limited availability of equipment; (b) the lack of faculty training; (c) no clear expectation that faculty will

incorporate technology in academic activities; (d) the lack of funding for systemic change; (e) the lack of time to develop facility in using equipment and software; (f) the lack of technical support; and (g) the lack of appropriate materials, particularly integrated media materials suitable for teacher education instruction (Usun, 2003a, 2003b). Improving the performance of Turkish schools through preparing technologically proficient teachers will require expanding technology use among teacher educators. As part of this reform effort, the Ministry of Education should move away from traditional methods (teaching as subject-based and teacher-centered where knowledge is transmitted by a teacher through teacher-driven lectures, seminars or assignments; where learning is based on repetition, rehearsal and memorization) to more contemporary and current learning theories, which value activation of prior knowledge, a connection of the theoretical to the experiential, and the use of relevance and efficacy to assess information. With these theories, "there is a fundamental shift from instruction to construction and delivery. Learning is not simply assimilating knowledge transmitted by textbooks and instructors but personally building and communicating knowledge" (Harada, 2003, p. 42). Turkey must prepare new academic faculty to use technology through personally building their knowledge of technology. Schools, colleges, and departments of education should develop and require coursework in which students learn how to use technology effectively by demonstrating integration during student teaching.

The results of the study also reflect that some females perceive themselves differently than males on many of the questions. Although no gender differences were found among the Turkish faculty members with degrees from western

universities, female graduate students mean scores were significantly lower on the "How to use other technology in the classroom" (Category C4). One possible reason for this may be that different types of technological tools, especially older forms of technology, such as calculators, slides, and overheads, may not be emphasized in western graduate programs.

The sample showing the most differences between male and female responses was for the pre-service teachers, especially for "How to use a computer in science for" (Category C2). Women consistently rated themselves lower than males for category (C2), "How to use a computer in science for" than did their male counterparts. Men perceived themselves as having more current knowledge and more assignment requirements with computers and other technologies, and knew more about the use of technology than their female counterparts. This would indicate that a gender gap may exist among Turkish pre-service teachers about their own personal experiences with computer technology. Although based on the current study one cannot say that gender had an effect on graduate students and Turkish faculty members who earned their degrees from western universities, data suggest that gender differences (the way men and women evaluate their educational outcomes) may be based in part on their experiences with computer technology in the classroom.

The data from this study also reflects that the differences observed among faculty rank were mainly found between "Instructors and Assistant Professors" (see Tables 4.24, pg. 145; 4.25, pg. 147; 4.26, pg. 148; and 4.27, pg. 149). One possible explanation is that most teachers in Turkish universities have a Ph.D. In order to earn your Ph.D. degree, you must take technology courses, and have proficiency in the

English language. This provides opportunities to read and understand current research and new approaches that utilize technology for education. It would seem that assistant professors have an advantage over instructors and are able to gain a broader understanding of technology through their program of study and subsequent reading and study.

Integrating technology into teaching and learning in Turkish education is a slow, time-consuming process that requires substantial levels of support, encouragement, and requires patience and understanding. The most common reasons given for the low level of computer use in schools are limited access to equipment and lack of training (Usun, July 2003b). However, the Turkish government has realized that integrating technology is one of the keys to developing a modern Turkey. Both curriculum and pedagogy must be reformed in order to take advantage of the benefits of technology and move Turkey into the 21st century. The Ministry of Education has spent millions of dollars on computers for K-12 schools and higher education over the past decade (Askar & Akkoyunlu, 1994; Yedekcioglu, 1996). The total number of computers in schools has indeed increased (Akkoyunlu, 2002; Akkoyunlu & Orhan, 2001; Metargem, 1991). Despite this effort and growth, the limited investigations into computer use in classrooms have concluded that computer-based technologies are not being fully exploited by the majority of teachers (Turkmen & Pedersen, 2005; Usun, July 2003b).

Some possible reasons why Turkish government efforts have not succeeded during the past decade is that almost all attempts have been lost in the highly bureaucratic Turkish government process and centralized organization of the MEB

(Aydin, 2001; Turkmen & Pedersen, 2005). Another potential reason is that political affairs during the 1980s and 1990s were unstable. There was tremendous dissension between various factions, and governments were formed and reformed as different parties gained and lost control. Therefore many educational reforms and projects were not finished, since each government leader would implement their own personal reforms rather than completing previous opposing parties' ideas. A final reason for lack of systemic growth could be the economical problems caused by unbalanced or unstable economic growth within Turkey. The Cyprus problem, the violence between Kurdistan Workers' Party (PKK) and Turkish security forces have undermined the Turkish democracy, and chaos and instability in the Middle East have deeply affected the Turkish economy. All these reasons can be linked to why many if not most of the reforms or projects have failed during the last three decades.

This study also showed that Turkish faculty members with Turkish degrees do not have ability to use technology efficiently in science classes. According to current OECD research (over 250 thousand 15 years-old students from 41 countries), Turkey is significantly behind many other OECD countries in science, problem solving in math, and reading, (Elevli, 2004). The literature suggests that: (a) relatively few teachers routinely use computer-based technologies for instructional purposes; (b) when computers are used, they are generally used for low-level tasks such as drills and word processing; and (c) computers are not sufficiently integrated across the curriculum. This corroborates the current study and other researchers who found that the most common reasons given for the low level of computer use in schools are limited access to equipment and lack of training (Akkoyunlu, & Orhan, 2001; Arslan,

2003; Askar & Akkoyunlu, 1994; Aydin & McIsaac, 2004; Orhun, 2003; Ozar & Askar, 1997; Usun, 2003, 2003b; Yedekcioglu, 1996). In order for teachers to be effective in their classrooms, pre-service teachers must be immersed in appropriate technology in their coursework. A crucial first step would be to have all pre-service teachers and faculty educated to use technology effectively in their teaching. Without this step, successful implementation of technology will be difficult at best.

The Turkish government has started the long road to change by encouraging and supporting graduate students to study in western universities. These new professionals have the potential to have a positive impact on the future of Turkish education. From the current study, it is evident that these new professionals believe that technology support should become an integral part of teacher education and classroom curricula (Tables 4.11, pg. 97; 4.14, pg. 108; 4.17, pg. 124; and 4.20, pg. 132). New model programs should be characterized by required courses for pre-service teachers which teach them how to use instructional technologies and expose them to technology-rich higher education classrooms. This study showed that graduate students and Turkish faculty members who earned their degrees from western universities know how educational technologies such as computers, video, digital cameras, multimedia systems, and networks can support teacher education programs and how computer and related educational technologies increase students' achievement. Because they were educated in technology-enriched learning environments, they know and understand not only the technology, but also the most appropriate approaches for creating learner-centered, interactive, technology based and collaborative learning experiences. They recognize that students should focus on

critical thinking, constructing knowledge, and developing an understanding of content in this environment (Pedersen & Yerrick, 2000). The graduate students and Turkish faculty members who earned their degrees from western universities know technology is a tool that as Tileston (2000) notes, can help teachers embody best practices to create an enriched and collaborative learning environment, meet a variety of learning style needs, support learning transfer, assist with the attainment of long-term memory and deep understanding, address high-level thinking, make education equitable, and incorporate real world problems and authentic assessments.

Limitations

This study was a cross-sectional study conducted over a short period of time. The survey instrument was an adaptation from earlier studies and was previously evaluated for validity and reliability. Various factors associated with each population were not standardized prior to analysis. While gender and other demographics were included in this study, other controls in analysis such as family, social and economic status, college scores, work responsibilities, part-time or full-time enrollment were not incorporated into this study.

Areas for Further Investigation

This research study is only a beginning in the quest to understand technology use in Turkey. From this work, several recommendations for further study in the areas of technology education and technological literacy are apparent.

1. Since the information gathered in this study was a short term study, a long-term longitudinal study is needed.

2. Incorporation of other factors such as family social and economic status, college scores, work responsibility, part-time or full-time enrollment. This will enhance further characterization of the four populations.
3. Increasing the number of participants as well as increasing the number of institutions included in this research would aid in expanding the knowledge base.
4. Studies need to examine those who have returned to Turkey in terms of their expectations and goals for working in Turkey, their expectation for change in Turkish education, and the kinds of obstacles they encounter.
5. A comprehensive study needed in order to examine Turkey's 1416 Law's effectiveness and impact on the country's development.
6. Additional research is needed to determine the value of technology education. This includes research related to the contributions of technology education in regards to the integration of science, and technology, positive learning environments, and effects technology education has on students' development of skills and technological literacy.

Recommendations

Based on the results and findings of this study, there are several salient recommendations to be made relating to issues of integrating educational technology into the Turkish education system. These recommendations will be shared with the Turkish Ministry of Education's General Directorate of Educational Technologies and Department of Education Research and Development (MEB), The Council of

Higher Education (YOK), and The Scientific and Technical Research Council of Turkey (TUBITAK).

- The integration of educational technology into the science curriculum will not succeed without giving teachers ample time to practice, explore, conceptualize, and collaborate. They need education and ongoing support to be able to develop the confidence needed to lead their students.
- The Turkish government must infuse computers into the daily lives of teachers and students. Every school, even primary schools, should have computers in classrooms throughout the entire country.
- Turkish teacher educators should sufficiently model appropriate use of computers for instructional purposes, either in courses or field experiences.
- Technological tools should be integrated according to the needs and characteristics of Turkish students (with careful consideration of its cultural effect and with careful blend of Turkish cultural values), rather than using educational materials developed by other countries.
- The pre-service teacher education programs should incorporate technology across the curriculum.
- The instruction that is provided to pre-service teachers should focus on not only the older and simpler instructional applications of computer technology (e.g., computer assisted instruction, word processing) but also practice with newer, more sophisticated tools (e.g., electronic networks, integrated media, problem-solving applications), which support development of students' higher-order thinking and problem-solving skills.

Summary

All disciplines have their own epistemological beliefs and associated culture. Educational technology will play a central role in educating students, even citizens of pluralist democracies in the 21st century. Technology of the 1990s was marked by a focus on the integration of computer technology, communication technology, and multimedia. This became the focal point for the new Turkish pedagogy. Currently Information and Communication Technology (ICT) has been adopted as a focus in Turkish education. ICT has been greatly influenced by the EU and involves finding, sharing, and re-structuring information. Technologies exist that can assist and enhance learning in the classroom. But for Turkey, there needs to be greater support for Turkish teachers and professors in order to deliver their effective educational technologies. Universities must lead the way in educating new teachers on the new technologies can be integrated effectively into their classrooms.

Based on the current study, it appears that Turkish males and females have different technology-related attitudes, behaviors, and skills. Gender perspectives on "Technology Usage and Needs Science Educators" survey have brought to light the gendering of educational technology in the Turkish education system. The technological gender gap between pre-service teachers is created and influenced by several factors, which might include cultural, religious, economical, and psychological factors related to the place of females in Turkish society. The need to remedy gender inequities in the use of educational technology is dire. Ignoring, denying, or failing to respond to the technological gender gap is likely to render large

numbers of female students unprepared to meet the technological challenges of the future.

Most science faculty members seem to be willing to incorporate educational technology into their curricula. However, it is clear that they want to know more about using computers to deliver science instruction, to manage instruction, and to use computers as data banks. The most widely-used application on computers by teachers appears to be word processing. In fact, a relatively small number of science faculty members are using educational technology, especially computer and digital technological devises as integral part of their students learning experience (see Tables 4.10, 11, 14, 17, and 21). A small number use computers to produce items such as crossword puzzles, word searches, posters, signs, and diagrams to support instructional activities or use computers as a component in selected laboratory activities. But this Turkish government must do more to prepare faculty to effectively use technology in their teaching. Science education teachers must be encouraged to accept their responsibilities as both users and learners of educational technology, must be encouraged and empowered to seek learning on their own and be willing to accept the notion that successful computing involves more than merely following procedural rituals. There are no quick fixes, no shortcuts, and no way to effectively guide computer use for others without personal in-depth experiences that amount to a complete education for the facilitator/teacher

Through Turkish governmental efforts, students are increasingly being introduced to computer database searching at universities. Many universities subscribe to databases on CD-ROM. In addition, modems are used to access

governmental databases at remote locations. Such databases range from libraries' online catalogs to scientific data being gathered from spacecraft and satellites (McIsaac, 1992; Turkmen & Pedersen, 2005; Usun, July 2003a).

Computer use in the Turkish classroom is still in its infancy. Its overall effectiveness needs to be enhanced by better hardware and software as well as greatly increased availability of each. More research is needed to discover the most effective strategies for implementation. The rate at which computers will be used to enhance education, in science and in other fields, depends mainly upon state and national monetary commitment, followed by the willingness of the government to support individual schools in proving sophisticated in-service programs.

Science education of the future will certainly incorporate computer use--including word processing, many forms of CAI, laboratory instrumentation, interactive video courseware, and scientific database searching--and the educational process will be better because of it both in Turkey and around the globe.

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APPENDIX A
Faculty Technology Survey
(English)

Faculty Technology Survey

TECHNOLOGY USAGE AND NEEDS OF SCIENCE EDUCATORS

This questionnaire is designed to gather information about how pre-service teachers use computer technology, the importance they place on it, and their needs in the effective technology integration issues. Your response will provide important information which will help us design an online training environment in order to help you learn how to use computers as tools to enhance your teaching and to improve your students' learning. Thank you in advance for your cooperation.

Section A- Directions: Please complete the following questionnaire. Answer all the questions.

1. Institution/Respondent:_____
2. E-mail address:
3. Number of years taught in public or private K-12 school or university_____
4. What was your undergraduate degree area; (Bio. Chem., Phy,.)_____
5. What is your rank?

Teaching Assistant____, Instructor____, Assistant Professor _____, Associate Professor____, Professor ___.

6. Gender; Female _____, Male _____

7. Rate your overall skill with using technology in support of your professional practice.

___Non-user

___Novice

___Intermediate

___Advanced

___Expert (I often serve as a resource to others

8. Did you take technology or computer classes in?

High school _____YES, _____NO

Undergraduate School _____YES, _____NO

Master's course work _____YES, _____NO

Doctoral course work _____YES, _____NO

Within the past 5 years _____YES, _____NO

9. Have you taken or are you presently taking a computer course or workshop?

_____YES_____NO

Section B- Level of agreement about use of technology.
Please indicate your level of agreement with the following statements about your use of technology.

	Strongly Agree	Agree	Disagree	Strongly Disagree	Does Not Apply
1- When designing my own lessons, I regularly include educational technologies where appropriate.					
2- When selecting educational technologies, I refer to, and base my selections on, current research on their effectiveness.					
3- I am comfortable planning for class sessions that involve student use of technology during instruction.					
4- I have strategies for assessing student learning in technology-rich learning environments.					
5- I regularly use technology to enhance learning in my classroom.					
6- I have strategies for using technology to individualize instruction and meet the needs of diverse learners.					
7- I am comfortable teaching with technology and have adequate classroom management strategies for technology-supported learning.					
8- I use technology to assess and analyze student progress e.g. using spreadsheets, grade books, or handheld computers/PDA's to record and manage assessment data.					
9- I have strategies for assessing student products created using technology.					
10- I regularly use technology to communicate and collaborate with peers (e.g., email, threaded discussion boards, listserv, and chat).					
11- I regularly use technology to increase my own professional productivity (word processing, spreadsheets, end note, PowerPoint, etc.).					
12- I have developed my own electronic portfolio.					
13- I have a personal technology plan that guides my own technology-related professional development.					
14- As appropriate, I address social, ethical and legal implications of technology use with my students.					

Section C- Directions: for each technology, each statement should be rated in three different ways using two sets of numbers, select the response that best describes
a) Describes your present level of knowledge with personal and professional use.
b) Describes the level of knowledge you would like to have. (If you have as much knowledge as you would like to have, the same number should be circled in each column.)
c) How often your assignments require students to use that technology,

I. Ways in which computers can be used to:

	a) CURRENT KNOWLEDGE	b) DESIRED KNOWLEDGE	c) My assignments require or assume the use of this technology
	Very Low Low Medium High Advanced	Very Low Low Medium High Advanced	Never Seldom Sometimes Often Usually
1) Composing/writing papers (Word processing).	□		
2) Personal record keeping.	□		
3) Statistical analysis and research.	□		
4) Class management (Develop syllabi, track grades).	□		
5) Entertain oneself (games).	□		
6) Deliver individual learning (computer-aided learning).	□		
7) Design of instructional materials.	□		
8) Teach students at a distance.	□		

II. How to use a computer in science for:

1) Library search services (data collection using peripherals).	□		
2) Database storage of lab data.	□		
3) Demonstrations and modeling.	□		
4) Graphing.	□		
5) Computer assisted instruction.	□		
6) Problem solving.	□		
7) Individualized instruction.	□		
8) Analysis of lab data.	□		

9) Science-technology-society issues.	□		
10) Spreadsheets (e.g., Excel).	□		
11) Databases (e.g., Access, FileMaker).	□		
12) Email.	□		
13) Communication tools (e.g., List-servers, chat, discussion boards...).	□		
14) PowerPoint, Astound.	□		
15) Other multimedia authoring software (e.g., Author-ware, Hyper-studio, Macromedia).	□		
16) Web publishing (e.g., Dream weaver, page-mill, navigator, web-CT or similar).	□		
17) Video editing software (e.g., iMovie, adobe premiere).	□		
18) Graphic peripherals (e.g., Scanners, digital cameras).	□		
19) Web browsers - Basic functionality and efficiency (e.g., Netscape, Internet explorer).	□		
20) Web search techniques	□		
21) Technologies specific to your field (e.g., Probe-ware in the sciences, geographic information systems in the social sciences).	□		
22) Data analysis software (e.g., SPSS, SAS, other statistics or analysis software).	□		
23) Creation and/or use of streaming media.			

III. Effects of computer use on:

	a) CURRENT KNOWLEDGE	b) DESIRED KNOWLEDGE	c) My assignments require or assume the use of this technology
	Very Low Low Medium High Advanced	Novice Low Medium High Advanced	Never Seldom Sometimes Often Usually
1) Classroom management.	□		
2) Class preparation.	□		
3) Class presentations.	□		
4) Professional presentations.	□		
5) Time management.	□		

IV. How to use other technology in the classroom:

1) Video.	□		
2) Film.	□		
3) Interactive video.	□		
4) Hypermedia.	□		
5) Overhead projector.	□		
6) Slides.	□		
7) Concrete Manipulative models (Photographs...).	□		
8) Calculators.	□		
9) Microscope.	□		
10) Digital cameras.	□		
11) Others.	□		

APPENDIX B
Faculty Technology Survey
(Turkish)

Akademik Personel icin Teknoloji Anketi

FEN BİLGİSİ EGİTİMİNDE TEKNOLOJİ KULLANIMI VE GEREKLİLİGİ

Bu anket "ogretim elemanlarinin" teknolojik egitim araçlarını nasıl kullandıgı, bilgisayarı derslerinde kullanmaya verdikleri önemi ve teknolojiyi etkili bir şekilde kullanma ihtiyaçları hakkında bilgi toplamak için düzenlenmiştir.Sizin cevaplarınız ögrencilerinizin daha iyi ögrenmesine, ögretim elemanların teknolojik egitim araçlarını etkili bir şekilde kullanmalarına ve daha iyi egitim, ögretim vermelerine yardımcı olacaktır. Yardımlarınız için teşekkürler.

Bolum A- Açıklamalar: Lütfen aşagıdaki boşlukları uygun şekilde doldurunuz.

1. İsim / Üniversite_____

2. E-mail Adresi _____

3. Bu meslekte kaç yıl tecrübeniz var _____

4. Lisans diplomanızdaki alanınız. (Biyoloji. Kimya, Fizik ...)_____

5. Ünvanınız:

Asistan___, Ögretim Görevlisi ___, Yardimci Doçent. ___, Doçent ____,

Profesör___.

6. Cinsiyetiniz: Kadın_____, Erkek_____

7. Derslerinizde, teknolojik egitim araçları kullanımındaki bilgi düzeyiniz:

___Hiç kullanmam

___Cok az bilgi sahibiyim

___Orta derece bilgiliyim

___Ileri duzeyde bilgiliyim

___Uzman düzeyinde bilgiliyim

8. Teknolojik egitim araçlari veya bilgisayar kullanımı ders aldınız mı?

Lisede	EVET _____, HAYIR_____.
Üniversitede	EVET _____, HAYIR_____.
Masterda	EVET _____, HAYIR _____.
Doktorada	EVET _____, HAYIR _____.
Son 5 yil icinde	EVET _____, HAYIR _____.

9. Bilgisayar kursu, seminerlerine katıldınız mı veya su anda katiliyormusunuz?

EVET_____, HAYIR_____.

Bolum B-. Teknoloji kullanımı hakkında size uygun olan ifadeyi işaretleyiniz.

	Kesinlikle Katılıyorum	Katılıyorum	Katılmıyorum	Kesinlikle Katılmıyorum	Fikrim Yok
1- Ders planımı hazırlarken, egitimsel teknolojik araçlarını uygun olan yerlerde düzenli şekilde kullanırım.					
2- Egitimsel teknolojik araçları seçerken, bu araçların etkisi hakkında yapılan araştırmaları baz alarak tercihimi yaparım.					
3- Ders planımda, ögrencilerimin egitimsel teknolojik araçları kullanımı konusunda rahatımdır.					
4- Teknoloji yönünden zengin ögrenim ortamlarında, ögrencilerimin ögrenim seviseyini degerlendirmede stratejilere sahibim.					
5- Ögrenimi arttırmak için, derslerimde düzenli bir şekilde egitimsel teknolojik araçları kullanırım.					
6- Farklı ögrencilerimin ihtiyaçlarını karşılamada ve bireysel egitimde teknolojiyi kullanmak için stratejilere sahibim.					
7- Teknoloji ile ögrenimde rahatım ve teknoloji destekli ögrenmede yeterli sınıf idaresi stratejilerine sahibim.					
8- Ögrencilerin ögrenme gidişatını degerlendirmede ve incelemede teknolojiden yararlanırım, örnegin quız kagıtları, not defteri, ve el bilgisayarı / kayıt cihazı.					
9- Ögrencilerin teknoloji kullanarak yarattıkları ürünleri, ödevleri, projeleri degerlendirmede stratejilerim var.					
10- Diger meslektaşlarımla ve ögrencilerimle iletişim kurmada ve yardımlaşmada, düzenli bir şekilde teknolojiyi kullanırım. Mesela email, internetteki tartışma odaları, listserv gibi).					
11- Kendi profesyonel üreticiligimi arttırmada, düzenli bir şekilde teknolojiden yararlanırım. (mesela, word processing, quız kagıtları, dip not, PowerPoint, Excel).					
12- Elektronik portfolyomu (ders ile ilgili tüm materyaller) kendim yaptım.					
13- Teknoloji ile ilgili mesleki gelişimime rehber olan veya yönlendiren kişisel teknolojik planlara sahibim.					
14- Hedefim ögrencilerimle birlikte sosyal, etiksel ve yasal olarak uygun şekilde teknolojiyi kullanmaktır.					

Bolum C- Açıklamalar: Her bir ifade 3 farklı bölümde işaretlenmelidir. Size uygun en iyi tanımlamayı seçerek işaretleyiniz.

a) Kişisel ve profesyonel teknoloji kullanımında şu anki bilgi düzeyinizi tanımlayınız.
b) Bilgi düzeyinizin nasıl olmasını istediginizi tanımlayınız. (Eger sahip oldugunuz bilgi düzeyi olmasını istediginiz düzey ile aynı ise, aynı kutucuk her bir sütun için işaretlenmelidir.)
c) Nekadar sıklıkla ödevleriniz, ögrencilerin teknoloji kullanımına ihtiyaç gösteriyor.

I. Bilgisayar kullanılabilecek alanlar:

	a) Şu anki bilgi düzeyiniz	b) Olmasını istediginiz bilgi düzeyi	c) Ögrenciler, ödevlerinde hangi sıklıkla teknolojik araçları kullanma ihtiyacı duyuyor.
	Çok düsük Düsük Orta derece Yüksek İleri derece	Çok düsük Düsük Orta derece Yüksek İleri derece	Asla Nadiren Bazen Sıklıkla Genellikle
1) Derleme/yazmada (Word processing).	□		
2) Kişisel belgelerin saklanmasinda.	□		
3) İstatistiksel inceleme ve arastirmalarda.	□		
4) Sinif idaresinde (ders plani, not vermede).	□		
5) Kişisel eglenceler (bilgisayar oyunlari).	□		
6) Kişisel egitim verme (bilgisayar yardimli ögrenim).	□		
7) Ders materyallerin dizayni.	□		
8) Uzaktan egitim.	□		

II. Fen Bilgisinde bilgisayarın nasıl ve nerede kullanılacagı:

1) Kütüphanede arastirma servisi icin (veri toplamada).	□		
2) Database olarak labaratuvar sonuclarinin saklanmasinda.	□		
3) Modelleme ve sunum icin.	□		
4) Grafik cizmde.	□		
5) Bilgisayar yardimli egitimde.	□		
6) Problem çözmede.	□		
7) Kişisel egitimde.	□		
8) Labaratuvar sonuclarinin incelenmesinde.	□		
9) Bilim-teknoloji-toplum konularinda.	□		
10) Ödev kagıtları (mesela, Excel).	□		
11) Database (mesela, Access, filemaker).	□		
12) E-mail.	□		
13) Iletisim arac-gereclerinde (mesela, list-servers, tartışma odaları, chat...).	□		
14) PowerPoint, Astound programlarla sunumlarda.	□		
15) Diger multimedia yazilimlarda (mesela, Author-ware, hyper-studio, macromedia).	□		
16) Web sayfa yayinlamada (mesela Dream weaver, page-mill, navigator, web-CT veya benzerleri).	□		
17) Video kayit yazilim (mesela iMovie, adobe premiere).	□		
18) Grafik tasarim (mesela Scanners, digital cameras).	□		
19) Web sayfa browsers (mesela Netscape, Internet explorer).	□		
20) Web sayfası arastirma tekniklerinde.	□		

21) Alaninizdaki sipesifik teknolojiler (mesela, Fen bilimlerindeki probe-ware programi, sosyal bilimlerdeki geographic information sistem...).	□		
22) Data analiz software (mesela, SPSS, SAS, ve diger istatistik veya analiz software).	□		
23) Streaming media yaratma ve/veya kullanimi.			

III. Bilgisayar kullanımının etkileri:

	a) Şu anki bilgi düzeyiniz	b) Olmasını istediginiz bilgi düzeyi	c) Ögrenciler, ödevlerinde hangi sıklıkla teknolojik araçları kullanma ihtiyacı duyuyor
	Çok düsük Düsük Orta derece Yüksek İleri derece	Çok düsük Düsük Orta derece Yüksek İleri derece	Asla Nadiren Bazen Sıklıkla Genellikle

1) Sınıf idaresinde.	□		
2) Ders hazirlamada.	□		
3) Sinifta sunumlarda.	□		
4) Profesyonel sunumlarda.	□		
5) Zaman kullanımında.	□		

IV. Diger teknolojik araçların sınıfta kullanımı:

	a) Şu anki bilgi düzeyiniz	b) Olmasını istediginiz bilgi düzeyi	c) Ögrenciler, ödevlerinde hangi sıklıkla teknolojik araçları kullanma ihtiyacı duyuyor
	Çok düsük Düsük Orta derece Yüksek İleri derece	Çok düsük Düsük Orta derece Yüksek İleri derece	Asla Nadiren Bazen Sıklıkla Genellikle
1) Video.	□		
2) Film.	□		
3) Interaktif video.	□		
4) Hypermedia (mesela world wide web sistem).	□		
5) Tepegöz (Overhead projector)	□		
6) Slaytlar.	□		
7) Fotograflar.	□		
8) Hesap Makinalari.	□		
9) Mikroskop.	□		
10) Dijital kameralar.	□		
11) Digerleri.	□		

APPENDIX C
Preservice Teacher Technology Survey
(English)

Preservice Teacher Technology Survey
TECHNOLOGY USAGE AND NEEDS OF SCIENCE EDUCATORS

This questionnaire is designed to gather information about how pre-service teachers use computer technology, the importance they place on it, and their needs in the effective technology integration issues. Your response will provide important information which will help us design an online training environment in order to help you learn how to use computers as tools to enhance your teaching and to improve your students' learning. Thank you in advance for your cooperation.

Section A- Directions: Please complete the following questionnaire. Answer all the questions.

1. Name:_____
2. University:_____
3. Department:_____
4. E-mail address:_____
5. Gender: Female _____, Male _____
6. What is your age? ____Under 21, ____21-25, ____26-30, ____Over 30.
7. Rate your overall skill with using technology in support of your professional practice?

   ___Non-user

   ___Novice

   ___Intermediate

   ___Advanced

   ___Expert (I often serve as a resource to others
8. Did you take technology or computer classes in?

   High school _____YES_____NO

   Undergraduate School _____YES_____NO

   Master's course work _____YES_____NO

   Doctoral course work _____YES_____NO
9. Have you taken or are you presently taking a computer workshop?

_____YES_____NO

Section B- Level of agreement about use of technology
Please indicate your level of agreement with the following statements.

	Strongly Disagree	Disagree	Agree	Strongly Agree	Does Not Apply
1- In my education courses, I was taught to incorporate technology within lesson plans and curriculum designs.					
2- When planning how to use technology for instruction, I refer to and base my selections on current research regarding the effectiveness of those technologies.					
3- I am comfortable planning lessons and curriculum that involve student use of technology during learning					
4- In my education courses, I received lots of information about the effective use of technology as a learning tool for students.					
5- My professors regularly use technology as a teaching tool.					
6- My professors regularly guide student use of technology during class.					
7- I am well prepared to use technology as a teaching tool.					
8- I am well prepared to guide student use of technology in classes I teach or when I teach.					
9- I have strategies for using technology to individualize instruction and meet the needs of diverse learners.					
10- My professors use technology to individualize instruction and meet the needs of diverse learners.					
11- My professors' model strategies for managing technology-supported learning.					
12- I am prepared to manage technology-supported learning.					
13- My professors use technology to manage student assessment, e.g. using spreadsheets, electronic grade books, or handheld computers/PDA's to record and manage assessment data..					
14- I have strategies for using technology to manage student assessment.					
15- I am prepared to regularly use technology to communicate and collaborate with peers in the field of education.					
16- I am prepared to use technology to support my own professional growth through activities such as online learning, research and collaborative projects.					
17- As appropriate to my field, I am prepared to consider social, ethical and legal implications of technology use in my lessons.					

Section C- Directions: for each technology, each statement should be rated in three different ways using two sets of numbers, select the response that best describes
a) Describes your present level of knowledge with personal and professional use.
b) Describes the level of knowledge you would like to have. (If you have as much knowledge as you would like to have, the same number should be circled in each column.)
c) How often your assignments require students to use that technology,

I. Ways in which computers can be used to:

	a) CURRENT KNOWLEDGE	b) DESIRED KNOWLEDGE	c) My assignments require or assume the use of this technology
	Very Low Low Medium High Advanced	Very Low Low Medium High Advanced	Never Seldom Sometimes Often Usually
1) Composing/writing papers (Word processing).	□		
2) Personal record keeping.	□		
3) Statistical analysis and research.	□		
4) Class management (Develop syllabi, track grades).	□		
5) Entertain oneself (games).	□		
6) Deliver individual learning (computer-aided learning).	□		
7) Design of instructional materials.	□		
8) Teach students at a distance.	□		

II. How to use a computer in science for:

1) Library search services (data collection using peripherals).	□		
2) Database storage of lab data.	□		
3) Demonstrations and modeling.	□		
4) Graphing.	□		
5) Computer assisted instruction.	□		
6) Problem solving.	□		
7) Individualized instruction.	□		
8) Analysis of lab data.	□		

9) Science-technology-society issues.	□		
10) Spreadsheets (e.g., Excel).	□		
11) Databases (e.g., Access, FileMaker).	□		
12) Email.	□		
13) Communication tools (e.g., List-servers, chat, discussion boards...).	□		
14) PowerPoint, Astound.	□		
15) Other multimedia authoring software (e.g., Author-ware, Hyper-studio, Macromedia).	□		
16) Web publishing (e.g., Dream weaver, page-mill, navigator, web-CT or similar).	□		
17) Video editing software (e.g., iMovie, adobe premiere).	□		
18) Graphic peripherals (e.g., Scanners, digital cameras).	□		
19) Web browsers - Basic functionality and efficiency (e.g., Netscape, Internet explorer).	□		
20) Web search techniques	□		
21) Technologies specific to your field (e.g., Probe-ware in the sciences, geographic information systems in the social sciences).	□		
22) Data analysis software (e.g., SPSS, SAS, other statistics or analysis software).	□		
23) Creation and/or use of streaming media.			

III. Effects of computer use on:

	a) CURRENT KNOWLEDGE	b) DESIRED KNOWLEDGE	c) My assignments require or assume the use of this technology
	Very Low Low Medium High Advanced	Novice Low Medium High Advanced	Never Seldom Sometimes Often Usually
1) Classroom management.	□		
2) Class preparation.	□		
3) Class presentations.	□		
4) Professional presentations.	□		
5) Time management.	□		

IV. How to use other technology in the classroom:

1) Video.	□		
2) Film.	□		
3) Interactive video.	□		
4) Hypermedia.	□		
5) Overhead projector.	□		
6) Slides.	□		
7) Concrete Manipulative models (Photographs...).	□		
8) Calculators.	□		
9) Microscope.	□		
10) Digital cameras.	□		
11) Others.	□		

APPENDIX D
Preservice Teacher Technology Survey
(Turkish)

Üniversite Ögrencileri icin Teknoloji Anketi
FEN BİLGİSİ EGİTİMİNDE TEKNOLOJİ KULLANIMI VE GEREKLİLİGİ

Bu anket "üniversite ögrencilerinin" teknolojik egitim araçlarını nasıl kullandıgı, bilgisayarı derslerinde kullanmaya verdikleri önemi ve teknolojiyi etkili bir şekilde kullanma ihtiyaçları hakkında bilgi toplamak için düzenlenmiştir. Sizin cevaplarınız daha iyi ögrenmenize, ögretim elemanların teknolojik egitim araçlarını etkili bir şekilde kullanmalarına ve size daha iyi egitim, ögretim vermelerine yardımcı olacaktır. Yardımlarınız için teşekkürler.

Bolum A- Açıklamalar: Lütfen aşagıdaki boşlukları uygun şekilde doldurunuz.

1. İsim: _____

2. Üniversite: _____

3. Bölüm: _____

4. E-mail Adresi:_____

5. Cinsiyetiniz: Kadın_____, Erkek_____

6. Yaşınız: 20`nin altı ____, 21-25 ____, 26-30 ____, 30`un üstü _____

7. Derslerinizde, teknolojik egitim araçları kullanımındaki bilgi düzeyiniz:

___Hiç kullanmam

___Cok az bilgi sahibiyim

___Orta derece bilgiliyim

___Ileri duzeyde bilgiliyim

___Uzman düzeyinde bilgiliyim

8. Teknolojik egitim araçlari veya bilgisayar kullanımı ders aldınız mı?

Lisede EVET _____, HAYIR_____.

Üniversitede EVET _____, HAYIR_____.

Masterda EVET _____, HAYIR _____.

Doktorada EVET _____, HAYIR _____.

9. Bilgisayar kursu, seminerlerine katıldınız mı veya su anda katiliyormusunuz?

EVET_____, HAYIR_____.

Bolum B-. Teknoloji kullanımı hakkında size uygun olan ifadeyi işaretleyiniz.

	Kesinlikle Katılıyorum	Katılıyorum	Katılmıyoru	Kesinlikle Katılmıyoru	Fikrim Yok
1- Aldıgım derslerde, ders planı ve müfradat hazırlamada teknolojiyi nasıl kullanacagım konusunda egitildim.					
2- Egitim için teknolojinin nasıl kullanacagımı planlarken, bu teknolojinin etkilerini inceleyen güncel arastırmaları kullanirim.					
3- Ders planımda, ögrencilerimin egitimsel teknolojik araçları kullanımı konusunda rahatımdır					
4- Aldıgım derslerde, ögretmenlerimden teknolojinin etkili bir egitim aracı olduguna dair birçok bilgi edindim					
5- Ögretmenlerim düzenli şekilde teknolojiyi ögrenme aracı olarak kullanırlar.					
6- Ögretmenlerim düzenli şekilde, ders esnasında teknolojiyi kullanmamız için bize yol gösterirler.					
7- Teknolojiyi egitim aracı olarak kullanma konusunda iyi bir egitim aldım.					
8- İleride ders anlatacagım ögrencilerimi, teknolojinin egitim aracı olarak kullanılmasında yönlendirecegim konusunda iyi bir egitim aldım.					
9- Ogrencilerimin bireysel egitimde ve farkli ihtiyaclarini karsilamada teknolojiyi kullanmak için stratejilere sahibim.					
10- Ögretmenlerim, ögrencilerin farkli ihtiyaçlarını karşılamada ve bireysel egitimde teknolojiyi kullanırlar.					
11- Ögretmenlerim teknoloji destekli ögrenimde stratejilere sahiptir.					
12- Teknoloji destekli ögrenim uygulaması konusunda egitim aldım.					
13- Ögretmenlerim, ögrencilerin ögrenme gidişatını degerlendirmede ve incelemede teknolojiden yararlanırlar, örnegin quız kagıtları, elektronik not defteri, ve el bilgisayarı / kayıt cihazı .					
14- Teknolojiyi kullanarak ögrencilerin ödevlerini ve projelerini degerlendirmede stratejilerim var.					
15- Diger ögrencilerle ve ögretmenlerimle iletişim kurmada ve yardımlaşmada, düzenli bir şekilde teknolojiyi kullanırım. Mesela email, internetteki tartışma odaları, listserv gibi.					
16- Kendi profesyonel üretkenligimi arttırmada, düzenli bir şekilde teknolojiden yararlanma konusunda iyi egitim aldım. Mesela internet yoluyla egitim, araştırma ve başkalarıyla ortak projeler hazırlama.					
17- Kendi alanımla ilgili, sosyal, etiksel ve yasal olarak uygun şekilde teknolojiyi kullanma konusunda egitim aldım.					

Bolum C- Açıklamalar: Her bir ifade 3 farklı bölümde işaretlenmelidir. Size uygun en iyi tanımlamayı seçerek işaretleyiniz.

a) Kişisel ve profesyonel teknoloji kullanımında şu anki bilgi düzeyinizi tanımlayınız.
b) Bilgi düzeyinizin nasıl olmasını istediginizi tanımlayınız. (Eger sahip oldugunuz bilgi düzeyi olmasını istediginiz düzey ile aynı ise, aynı kutucuk her bir sütun için işaretlenmelidir.)
c) Nekadar sıklıkla ödevleriniz, ögrencilerin teknoloji kullanımına ihtiyaç gösteriyor.

I. Bilgisayar kullanılabilecek alanlar:

	a) Şu anki bilgi düzeyiniz	b) Olmasını istediginiz bilgi düzeyi	c) Ögrenciler, ödevlerinde hangi sıklıkla teknolojik araçları kullanma ihtiyacı duyuyor.
	Çok düsük Düsük Orta derece Yüksek İleri derece	Çok düsük Düsük Orta derece Yüksek İleri derece	Asla Nadiren Bazen Sıklıkla Genellikle
1) Derleme/yazmada (Word processing).	□		
2) Kişisel belgelerin saklanmasinda.	□		
3) İstatistiksel inceleme ve arastirmalarda.	□		
4) Sinif idaresinde (ders plani, not vermede).	□		
5) Kişisel eglenceler (bilgisayar oyunlari).	□		
6) Kişisel egitim verme (bilgisayar yardimli ögrenim).	□		
7) Ders materyallerin dizayni.	□		
8) Uzaktan egitim.	□		

II. Fen Bilgisinde bilgisayarın nasıl ve nerede kullanılacagı:

1) Kütüphanede arastirma servisi icin (veri toplamada).	□		
2) Database olarak labaratuvar sonuclarinin saklanmasinda.	□		
3) Modelleme ve sunum icin.	□		
4) Grafik cizmde.	□		
5) Bilgisayar yardimli egitimde.	□		
6) Problem çözmede.	□		
7) Kişisel egitimde.	□		
8) Labaratuvar sonuclarinin incelenmesinde.	□		
9) Bilim-teknoloji-toplum konularinda.	□		
10) Ödev kagıtları (mesela, Excel).	□		
11) Database (mesela, Access, filemaker).	□		
12) E-mail.	□		
13) Iletisim arac-gereclerinde (mesela, list-servers, tartışma odaları, chat...).	□		
14) PowerPoint, Astound programlarla sunumlarda.	□		
15) Diger multimedia yazilimlarda (mesela, Author-ware, hyper-studio, macromedia).	□		
16) Web sayfa yayinlamada (mesela Dream weaver, page-mill, navigator, web-CT veya benzerleri).	□		
17) Video kayit yazilim (mesela iMovie, adobe premiere).	□		
18) Grafik tasarim (mesela Scanners, digital cameras).	□		
19) Web sayfa browsers (mesela Netscape, Internet explorer).	□		
20) Web sayfası arastirma tekniklerinde.	□		

21) Alaninizdaki sipesifik teknolojiler (mesela, Fen bilimlerindeki probe-ware programi, sosyal bilimlerdeki geographic information sistem...).	□		
22) Data analiz software (mesela, SPSS, SAS, ve diger istatistik veya analiz software).	□		
23) Streaming media yaratma ve/veya kullanimi.			

III. Bilgisayar kullanımının etkileri:

	a) Şu anki bilgi düzeyiniz	b) Olmasını istediginiz bilgi düzeyi	c) Ögrenciler, ödevlerinde hangi sıklıkla teknolojik araçları kullanma ihtiyacı duyuyor
	Çok düsük Düsük Orta derece Yüksek İleri derece	Çok düsük Düsük Orta derece Yüksek İleri derece	Asla Nadiren Bazen Sıklıkla Genellikle

1) Sınıf idaresinde.	□		
2) Ders hazirlamada.	□		
3) Sinifta sunumlarda.	□		
4) Profesyonel sunumlarda.	□		
5) Zaman kullanımında.	□		

IV. Diger teknolojik araçların sınıfta kullanımı:

	a) Şu anki bilgi düzeyiniz	b) Olmasını istediginiz bilgi düzeyi	c) Ögrenciler, ödevlerinde hangi sıklıkla teknolojik araçları kullanma ihtiyacı duyuyor
	Çok düsük Düsük Orta derece Yüksek İleri derece	Çok düsük Düsük Orta derece Yüksek İleri derece	Asla Nadiren Bazen Sıklıkla Genellikle
1) Video.	□		
2) Film.	□		
3) Interaktif video.	□		
4) Hypermedia (mesela world wide web sistem).	□		
5) Tepegöz (Overhead projector)	□		
6) Slaytlar.	□		
7) Fotograflar.	□		
8) Hesap Makinalari.	□		
9) Mikroskop.	□		
10) Dijital kameralar.	□		
11) Digerleri.	□		

APPENDIX E
Science Education Departments in Turkish Universities

Science Education departments are located geographically in Turkish Universities	
REGION	**UNIVERSITY - CITY**
AEGEAN REGION (5/5)	1. Adnan Menderes University. - AYDIN 2. Celal Bayar University - MANISA 3. Dokuz Eylul University - IZMIR 4. Pamukkale University - DENIZLI 5. Mugla University - MUGLA
MARMARA REGION (5/9)	1. Istanbul University - ISTANBUL 2. Marmara University - ISTANBUL 3. Bogazici University - ISTANBUL 4. Balikesir University - BALIKESIR 5. Canakkale 18 Mart University - CANAKKALE 6. Kocaeli University - KOCAELI 7. Trakya University - EDIRNE 8. Uludag Unv. - BURSA 9. Sakarya Unv. - SAKARYA
BLACK SEA REGION (3/3)	1. 19 Mayis University - SAMSUN 2. Karadeniz Teknik University - TRABZON 3. Abant Izzet Baysal University - BOLU
CENTRAL ANATOLIA REGION (5/8)	1. Cumhuriyet Unv. - SIVAS 2. Erciyes Unv. - KAYSERI 3. Gazi University - ANKARA 4. M.E.T.U. - ANKARA 5. Hacettepe University - ANKARA 6. Kirikkale Unv. KIRIKKALE 7. Osmangazi University - ESKISEHIR 8. Selcuk University - KONYA
MEDITERRANEAN REGION (3/3)	1. Suleyman Demirel University - ISPARTA 2. Mersin University - MERSIN 3. Cukurova University - ADANA
EAST ANATOLIA REGION (5/5)	1. Ataturk University - ERZURUM 2. Firat University - ELAZIG 3. Inonu University - MALATYA 4. Kafkas University - KARS 5. 100. Yil University - VAN
SOUTHEAST ANATOLIA REGION (1/1)	1. Dicle University - DIYARBAKIR
TOTAL	**27/34** Survey was sent survey to Underlined universities.

Survey was sent to 27 universities which located in the blue areas