THE EFFECT OF THE WEB BASED ASYNCHRONOUS TEACHING METHOD COURSE ON THE PRE-SERVICE TEACHERS' ACHIEVEMENT, METACOGNITION, AND ATTITUDES TOWARDS COMPUTER, WWW AND WEB BASED COURSE

A THESIS SUBMITTED TO
THE GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES
OF
MIDDLE EAST TECHNICAL UNIVERSITY

BY

ABDULLAH TOPÇU

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR
THE DEGREE OF DOCTOR OF PHILOSOPHY
IN
SECONDARY SCIENCE AND MATHEMATICS EDUCATION

APRIL 2005

Approval of Graduate School of Natural and Applied Sciences

_____
Prof. Dr. Canan ÖZGEN
Director

I certify that this thesis satisfies all the requirements as a thesis for the degree of Doctor of Philosophy.

_____
Prof. Dr. Ömer GEBAN
Head of Department

This is to certify that we have read this thesis and that in our opinion it is fully adequate, in scope and quality, as a thesis for the degree of Doctor of Philosophy.

_____
Assoc. Prof. Dr. Behiye UBUZ
Supervisor

Examining Committee Members

Prof. Dr. Halil İbrahim Yalın (GU, CEIT) _____

Assoc. Prof. Dr. Behiye Ubuz (METU, SSME) _____

Assist. Prof. Dr. Soner Yıldırım (METU, CEIT) _____

Assist. Prof. Dr. Ali Eryılmaz (METU, SSME) _____

Dr. Ali Arifoğlu (METU, II) _____

I hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this wok.

Name, Last name: Abdullah Topçu

Signature:

ABSTRACT

THE EFFECT OF THE ASYNCHRONOUS WEB BASED COURSE ON THE PRE-SERVICE TEACHERS' ACHIEVEMENT, METACOGNITION, AND ATTITUDES TOWARDS COMPUTER, WWW AND WEB BASED COURSE

Topçu, Abdullah

Ph.D., Department of Secondary Science and Mathematics Education

Supervisor: Assoc. Prof. Dr. Behiye UBUZ

April 2005, 181 pages

This study aimed to explore the effects of instructional methods in the asynchronous web-based "Science and Math Teaching Methods Course" on pre-service teachers' achievement, metacognition, and attitudes towards computer, WWW, and the web-based course. It was conducted with two groups, total of 63 third grade pre-service teachers, and one instructor (the researcher), in the Elementary Education Department at Bosphorus University in the academic year of 2003-2004. The Instructor used "Direct Instruction" method based on behaviorist approach for one group, and "Indirect Instruction" method based on constructivist approach for the other one.

The general metacognition questionnaire and, attitude scales for the computer and WWW were given as pretests, and after a fourteen-week treatment period they were given as posttests to both groups. Additionally, in the middle of the semester a midterm exam, and at the end of the semester a final exam**,** and attitudes towards web-based course scale were administered. Thus, the effectiveness of the two different instructional methods was compared.

The data obtained were analyzed by statistical techniques of multivariate analyses of covariance. Results of the statistical analyses indicated that the group

exposed to the web-based indirect instruction had significantly higher achievement on the final exam than the one exposed to the web based direct instruction. On the other hand, the group exposed to the web based direct instruction had significantly higher attitudes towards web-based course than the one exposed to the web-based indirect instruction. However, the statistical analyses failed to show any significant differences between the groups on the midterm exam, metacognition, and, attitudes towards computer and WWW.

Keywords: Direct and Indirect Instruction Methods, Web-based Asynchronous Learning Environment, and Attitude toward Computer, WWW and Web-based Course, Metacognition.

ÖZ

EŞ ZAMANLI OLMAYAN WEB TABANLI DERSİN ÖĞRETMEN ADAYLARININ BAŞARISINA, ZİHİN-ÜSTÜ YETİLERİNE, VE BİLGİSAYARA, WWW VE WEB TABANLI DERSE KARŞI TUTUMLARINA ETKİSİ

Topçu, Abdullah
Doktora, Ortaöğretim Fen ve Matematik Alanları Eğitimi Bölümü
Tez Yöneticisi: Assist. Prof. Dr. Behiye UBUZ

Nisan 2005, 181 sayfa

Bu çalışma, eş zamanlı olmayan web tabanlı "Fen ve Matematik Öğretim Yöntemleri Dersi'nde" öğretim yöntemlerinin öğretmen adaylarının başarısına, zihin-üstü yetilerine, ve bilgisayara, WWW ve web tabanlı derse karşı tutumlarına etkisini araştırmayı hedefledi. Çalışma, 2003-2004 akademik yılında, Boğaziçi Üniversitesini İlköğretim Bölümünde iki grupta toplam 63 üçüncü sınıfta ki öğretmen adayı ve bir öğretmen (araştırmacı) ile yürütülmüştür. Öğretmen, bir sınıfta davranışçı yaklaşımı esas alan Direkt Öğretim Yöntemini, diğer sınıfta oluşumcu yaklaşımı esas alan Dolaylı Öğretim Yöntemini kullanmıştır. Ölçme aracları olarak Başarı Testleri (Ara ve final sınavları), Bilgisayara Karşı Tutum Ölçeği, WWW'e Karşı Tutum Ölçeği, Web Tabanlı Derse Karşı Tutum Ölçeği, ve Genel Zihin-Üstü Yeti Anketi kullanılmıştır.

Zihin-üstü yeti anketi, ve bilgisayar ve WWW'e karşı tutum ölçekleri ön-test olarak ve 14 haftalık uygulama sürecinin sonunda da son-test olarak her iki grupta da uygulanmıştır. Bundan başka, dönem ortasında ara sınav, dönem sonunda da final sınavı ve web tabanlı derse karşı tutum ölçeği uygulanmıştır. Böylece, her iki öğretim yönteminin etkinliği karşılaştırılmıştır.

Problemler çerçevesinde kurulan hipotezlerin test edilmesi için, son-test puanları ortak değişkenli çok yönlü varyans (MANCOVA) istatistiksel tekniği kullanılarak analiz edildi. İstatistiksel sonuçlar, Web Tabanlı Dolaylı Öğretim Yöntemi uygulanan grubun Web Tabanlı Direkt Öğretim Yöntemi uygulanan grubtan anlamlı oranda daha başarılı olduğunu göstermektedir. Buna karşılık, Web Tabanlı Direkt Öğretim Yöntemi uygulanan grup Web Tabanlı Dolaylı Öğrenim Yöntemi uygulanan gruptan anlamlı oranda daha yüksek web tabanlı derse karşı tutuma sahip olmuştur. Fakat, gruplar arasında ara sınavda, zihin-üstü yetide, ve bilgisayar ve WWW'e karşı tutumlarda anlamlı bir farklılık gözlemlenmemiştir.

Anahtar Kelimeler: Direkt ve Dolaylı Öğrenme Yöntemleri, Web Tabanlı Eş Zamanlı Olmayan Öğrenme Ortamı, Bilgisayara, WWW ve Web Tabanlı Derse Karşı Tutum, Zihin-Üstü Yeti

To My Parents

Sebahat and Mustafa TOPÇU

And

To My Wife Asuman and My Daughter Nalan Sena TOPÇU

ACKNOWLEDGEMENTS

The pursuit of a Ph.D was a personal goal that was inspired by many individuals throughout my life. While the path to completing this dissertation was a difficult one, the endless support and encouragement of certain individuals provided me the determination, confidence and motivation to see my goal to fruition. For that I am eternally grateful.

First, I would like to acknowledge my major advisor, Dr. Behiye Ubuz, for her encouragement, support, insight, and friendship. Her extraordinary ability to inspire and motivate not only kept me on task and guided me to completion of my dissertation in record time, but also made the entire experience truly enjoyable. I am truly honored to be one of the many Ph.D.'s she has inspired. I hope that someday I can inspire others as she has inspired me.

I thank my committee members, Dr. Ali Eryılmaz and Dr. Soner Yıldırım who were major catalysts in transforming my doctoral aspirations into reality. Their relentless prodding made me take the first step, I took their advice. I thank Dr. Ali Eryılmaz for the guidance especially about the statistical analyses and Dr. Soner Yıldırım for guidance especially about the theory and applications of the web based learning environment. They kept me on track and on target. Their wealth of knowledge and expertise provided me not only with the knowledge and skills needed to complete my doctoral studies, but also a level of professionalism to aspire to. I have the utmost respect and admiration for each of them.

I thank Dr. Emine Erktin for her help to conduct the study in Bosphorus University, keen insight, and friendship. I especially thank my fellow doctoral students, Mine Işıksal, Çiğdem İş, Hüseyin Yıldırım, who were instrumental in helping me to complete my dissertation every step of the way. Your friendship and support will be remembered always.

To my parents and family who instilled me the confidence, pride, and work ethic that allowed me to persevere with my studies for so many years. There is nothing more satisfying than the sparkling eyes and smile of a proud parent.

Most of all, I thank my wife Asuman and my daughter Nalan Sena for their unwavering support, encouragement, understanding, and love that got me through the past four years and helped me realize my dream. I am forever grateful to you both, for the completion of this dissertation as much your accomplishment as it is mine.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF TABLES (CONTINUED)

TABLES

LIST OF FIGURES

FIGURES

LIST OF SYMBOLS

SYMBOLS

WWW:	World Wide Web
ME:	Midterm Exam
FE:	Final Exam
WBI:	Web-based Instruction
WBC:	Web-based Course
WBII	Web-based Indirect Instruction
WBDI	Web-based Direct Instruction
WBIIG	Web-based Indirect Instruction Group
WBDIG:	Web-based Direct Instruction Group
CAS:	Computer Attitude Scale
PRECAS:	Students' Computer Attitude Pretest
POSTCAS:	Students' Computer Attitude Posttest
GWBAS	General Web Based Course Attitude Scale
CFWS:	Current Feeling About World Wide Web Subscale
WBAS:	Web-based Course Attitude Subscale .
WBASS:	Web-based Course Attitude Subscale Scores.
PRECFW:	Students' Current Feeling About World Wide Web Pretest
POSTCFW:	Students' Current Feeling About World Wide Web Posttest
GMQ	General Metacognition Questionnaire
PREGMQ :	Students' Metacognition Pretest
POSTGMQ:	Students' Metacognition Posttest

CHAPTER 1

INTRODUCTION

The World Wide Web (WWW) empowers modern society, enriches the knowledge of all age learners, and opens the way to a universe of opportunity to all school students. Over past decade, the power of the WWW has dramatically grown in many educational contexts and for a variety of purpose; web based instruction and distance learning, tutorials, drill-and-practice exercises, automated testing, remote data collecting, and many more. Web-based environment becomes an emerging, recognized educational paradigm that brings about unprecedented options for learning and instruction (Harasim, 1990) and it is becoming a convenient, global, interactive, dynamic and popular mediums to higher education (Crossman, 1997).

Although there are many examples of web-based course (WBC), it is now clear that a WBC provides much more than just presenting the components of a conventional course (Belanger & Jordan, 2000). The web-based environment provides both teachers and students with numerous learning opportunities by allowing students to learn and develop at their own pace; enhancing writing and communication skills; developing higher-order problem-solving skills; and nurturing critical reflection (Collins, 2000). However, "… simply publishing a WWW page with links to other digital resources does not constitute instruction" (Ritchie & Hoffman, 1997). Courses are not improved by posting them on a web site and discussions in this course do not automatically happen when students are connected to a mailing list or computer bulletin board. According to Kahn (1997), Web-Based Instruction (WBI) can be viewed as an innovative approach for delivering instruction to a remote audience using the Web as

the medium. Instruction is the delivery of information and activities that facilitate learners' attainment of intended, specific learning goals and the medium is the physical means by which the instructional message is communicated. So, the following definition incorporates these issues: WBI is a hypermedia-based instructional structure that utilizes the attributes and resources of the WWW to create a meaningful and supportive learning environment.

Unfortunately, the rush to create WBI has not seen a parallel investment in sound educational strategies. Schneider (1994), and Merisotis and Phipps (1999) proposed that improving WBI is a question not of technology, but of pedagogy – the art of teaching. Goggin, Finkenberg and Morrow (1997) stated that finding the most effective way to organize and conduct a course, determining which teaching methods are best for a given subject matter, how individual learning styles interact with the different technologies used, and whether students possess the initiative and will take responsibility for their own learning are important questions for a WBI. However, surprisingly, only a small percentage of teachers have attempted to put a web based course that has instructional variety (Matuga, 2001),

While teaching in a web-based environment, institutions and instructors need to be mindful of a technological driven pedagogy that could possibly advance inequities by leaving certain groups of student feeling incapable of competing in this environment (Anderson & Reed, 1998). Most research studies (Barker & Dickson, 1996; Belanger & Jordan, 2000; Berge, 1999; McLoughlin & Luca, 2002; Pevato, 2003; Russell, 1999) conducted in WBI focus on the effectiveness of communications technology and learner achievement. These researches compare the achievement of learners at a web-based environment and in face-to-face classes by measuring grades, pre- and post-test scores, retention, and job performance. The usual finding in these comparison studies is that there are no significant differences between learning in the two different environments, regardless of the nature of the content, the educational level of the students, or the media involved (Moore & Kearsley, 1996). This evidence also points to the fact that media itself does not affect the learner's level of achievement. As Clark (1994) stated, "The best current evidence is that media are mere vehicles that deliver instruction but do not influence student achievements any more than the truck that delivers our groceries causes changes in

nutrition...only the content of the vehicle can influence achievement." (p.4). Russell (1999) concluded that there is nothing inherent in the technology that elicits improvements in learning, although the process of redesigning a course to adapt the content to the technology can improve the course and improve the outcomes. In other words, as Clark stated, learning is not caused by the technology, but by the instructional method "embedded in the media" (Scardamalia & Bereiter, 1993).

There are both opportunities and challenges for incorporating valid pedagogical principles in WBI. It is contended that the majority of traditional learning theories still serve their original intent that is to facilitate the transfer of knowledge and to promote the construction of new instructional models. On the other hand, very little research is available on instructional methods in a web-based environment. In fact, this might be caused by the difficulty of assessing the impact of instructional methods on students' achievement, attitude or any other variables in a course delivered solely through the web.

Another reason to focus on the instructional methods in the web-based environment is the development of the tools that facilitate interactions among the element of the web-based environment. Dialogue, feedback, transactional distance, social presence and learner control are important factors affecting the overall context of the interaction. Interaction is one of the major important components of any learning experiences and it has been identified as one of the major constructs in web based education (McIsaac & Gunawardena, 1996; Moore & Kearsley, 1996; Wagner, 1994). Effective WBI should have effective learning experiences that depend on the interaction such as learner-learner, learner-instructor, learner-content and learner-interface. Instructor's true orientation on the interaction would lower transactional distance and heighten dialogue and consequently, heighten students' satisfaction (Pascarella et al., 1996).

Researches have generally supported the intuitively appealing proposition that a positive attitude towards computers and WBC is associated with greater computer and web technology experiences (Basile & D'aquila, 2002; Yıldırım, 2000). For example, individuals who have a favorable attitude toward computers may elect to learn more about them and may use them more often (Arndt, Feltes, &

Hanak, 1983; Levine & Donitsa-Schmidt, 1998; Rainer & Miller, 1996; Robey, 1979; Temple & Lips, 1989; Woodrow, 1990). It is also found that there is no significant difference in students' attitudes towards distance courses and on-site courses (Larson & Bruning, 1996; Lawless, 2000; Weems, 2002). Furthermore, Goodwin (1993) found that learners and faculty perceived the Internet as an appropriate delivery medium for higher education. In online distance courses, a positive relationship between the learners' satisfaction with instruction and their subsequent success has been observed (Collins, 2000; Fredericksen, Pickett, Pelz, Shea, & Swan, 2000; Jiang & Ting, 1998; Motiwalla & Tello, 2000; Oliver & Omari, 2001). However, frustration with the educational experience could lower performance and produce a poor attitude towards web-based learning and courses (Yellen, 1997-1998). Therefore, gaining insights into how students perceive their learning experiences with web-based courses are crucial for distance educators. At the same line, the research focusing on the change of the attitude toward computer, WWW and WBC with respect to the different instructional method are crucial important.

While students will have more freedom and opportunity in a web based environment, they must also assume more responsibility for managing their own learning, in terms of when they will study, how they monitor their learning, how much they want to learn, and seeking out information and resources (Moore & Kearsley, 1996). Romainville (1994) asserted that university students must be able to manage their own cognitive strategies to be able to succeed. Students must be able to adapt the strategies to their personal characteristics and to the context of their learning. The first stage in this process is probably that students must be aware of their cognitive strategies and should be able to describe and critically reflect on them. Moore (2002) called these abilities as metaskills. Although some studies have been reported on metacognitive strategies of university students in the traditional face-to-face mode of education (Flavell, 1979; Garner & Alexander, 1989; Romainville, 1994), there has been little about this phenomenon in the WBI or distance education mode. Some recent studies in this regard have touched on the monitoring and metacognitive judgments (Hew & Cheung, 2003; Moore, 2002). To better tailor instructional materials and teaching to suit learners who study on their own, remote

from the tutors, peers, and other support facilities, it is important to explore the metacognitive strategies or metaskills in a web based environment.

1.1 Research Questions

The study sought to address the following research questions.

1. What is the effect of the asynchronous Web-based Direct Instruction (WBDI) and Web-based Indirect Instruction (WBII) on the pre-service teachers' achievement in the "Science and Mathematics Teaching Methods Course"?

2. What is the effect of the asynchronous WBDI and WBII on the pre-service teachers' attitudes towards computer?

3. What is the effect of the asynchronous WBDI and WBII on the pre-service teachers' attitudes towards WWW?

4. What is the effect of the asynchronous WBDI and WBII on the pre-service teachers' attitudes towards WBC?

5. What is the effect of the asynchronous WBDI and WBII on pre-service teachers' metacognition?

1.2 Null Hypothesis

The questions stated above were tested with the following hypothesis that is stated in null form.

1: Pre-service teachers' scores on the midterm exam, 2: Pre-service teachers' scores on the final exam, 3: Pre-service teachers' scores on the computer attitude posttest, 4: Pre-service teachers' scores on the WWW attitude posttest, 5: Pre-service teachers' scores on the WBC attitude subscale, 6: Pre-service teachers' scores on metacognition posttest.

Null Hypothesis

$H_{0(1, 2, 3,4, 5, 6)}$: $\mu_{WBII} - \mu_{WBDI} = 0$

There will be no significant difference between the scores of the pre-service teachers exposed to the asynchronous WBII and those exposed to the asynchronous WBDI on the population means of the collective dependent variables of pre-service teachers' scores on the midterm exam, final exam, pre-service teachers' scores on the computer attitude posttest, pre-service teachers' scores on the WWW attitude posttest, pre-service teachers' scores on the WBC attitude scale, pre-service teachers' scores on metacognition posttest when the effects of pre-service teachers' GPA, computer attitude pretest scores, WWW attitude pretest scores, metacognition pretest scores, age, department, and gender have been accounted for.

1.3 Significance of the Study

When a course is delivered in an online environment, traditional roles between student and teacher and between student and subject become redefined and new roles emerge. Issues involving equity of access, the needs of the learner, and the role of instructor and site facilitator emerge. The urgency of "doing something" is prompted by the rapid growth of the means to deliver instruction via the latest technology. This is clearly a time to do and ask: what are we trying to do; for whom, why, and how (internet based) education will improve the quality of teaching and enhance the benefits to learners (Simonson, 1997).

The rush to utilize the Internet in higher education too often results in poor implementations, insufficient investments, and failure. Bates (1995) describe the current state of online distance education; most distance-learning course resemble traditional classroom or poor imitations - talking heads, lots of text, and streaming video. Distance education has failed to take advantage of the Internet as a new media. It tends to be more mass than individual to involve more –one-way than interactive communication. Issues of course quality are not only, or even perhaps the major challenges for online distance education. Are these learning environments what the students expect and want from their instructors? Are these learning environments able to provide the levels of motivation needed to master the course

content? The issue is not, as some opponents of technology would have us believe, to debate the relative merits of the Internet in distance-delivered higher education but rather to define and apply sound instructional models and principles for effectively using the Internet. Web based courses that are interaction-intense and have a sound instructional method have to be developed, to be compared in terms of the effectiveness and to be the subject of the research of the distance education (Pevato, 2003).

Another important point is professional development of the teachers. With the Internet's explosion, teachers are beginning to experiment, individually and informally, with the idea of self-managed and self-directed online professional development. To encourage and facilitate online professional development, teachers need to be competent users of the Internet, and be aware of the Internet's uses. Thus, teachers, both pre-service and in-service, can be trained in using the Internet effectively (Brown, 1999; Hughes, 2001). Also, teachers ought to be trained in using the Internet for the purpose of enhancing professional development, meaning that teachers should be trained in engaging in various online professional development activities. The training should include activities that revolve around extending and expanding networking, which would result in exchanging and sharing experience and ideas with other teachers from other parts of the world via discussion boards, bulletin boards, chat rooms and emails. Researches should focus on the professional development of the pre-service and in-service online teacher education (Maddux & Johnson, 2004; Manathunga, 2002).

Once a web-based course has been designed and implemented, are there differences in achievement, when the instructional methods in web based environment are compared? (Richardson, 2003; Ritchie & Hoffman, 1997) How do students feel about taking a WBC? Are their attitudes towards WWW, WBC and experiences positive? (Steel & Hudson, 2001; Swan, Shea & Fredericksen, 1999) How do the instructional methods affect the metacognitive strategies? (Brown, 1999; Moore, 2002) We need to explore answers for these questions. It is not enough to utilize new technology, the technology must be accessible to all students and it must enhance learning. So, researches conducted on the web based environment until now imply that future researches should focus on the instructional methods and their

comparative effect on the students' achievement, students' metacognitive strategies and the development of the students' attitude toward computer, WWW and WBC.

As a result, the goals of thesis are three-fold. The immediate goal is to provide a sound instructional models and principles for the asynchronous web based learning environment for the instructors and school administrators who want to conduct an online course. Simply putting the lecture notes of the face-to-face courses on the web does not improve learning in the web based asynchronus learning environment. Over the years, a wide range of research studies compared face-to-face and online courses have been done on issues such as effectiveness of technologies, the effect of WBC on students' achievement and attitude towards this environment and its tools. For the first time, this study presents comparative model for the direct and indirect instructional method in asynchronous web based learning environment for educationists.

Another important goal is to provide differential effects of the instructional methods (WBDI and WBII) on the students' achievement, metacognition and attitude towards computer, WWW and WBC in the asynchronous web based learning environment. Thus, the study pushes the online instructors and educators' attention from the course web site design (technological issues) to the quality and frequency of the learning activities on the course sites such as forum discussions, visual exercises etc. and presents valuable implications for the future online course implementations. In this context, this study recommends online instructors using probing questions to increase interactions in the learning activities and to scaffold students' cognitive strategies in the web based learning environment.

The broader and more long-term goal is to try to bring more attention to the capacity and competency of the web based asynchronous learning environment for the professional development of the pre-service and in-service teachers. Critical issues for the fields of teacher education and technology include an understanding of how pre-service and in-service teachers are trained and prepared for new technologies and of how in-service teachers can be developed and informed about the educational developments. This study presents an effective model for the professional development of the pre-service and in-service teachers.

1.4 Definition of the Terms

This section provided brief descriptions and definitions of some particular terms that were used in the entire study.

Asynchronous: a two-way communication process not coinciding in time. Any learning experience where interaction does not occur simultaneously in real-time.

Constructivism**:** refers to the paradigm that learners construct knowledge themselves –each learner individually (and socially) constructs meaning – as he or she learns. Constructing meaning is learning (Romainville, 1994). The constructivist perspective describes learning as a change in meaning constructed from experience. Constructivist instruction asks learners to use their knowledge to solve problems that are meaningful and realistically complex. The problems provide the context for the learners to apply their knowledge and to take ownership of their learning. Good problems are required to stimulate the exploration and reflection necessary for knowledge construction. Learners work together as peers, applying their combined knowledge to the solution of the problem whereas teachers take the role of the facilitator or guider in instruction (Tam, 2000).

Distance Education: instructional delivery, either synchronous or asynchronous, that allows instructors and students to be geographically separated (Perraton, 1988).

Distance learner: someone who is enrolled on a course which has a mode of study as "distance learning". Learner and instructor are separated from each other and connected through a media (WWW, TV, etc.).

Hypermedia: a multimedia system in which related items of information are connected and can be presented together.

Interaction: Communication among instructor, learner, content, and interface.

Internet: The Internet is a network of interconnected computers.

Metacognition: It refers to cognition about cognition. It is second-order cognition: thoughts about thoughts, knowledge about knowledge. In other words, it

refers to the learners' awareness of, control over, cognitive processes (Garner & Alexander, 1989).

Online or web based: Online or web based refers to the use of the Internet or the Intranet, or the WWW within an organization. Online materials require an accessible but fairly sophisticated computer infrastructure to ensure that all communication occurs without mishap.

Online education: Online education is the general term for any kind of course that is transmitted over the Internet or over an organization's internal Intranet, which uses the same technology as the public Internet.

Synchronous: a two way communication process coinciding in time. Learning experiences and interactions occur simultaneously in real-time.

Traditional education: an educational setting with a fixed time and place primarily face to face instruction.

Web page: Web page is a document accessible via the Web.

Web site: Web site is a collection of related Web pages.

World Wide Web or Web: It is the universe of information accessible via networked computers.

Web-based course: It is a course presented through the Internet via the WWW. This course allows the student to complete work on-line. Students can work from a computer at home, or work in a computer lab on campus. The course web site contains instructional material, a link to communicate with the instructor, and directions to electronically send homework and other assignments and receive feedback. WBC is limited to individuals with experience in using the Internet and has ready access to a computer system with some type of Internet software. WBC is also called Online Course.

Web-based Instructions: It can be viewed as an innovative approach for delivering instruction to a remote audience using the Web as the medium. Instruction is the delivery of information and activities that facilitate learners' attainment of intended, specific learning goals and the medium is the physical means by which the instructional message is communicated. So, in other words, WBI is a hypermedia-

based instructional medium, which utilizes the attributes and resources of the WWW to create a meaningful and supportive learning environment (Khan, 1997).

Web-based direct instruction: It is a type of WBI based on information processing for learning. It is sourced from the behaviorist approach (Kruse & Keil, 2000). Its process is sequential and linear, and planning is top down and systematic. Objectives guide development (Willis, 1995).

Web-based indirect instruction: It is a type of WBI based on constructivist approach. Its process is recursive and non-linear. Planning is organic, developmental, reflective and collaborative. Instruction emphasizes learning in meaningful context. Objectives emerge from design and developmental work (Willis, 1995).

CHAPTER 2

REVIEW OF THE LITERATURE

"Distance education" is a term that is used synonymously with "distance learning" by numerous researchers, practitioners and instructional designers. Both terms are taken to mean the separation of teacher and learner in space and/or time (Perraton, 1988). Distance education is not a new concept. Its first form occurred as early as the 19th century when students, mainly in Europe, took correspondence courses by mail (Neal, 1999). The early forms of distance education, correspondence course, radio, broadcast televisions etc., worked; however, they were static. The communication in these forms was not multi-directional. However, with the emergence of the desktop in the computer 1970's and the development of the WWW in the summer of 1991, sophisticated interactive communication at a distance became possible. Computer networks were an example for the interactive media. Internet, an interconnected system of computer networks, provides new opportunities for interaction and it has become an important delivery medium of WBI, which is predominantly seen as newest format of distance teaching and learning (Cantelon, 1995). WBI is hypermedia-based medium that utilizes the attributes and resources of the WWW to create meaningful environment where learning fostered and supported. In other words, it can be defined as "an innovative approach for delivering instruction to remote audiences, using the web as the medium" (Kahn, 1997, p.5).

WBI uses web as a mode of delivering WBC materials. An instructor chooses web based tools; such as forum, email, listservs, chat rooms, etc, and then uses these tools on the web as a way of instructing students at a distance. Moore (1979) defined

this learning and teaching model as an educational system in which learner is autonomous, and separated from his teachers by space and/or time, so that communication is by print, electronic, or non-human medium. In this context, autonomous learner is one who knows how to proceed through each of the learning events. Because the learner is alone, perhaps in a non-individualized, and therefore self-pacing, course, the learner is compelled to accept a comparatively high degree of responsibility for the conduct of his learning.

Learners vary the extent to which they are able to exercise autonomy. There are courses with much autonomy and dialogue, and courses with less, and they vary distance. A WBC of high autonomy may be as damaging to a person as one of low autonomy. The problem is to match WBC to learners so that each learner exercises the maximum autonomy and grows (Keagan, 1997). Therefore, learner autonomy should include both independent and interdependent participation in a learning activity (Moore, 1994; Chen & Willits, 1999). To realize that learner actively adapts to information being presented by a form of technology, which in turn adapts to the learner. Therefore, interactivity, for providing participations, is a vital element in all web based instructional process (Moore, 1991, 1993a. 1993b; Moore & Kearsley, 1995; Muirhead, 1999; Parker, 1999; Saba & Shearer, 1994; Spitzer, 2001; Zirkin & Sumler, 1995).

Moore (1989) identified three interactive relationships associated with distance learning: learner–content, learner–instructor, and learner–learner interactions. However, Hillman, Willis and Gunawardena (1994) argue that Moore's three relationships do not account for interactions that occur between learners and the technologies that deliver instruction and/or content, and therefore added a fourth: learner–interface. They describe it as the interaction between learners and a technological medium that must occur to have any effective contact with content, an instructor, or other learners.

WBI makes up of a combination of technologies having different level of interaction in either a synchronous (real-time) or asynchronous (anytime) mode (Farrignton, 1997). WBI might be asynchronous and includes e-mail, bulletin boards, downloading streaming audio and video, electronic lectures, and internet tutorials

(Barker & Dickson, 1996; Boshier et al, 1997; Kearsley, 1995; McNabb 1994; Trentin & Beningno, 2000; Sherry, 1996). Moreover, students are able to access the website at anytime and participate in threaded forum discussions, send e-mails, or complete exams. On the other hand, WBI might also be synchronous mode and includes real-time conferencing (video and/or audio), Internet relay chats, white boards, and file sharing (Downes, 2000; Hew & Cheung, 2003; Harasim et al, 1995). So, WBI clearly has the potential to offer a rich, interactive and stimulating educational environment (Simonson, Smaldine, Albright & Zvanek, 2000; Windschitl, 1998).

French (1999) argues that interactivity must be designed to support learning objectives, and the interface and infrastructure that support the content must be taken into account when designing interaction features. However, WBI has been focused mainly on student-content, and self-study lessons and materials. Berge (1999) argued that simply making communication tools available to students does not mean that students can and will use them. If the interaction is not an integrated, essential, and graded part of a web based learning environment, the majority of students will never use it at all, and those who start to use it will generally decide that nothing is going on there, and will stop using it. So, interaction and autonomy are closely related to the instructional methods utilized in the web based learning environment.

Moore (1986) stated: "There is now a distance between learner and teacher which is not merely geographic, but educational and psychological as well. It is a distance in the relationship of the two partners in the educational enterprise. It is a “transactional distance””. Transactional distance is the extent to which the instructor manages to successfully engage the students in their learning. If students are disengaged and not stimulated into being active learners, there can be a vast transactional distance, whether the students are under the teacher's nose or on the other side of the city. But if a teacher, whether online or on campus, can establish meaningful educational opportunities, with the right degree of challenge and relevance, and can give students a feeling of responsibility for their own learning and a commitment to this process, then the transactional gap shrinks and no one feels remote from each other or from the source of learning (Moore, 1986). So, the important factor is the strategies employed, and the overall design of instruction. In

order for a WBC to be effective, it has to be as well designed as any other traditional course. It has been suggested that if a strategy works in a regular classroom, it probably will work in web based learning environment with some adjustment (Herring & Smaldino, 1997). WBC needs to follow an instructional method that is grounded on theory and research (Price, 1996). Instructional methods should be chosen based on the characteristics of the instructor, students, content, and delivery system.

2.1 Web-Based Direct Instruction

Direct instructional method is based on information processing model based on cognitive processing and representation of knowledge for learning (Jonassen, et al., 1995; Reynolds, Sinatra, & Jetton, 1996). It is sourced from the behaviorist approach (Kruse & Keil, 2000). Instructional events in this method are gain attention, inform learners, stimulate recall of prior learning, present content, provide learning guide, elicit performance, provide feedback, assess performance and enhance retention and transfer to the job (Gagné, 1985). Therefore, WBDI has the following characteristics: (1) The process is sequential and linear, (2) planning is top down and systematic, (3) objectives guide development, (4) experts, who have special knowledge, are critical to instructional design work, (5) careful sequencing and the teaching of subskills are important, (6) the goal is delivery of preselected knowledge and (7) summative evaluation and objective data are critical (Willis, 1995). As a result, WBDI scaffolds the instructional events through the content with activities and exercises (Jonassen, 1999).

The fundamental instructional goal is accurate transmission and reception of knowledge. Just as this tenet drives strategies that determine the communication between learner and content, it also drives communication between the instructor and learners, and among learners. Communication is a mean (i.e., strategy) to an end (i.e., acquisition of knowledge). This purpose serves as a guide for decisions about the mode (i.e., synchronous, asynchronous), technology (e-mail, bulletin board, video conferencing), and configuration of interactions (i.e., instructor to students, students

to students) that are part of the course design. It suggests that the primary communication mode will be that from instructor to students or to groups of students.

Jonassen (2000) said that there are four primary instructional goals of WBDI. For each goal, communication strategies must be identified and implemented to maximize goal attainment. Each goal together with examples of communication strategies are listed below, but this list is not exhaustive. In selecting strategies, instructors must consider both type of communication (i.e., one-to-one, many-to-many) and time elements (i.e., synchronous vs. asynchronous) as they relate to the basic purpose of education (i.e., transmission of expert knowledge).

Instructional Goal 1: Present course content in a manner that hierarchically structures the sequence of information. Communication strategies include (a) using an authoring program to control the structure and sequencing of course content (one-to-many, asynchronous), (b) embedding questions in course materials to facilitate elaboration of content (one-to-many, asynchronous), and (c) using audio and video conferencing to present content and prescribe learning activities (one-to-many, synchronous).

Instructional Goal 2: Obtain student feedback to insure accuracy of understanding. Communication strategies include (a) using e-mail to pose questions and solicit answers (one-to-one, asynchronous), (b) creating a bulletin board or forum to pose topics for discussion and to solicit responses that reflect students' thinking about the subject matter (many-to-many, asynchronous), and (c) using audio and video conferencing to discuss content and solicit student responses (one-to-many, synchronous).

Instructional Goal 3: Provide opportunities for students to question the instructor in order to insure accuracy of understanding. Communication strategies include (a) providing hyperlinks to the instructor's e-mail address (one-to-one, asynchronous), (b) using instant messaging (one-to-one, synchronous), and (c) creating a bulletin board or forum to promote questioning and provide instructor responses that are accessible to all students (one-to-many, asynchronous).

Instructional Goal 4: Create opportunities for students to communicate with each other in order to share their understanding of course content. Communication

strategies include (a) establishing chat rooms that enable on-line discussions of course content (many-to-many, synchronous) and (b) creating a bulletin board or forum for this same purpose (many-to-many, asynchronous).

As a result, the WBDI has highly structured content and the instructor determines the objectives. Therefore, students are less autonomous. Despite of this fact, student can manage the course activities easily because of the clear structure of the course content (Kearsley and Lynch, 1996). It means that they have less control over their learning environment. On the other hand, it does not mean that the quality and quantity of interactions are at the insufficient level. Interactions and discussions about content and instructional events can be conducted during the flow of the course.

2.2. Web-Based Indirect Instruction

Piaget (1977), Vygotsky (1978) and Bruner (1996) each proposed that learners could learn actively and construct knowledge based on their prior knowledge. In other words, *constructivism* requires an active process within which students build on previous knowledge and develop personal connections to conceptual material. The *constructivist paradigm* reflects a position that knowledge is not independent of the learner but is internally constructed by the learner as a way of making meaning of experiences (Cronin, 1997; Jonassen, et al., 1995). This position is actually a collection of different perspectives ranging from a purist view that knowledge is solely an internal and subjectively constructed phenomenon to a view that acknowledges an objective reality, but one that can only be known subjectively (Wilson, Teslow & Osman-Jouchoux, 1995). So, constructivists believe that knowledge is a construction of reality, that learners are active and proactive in the process of learning.

Constructivist approach tends to avoid the breaking down of context into component parts as traditional instructional designers do, but are in favor of environments in which knowledge, skills, and complexity exist naturally. Hence, instead of adopting a linear and ‘building-blocks’ approach to instructional design, constructivists need to develop procedures for situations in which the instructional

context plays a dominant part, and the instructional goals evolve as learning progresses. Willis (1995) characterizes the WBII as follows: (1) The process is recursive, non-linear, and sometimes chaotic, (2) planning is organic, developmental, reflective, and collaborative, (3) objectives emerge from design and development work, (4) general instructional design experts do not exist, (5) instruction emphasizes learning in meaningful contexts (the goal is personal understanding within meaningful contexts), (6) formative evaluation is critical, and (7) subjective data may be the most valuable.

Web based constructivist-learning environments include situating cognition in real-world contexts (ill-structured cases) and collaborative learning (Offir and Lev, 2000). Courses designed to address constructivism situate learning in “coherent, meaningful, and purposeful activities” (Bransford, Brown, & Cocking, 2000; Jonassen, 1997) such as whole or small-group discussions, collaborative problem-solving activities about ill-structured cases, simulations, games, and project-based work. Such activities help learners develop critical thinking skills by working collaboratively with others (Romiszowski 1997).

There are four primary instructional goals of WBII. As was the case with the WBDI, communication strategies must be identified and implemented to maximize goal attainment. Each goal together with examples of communication strategies are listed below, but this list is not exhaustive (based on Jonassen, 1999; Tam, 2000). In choosing strategies, instructors must consider both type of communication (i.e., one-to-one, many-to-many) and time elements (i.e., synchronous vs. asynchronous) as they relate to the basic purpose of education (i.e., individual construction of knowledge).

Instructional Goal 1: Present a problem-solving situation in a realistic context. The primary communication strategy is to select computer-supported collaborative learning tool that communicates "real life" problems in a format and that provides opportunities for students to collaboratively resolve problems (one-to-many and many-to-many, asynchronous).

Instructional Goal 2: Provide opportunities for learners to collaboratively construct knowledge based on multiple perspectives, discussion, and reflection.

Communication strategies include (a) selecting software tools that support collaborative learning/communication (many-to-many, synchronous and asynchronous), (b) using audio and video conferencing to facilitate information sharing and discussion among students (many-to-many, synchronous), and (c) employing Internet voice mail to promote immediacy of communications (one-to-many, synchronous).

Instructional Goal 3: Provide opportunities for learners to articulate and revise their thinking in order to insure the accuracy of knowledge construction. Communication strategies include (a) creating bulletin boards or forum to record students' responses for later analysis and reflection (many-to-many and one-to-one, asynchronous), (b) using e-mail to pose questions and solicit information (one-to-many, asynchronous), and (c) using audio and video conferencing to promote discussion and information sharing (many-to-many, synchronous).

Instructional Goal 4: Create opportunities for the instructor to coach and facilitate construction of student knowledge. Communication strategies include (a) using instant messaging to provide immediate motivation (one-to-one, synchronous), (b) using e-mail to analyze learners' understanding of content and to provide feedback (one-to-one, asynchronous), and (c) using audio and video conferencing to model reasoning and problem-solving skills (many-to-many, synchronous).

As a result, WBII facilitates collaborative, situated (ill-structured cases), and active learning (Harasim et al., 1995) and fosters a community of practice (Palloff & Pratt, 1999) through email, bulletin board services, forum discussions, and the Web. Web tools and softwares provide collaborative workspaces that include threaded discussions in forums, file attachments, private email, real-time text-based chats, videos for visualizing the range of ideas that students generate and collaborative document writing spaces. Using computer-mediated communication, learners can examine ideas in a social context of different perspectives and develop collective ways to understand issues (Riel, 1998). Having multiple participants in an online forum contributes to individuals' social constructions of meaning, their abilities to relate new knowledge structures to those they already possess, and their abilities to explore and create meaning (Garrison, 1997).

2.3. The Effects of Asynchronous WBI on Achievement

Russell (1999) reviewed 355 studies on distance education produced from 1928 to 1998. However, only 40 of the 355 studies specifically included computer-based or mediated instruction, and the compilation was completed prior to the blossoming of courses using the Web. Students were compared on test scores, grades, or performance measures unique to the study, and also on student satisfaction. Consistently, based on statistical tests, "no significant difference" between the comparison groups was found. Despite the technology used, the results are the same: no difference in student achievement. Russell (1999) concluded, "There is nothing inherent in the technology that elicits improvements in learning," although "the process of redesigning a course to adapt the content to the technology" can improve the course and improve the outcomes". Technology, then, is "merely a means of delivering instruction," a delivery truck, so to speak, that does not influence achievement. Russell (1999) concluded, "No matter how it is produced, how it is delivered, whether or not it is interactive, low-tech or high-tech, students learn equally well".

Some findings about the effects of WBDI on achievement are presented as follows: The studies of Pevato (2003) on the educational majors students found that students exposed to the WBDI had significantly higher achievement than students exposed to the traditional face-to-face course. He reported the reasons for significant effect as the highly structured and easily reached content of the course. Keller (1997) and Manathunga (2002) conducted a study on WBDI with the educational majors' students and they found that there is no significant difference on the students' achievement between the traditional method and this model. The study of Keller and Manathunga proposed that linear structure of the course provided students with the feeling of control for their learning process and it caused high motivation to study harder though the students were separated from his teachers by space and time. Along the same line, many other studies (Miller, 2000; Mulligan & Geary, 1999; Ryan, 2000; Schulman & Sims, 1999; Wideman & Owston, 1999) reported no significant difference on student achievement between WBDI and traditional instruction. On the other hand, Manuel (2001) conducted a study on WBDI with educational major students. He concluded that students did not significantly master

the content due to lack of experience in the web technologies and non-interactive structure of the course.

WBII has been proposed as an effective instructional method by many theorists and researchers and assumed as main stream in the web based learning environment (Osman & Hannafin, 1994; Jonassen, 1999; Jonassen, 2000; Tam, 2000). When instructors design authentic tasks that link the content of curriculum to real-world problems, students are challenged to reach mastery level (Pintrich & Schunk, 1996). It follows, then, that establishing constructivist approaches to learning can lead to more students attaining mastery level of achievement in web based learning environment (Johnson, 2001; Tsai, 2004). The study of Matuga (2001) with education major students on introduction to educational psychology online course revealed that there is significant difference on the achievement level between the previous face-to-face courses and this constructivist online course, in favor of the online course. Matuga reported that this course challenged students thinking critically and provided students more interaction with their friends so that students feeled the community of learning. Wegner et al study (1999) presented data from the study with undergraduate education major students on the comparison of WBII and traditional face-to-face instruction. Constructivist web-based delivery of coursework appears to have no negative effect on student achievement. There are other studies (Bourne, McMaster, Rieger, & Campbell, 1997; Davies & Mendenhall, 1998; Dominguez & Ridley, 1999; Gagné & Shepherd, 2001; Sener & Stover, 2000; Serban, 2000) that leads to a conclusion of no significant difference between WBII and traditional method on student achievement by reporting that students need strong metacognitive abilities. On the other hand, research has also shown that successful learning is not always guaranteed with constructivist approach. For example, Wilhelm (1997) reported as a result of his study on the comparison of the WBII and traditional method that undergraduate educational major students often experience difficulties with collaborative and self-directed learning that are essential elements of this type of learning. Pilling-Cormick (1997) also commented that inexperienced students could experience significant difficulties with self-directed learning activities. They reported that success in the WBII depends on students' abilities for self-monitoring and self-regulation.

For both instructional methods, several studies on online teachers' professional development were conducted and they revealed that teachers actually gain diverse and various competencies particularly new ideas, knowledge and skills (Brown, 1999; Spratt, Palmer & Coldwell, 2000; Steel & Hudson, 2001), higher performance in their profession, motivation (Watabe, Hamalainen & Whinston, 1995; Harasim et al., 1995), take support from other teachers, and share resources and materials (Selinger, 1997; Taylor & Stuhlmann, 1998; Rogers, 2000), gain awareness of computer technology (Wishart & Blease, 1999; Steel & Hudson, 2001; Bennett, Priest & McPherson, 1999), and acquire self directedness (Shotsberger et al., 1997; Hughes, 2001; Rodes et al. 2000).

The examples of studies on the WBC based on direct or indirect instructions that are compared with the traditional face-to-face methods can be increased. As a result, there are WBDI and WBII courses that have similar achievement level with the traditional courses and higher or lower achievement level than traditional face-to-face courses due to other confounding factors such as domain of interest, gender and, attitude towards web and web technologies. But more importantly and surprisingly, the researcher couldn't find any study that compares these two instructional methods on the achievement in the web based environment.

2.4. The Effects of Asynchronous WBI on the Attitude towards WWW

Providing useful and various information relevant to the WBC being taught is one of the most important indicators for future web use. It has also been suggested that instructor use of web based training materials correlates positively with student participation in the use web based resources, which in turn, influences student learning through the Web and attitude toward WWW (Chandler & Maddux, 1998; Jiang & Ting, 1998). Although existing research has largely focused on technical issues, less attention has been given to students' sufficiency in web and web technologies, some studies explored constructs necessary for establishing meaningful learning in the web based environment reported that increase in our understanding of students' needs provides instructor to design an optimal educational environments and opportunities for online students (Hara & Kling, 1999; Schrum, 1995).

The studies on WBDI found that educational major students' attitude toward WWW did not change significantly if they had sufficient familiarity towards web and web resources (Richardson, 2003; Hislop, 2000; Matuga, 2001). But, most of them reported that WWW was an important platform to share and take necessary information about any topics. On the other hand, Inman et al. (1999), and Taylor and Mohr (2001) reported that WBDI increased the educational major students' attitude toward WWW significantly. They proposed that it is caused by that students could find any information about learning activities on the web easily.

Attitude towards WWW also reported on the studies related to the WBII. Howland and Moore (2002) conducted a study on the undergraduate educational major's students and reported that most of the students feel comfortable or very comfortable on the web. This study found that there was significant increase in students' attitude toward WWW with respect to the initial condition. They connected this increase to the students' high interactions among the elements of the WBC and, in turn, the students' perception of the web as a sufficient platform to form a learning group. Fredericksen, Pickket, Pelz, Shea and Swan (2000) also reported similar finding from their study on the undergraduate students in education. On the other hand, Oliver and Omai (2001), and Serban (2000) reported that educational major students' attitude towards WWW through the WBII did not change significantly. They proposed that students need more sufficiency in the web tools and technologies for the constructivist approach. Otherwise, they were confusing the issue.

In general, the studies above indicated that students' attitude towards WWW is not change if they have sufficient experience on use of web, web technologies whether or not instructional methods are direct or indirect. Moreover, students perceived Internet as an appropriate delivery medium for higher education as Goodwin (1993) reported.

2.5. The Effects of Asynchronous WBI on the Attitude towards WBC

Moore (1991, 1993a, 1993b, 1994) and, Moore and Kearsley (1996) provided the theoretical basis for the students' attitude toward WBC. They said that the quality of the learning activities on the WBC, challenging level of the learning environment

and level of the interactions in relation with them determine the students' attitude toward WBC. Jiang and Ting (1998) found that students learn better in an interactive environment. Active participation in online discussion was dependent on the instructor's emphasis on quantity and quality of discussion time. The quantity and quality of discussion participation, which is determined by the instructional methods, then influenced students' attitude toward learning experience. (Kanuka & Anderson, 1998; McIsaac et al., 1999) Interactivity provides a way to motivate and stimulate learners, and provides a way through activities and technology for instructors to reflect on the content and process of learning (Hillman et al., 1994).

In the studies on WBDI, Hislop (2000), Richardson (2003), and Taylor and Mohr (2001) found that most of the educational major students expressed improved confidence in domain, expressed increased confidence for future courses and expressed high level of satisfaction with the course. They proposed that instructional method were the major determiner of the students' high attitude toward WBC. Furthermore, Taylor and Mohr reported that student's attitude towards WBC increased because they could easily reach course content and instructor. However, the studies of Larson and Bruning (1996), and Weems (2002) reported that the educational major students' attitude towards WBC did not change significantly. They explained this finding as the students could not interact with their friend sufficiently to build a learning community, and therefore students found the learning environment as static, less confident and insured themselves less about accuracy of the knowledge.

Howland and Moore (2002), and Fredericksen, Pickett, Pelz, Shea and Swan, (2000) conducted a study with the educational major students on the web-based courses in which constructivist approaches were used. When asked about their comfort level in WBC, most of the students reported feeling comfortable or very comfortable. Students reported that they have positive attitudes about their online course experience. They perceived this WBC to be harder than traditional classroom-based courses. However, their attitude toward WBC did not change significantly through the course period, though some students described their learning experience as rewarding but challenging, others were overwhelmed with the need to rely on themselves. On the other hand, the studies of Oliver and Omai, (2001) and Lawless

(2000) on WBII with educational major students reported that students did not develop a significant positive attitude toward WBC because the course requirements were very challenging and time consuming. However, they reported that students lived effective learning experiences that stimulated high interaction.

As a result, students' attitudes toward WBC can change depending on the instructional methods used, and prior experiences on the Web, Web technologies and WBC. Moreover, the change in attitude also depends on the time on task with computer, web and activities embedded into the WBC.

2.6. The Effects of Asynchronous WBI on the Attitude towards Computer

Students' attitudes towards computer are important in influencing the future use of computers in instructional settings; therefore, many attempts have been made to assess students' overall attitude towards computer and the factors affecting it (Hunt & Bohlin, 1993; Martinez & Mead, 1988; Moon, 1994; Price & Wniecki, 1995; Smith & Necessary, 1996). Research has generally supported the intuitively appealing proposition that greater computer experience associated with a positive attitude towards computer (Anderson & Reed, 1998; Lauzon & Moore, 1989; Welles, 1997; Zhang & Espinoza, 1998). Individuals who have a favorable attitude towards computer may elect to learn more in this environment and may use them more often (Arndt, Feltes, & Hanak, 1983; Levine & Donitsa-Schmidt, 1998; Rainer & Miller, 1996; Robey, 1979; Temple & Lips, 1989; Woodrow, 1990).

Pre-service teachers' in WBC whether or not it based on direct or indirect instructional methods perceive computer as a vital media for learning, and separated it from the web technologies if they have sufficient computer skills (Howland & Moore, 2002; McIsaac, Blocher, Mahes & Vrasidas, 1999; Matuga, 2001). Hesser & Kontos (1996-1997) reported that when educational major students entered with minimal or no computer skills in WBC based on direct instruction, the online delivery developed their attitudes toward computer throughout their study. They proposed that students' skill levels were increased and they were able to apply their new computer skills at other places though they lived quite tiresome problems through the course and they took a certain amount of instructional support in the

form of content presentation and responses about the web technologies. On the other hand, Ertmer, Evenbeck, Cennamo and Lehman (1994) found that if educational major students were to embrace computer technologies, such as word processing, electronic mail systems, WWW, video conferencing, and information databases, they feeled confident and comfortable using them, and their attitude towards computer through the WBC based on the indirect instruction did not change significantly. Supporting to the above findings -limited effect of the instructional methods-, researchers reported that students' attitude towards computer affected by, especially, the students' locus of control and beliefs about computers (Potosky & Bobko, 2001). On the other hand, instructional methods used have less and indirectly affect students' locus of control and beliefs about computer if the course content is not on computer technology (Anderson & Reed, 1998). As Maddux and Johnson (2004) reported, students' computer attitudes were related to their success in learning computer technology. Their study results demonstrated also that (a) enjoyment, motivation, importance, and freedom from anxiety have linear relationships with time, and (b) time has a linear relationship with computer achievement. From this perspective, WBC could increase students attitude towards computer due to time spent on task with computer.

As a result, students' attitudes towards computer do not depend on the instructional methods used in the web based learning environment. On the other hand, students can develop positive attitude towards computer due to time on task with computer related activities in the web based learning environment (Bandura, 1998; Hunt & Bohlin, 1993; Wang, Ertmer & Newby, 2004).

2.8. The Effects of the Asynchronous WBI on the Metacognition

Metacognition, as a construct, is based on information processing and general intelligence theories. Flavell (1979) defined it as "one's knowledge concerning one's own cognitive processes" (p. 232). From a different perspective, Brown, Campione and Barclay (1979) defined it as the control processes in which active learners engage as they perform various cognitive activities. So, metacognition generally refers to the ability to understand, control, and manipulate individual cognitive

processes; control of cognition (Brown, Bransford, Ferrara, & Campione, 1983; Reeve & Brown, 1984).

Metacognition can be divided into three main components: metacognitive knowledge, metacognitive judgments and monitoring, and self-regulation and control of cognition (Pintrich, Wolters, & Baxter, 2000). Metacognitive theorists uniformly agree upon the metacognitive knowledge, and metacognitive judgments and monitoring as being part of the domain of metacognition whereas self-regulation and control is less widely agreed upon (Alexander et al, 1995).

Metacognitive knowledge is knowledge about cognition and assumes that it is similar in many ways to other kinds of knowledge in long-term memory that individuals can have about any topics such as geography, mathematics or biology. In this sense, metacognitive knowledge may be more static and stable than monitoring and regulation (Shraw & Moshman, 1995). Metacognitive knowledge includes knowledge of cognition and cognitive strategies, knowledge of tasks and contexts, and knowledge of self (Alexander, Schallert, & Harei, 1991; Flavell, 1979). Unlike the metacognitive knowledge, metacognitive judgments and monitoring are more process related and reflect metacognitive awareness and ongoing metacognitive activities which individuals may engage in as they perform a task. Metacognitive judgments and monitoring could be divided into two categories: retrospective (confidence judgments about previous responding) and prospective (judgments about future responding) (Nelson & Narens, 1994). Lastly, self-regulation and control of cognition are known as activities that individuals engage in to adapt and change their cognition or behavior. Self-regulation and control of cognition involves the regulating mechanism and monitoring-controlling learning problems (McLain, Gridley, & McIntosh, 1991). In other words, it refers to continuous metacognitive adjustments and "fine-tuning" by learners in response to, or in the absence of, feedback concerning errors (Brown, Bransford, Ferrara, & Campione, 1983; Butler & Winne, 1995). Pintrich, Wolters and Baxter (2000) limit metacognitive control and self-regulation into four categories: planning, strategy selection and use, resource allocation, and volitional control. As a result, metacognition generally refers to a learner’ awareness of, or control over, cognitive processes (Bessant, 1997).

Moore (2002) said that it seems that before students can make sense of the vast store of information in the web based learning environment, they have to develop certain advanced metacognitive skills. The importance of developing the ability to guide one's own learning, and when using external resources to do so under one's own control, has long been discussed in distance literature. Metacognitive skills make up ability to be an autonomous learner. Though there is no researches about the effects of the instructional methods in the web based learning environment on the students' metacognition, the relations of the metacognition with the main constructs of the online distance education -autonomy and interaction- push the attention on the roles, developments and effects of the students' metacognitive abilities in the web based learning environment. There might be cyclic relations -on the base of cause and effect- between some elements of the Web based learning environment and students' metacognition. However, metacognition is not much investigated on the Web based learning environment (Moore, 2002).

Web based learning environment offers different types of support to learners. Almost without exception, they provide on-demand help, ranging from context-specific hints to specially designed hyperlinked background material, hyperlinked textbooks, and online glossaries. These help facilities would seem to be important assets for learners who try to master a new set of skills or subject matter. The proficient use of help facilities would seem to be an important factor determining learning outcomes among individuals working with these environments. However, an increasing number of studies provide evidence that learners often do not use help functions very effectively or even ignore them totally (Grasel et al, 2001; Renkl, 2002). Help seeking process in this environment includes, is, important metacognitive skills that are likely to influence learning in many situations and domains (Aleven at al, 2003; Grasel et al, 2001).

Students interact differently and in many forms with text as they carry out WBC. One such study carried out by Crusius and Channell (2000) has led to the conclusion that there are complex interactions between the student, the text and contextual factors which shape the learner's mediating processes and which then give rise to learning outcomes. In a comparative study of the strategy use of online learners enrolled in the same courses, White (1996) found a highly significant

difference between the two groups in terms of metacognitive strategy use on a number of measures. Online learners reported four times the use of metacognitive strategies compared to classroom learners. There were also differences in the kinds of metacognitive strategies used by the two groups: for example, self-management was the most frequently used metacognitive strategy by online learners, but accounted for a low proportion of the metacognitive strategy use of classroom learners.

Hardy and Boaz (1997) conducted a study on WBC in the education major and found that the students, in identifying factors for success, felt that they needed to be more independent, assertive, self-disciplined and motivated than the average college student. Technology based learning environments enable students to become more self-directed and to articulate their learning goals. They reported that web based learning is likely to be more metacognitive and self-directed (McLoughlin & Luca, 2002). The study of Sorg (2000) also reported that students found that their learning in web-based learning environment helped improve not only cognitive strategies but also skills as managing personnel resources and managing technology.

The forum discussions and bulletin board in the web-based environment develops students' monitoring process, which is a metacognitive ability. Question prompts have been found effective to help students focus attention and monitor their learning through elaboration on the questions asked (Norton, 2005). Researchers have integrated prompts into WBI to facilitate metacognition (Davis & Linn, 2000; Hannafin, Land, & Oliver, 1999; Lin & Lehman, 1999). Lin and Lehman (1999) found that justification prompts facilitated transfer to a contextually dissimilar problem. Similarly, Davis and Linn (2000) found that self-monitoring prompts embedded in the Web-based environment encouraged students to think carefully about their activities and facilitated planning and reflection.

As a result, the main constructs of the online education; interaction and autonomy are closely related or affected by the metacognitive strategies of the students. During the interaction, student-student or student-content or student-interface or student –instructor, students are strongly needs for the metacognitive judgments and monitoring abilities since they are alone while studying in the WBC.

On the other hand, as Anderson (1999) and Ozen (2000) reported that the experience of actually being an online learner helps develop and strengthen metacognition of the autonomous learner. The level of the learner autonomy depends on the instructional method used in the web based learning environment. While students exposed to WBII have high autonomy, because they determine their objectives, learning strategies and also time usage, students exposed WBDI have less autonomy. Therefore students exposed WBII might be stimulated more for use of the metaskill than students exposed WBDI.

2.9. Summary of the Literature Review

WBI is hypermedia-based medium that utilizes the attributes and resources of the WWW to create meaningful environment where learning fostered and supported. Electronic mail, bulletin boards, forum discussions and two-way communication tools support interactions and lower transactional distance and heighten dialogue. Interaction typically occurs between learner and content, learner and instructor, learner and interface, and learner with other learners. Researches indicate that high level of interaction in WBC lead to more positive attitudes toward WWW and WBC, and greater satisfaction with learning (Berge, 1999; Draves, 2000; Hackman & Walker, 1999; Muirhead, 1999; Parker, 1999; Spitzer, 2001). However, the presence of interactivity provided by the web does not automatically ensure that learning at a distance will take place. Web based instructional methods make the difference between learning experiences.

WBDI includes the information processing approach that based on the behaviorist (or objectivist) theory (Kruse & Keil, 2000; Gagné, 1985). The key concept is that the instructor transmits a fixed body of information to learner via an external representation sequentially and linearly. Objectives determined by the expert guide the development, and planning of learning is top down and systematic (Willis, 1995). WBII is based on constructivist principles, in which a learner actively constructs an internal representation of knowledge by interacting with the material to be learned. This can be in the form of both situated cognition (Streibel, 1991) and problem-based learning (Savery & Duffy, 1995). According to this viewpoint, design

process is recursive and non-linear. Planning is organic and developmental and objectives emerge from design and developmental work (Willis, 1995).

WBC based on direct instruction and indirect instructions are compared with traditional face-to-face instruction in numerous researches (Bourne, McMaster, Rieger, & Campbell, 1997; Davies & Mendenhall, 1998; Dominguez & Ridley, 1999; Gagné & Shepherd, 2001; Johnson, 2001; Keller, 1997; Manathunga, 2002; Miller, 2000; Mulligan & Geary, 1999; Ryan, 2000; Sener & Stover, 2000; Serban, 2000; Wegner et al, 1999; Wideman & Owston, 1999). They found that "no significant difference between WBDI (or WBII) and traditional face-to-face method on students' achievement. Moreover, it also seen that the mastery of the content are quite high in some researches in both WBDI and WBII (Pevato, 2003; Matuga, 2001).

Researchers reported different findings with respect to the instructional methods for the students' attitude toward computer, WWW and WBC. The studies about attitudes toward computer of Wang, Ertmer and Newby (2004), Maddux and Johnson (2004), Anderson and Reed (1998), Howland and Moore (2002), McIsaac, Blocher, Mahes and Vrasidas (1999), Hesser and Kontos (1996-1997), and Potosky and Bobko (2001) reported consistently that there is no significant change in attitude toward computer through WBC based on direct or indirect instructional approaches, if students have enough computer skills. About the attitudes toward WWW and WBC for WBDI; there are studies that reported no significant change in attitude toward WWW (Richardson, 2003; Hislop, 2000; Matuga, 2001) and significant change in attitude toward WWW (Inman et al., 1999; Taylor & Mohr, 2001) through the WBC based on direct instruction. Similarly, there are studies that reported no significant change on the students' attitude toward WBC (Weems, 2002; Larson & Bruning, 1996), and significant change on the students' attitude toward WBC (Hislop, 2000; Richardson, 2003; Taylor & Mohr, 2001) through the WBC based on direct instruction. About the attitudes toward WWW and WBC for WBII, there are also studies which reported that no significant change in attitude toward WWW (Oliver & Omai, 2001; Serban, 2000), and significant change in attitude toward WWW (Howland & Moore, 2002; Fredericksen, Pickket, Pelz, Shea & Swan, 2000) through the WBC based on indirect instruction. Similarly, there are studies that

reported no significant change on the students' attitude toward WBC (Oliver & Omai, 2001; Lawless, 2000) and significant change on the students' attitude toward WBC (Fredericksen, Pickket, Pelz, Shea & Swan, 2000; Howland & Moore, 2002) through the WBC based on indirect instruction.

Above all, students in either WBDI or WBII needs control their pace of learning, use of the appropriate learning strategies, monitor of their learning and regulate the cognitive strategies in accordance with their level of understanding. A few researches were conducted about the metacognition in WBC. The results showed that students need metacognitive abilities in WBC and web based learning environment stimulate metacognitive strategies (Anderson, 1999; Jonassen; 2000; McLoughlin & Luca; 2002; Ozen, 2000; Sorg, 2000; White, 1996).

The main idea obtained from all these studies conducted shows that there has been no experimental study that compares the effects of WBDI and WBII on the students' achievement, metacognition and attitudes toward computer, WWW and WBC. As a result, there is a need for research to test the effects of WBDI and WBII on students' achievement, metacognition, attitudes toward computer, WWW and WBC.

CHAPTER 3

METHODS

In this chapter, population and sample, measuring tools, description of variables, data collection and analysis, development of the web-based course (teaching/learning materials), treatment, treatment verification, power analysis, internal validity, limitations and assumptions of the study are explained briefly.

3.1 Population and Sample

The target population of the study was all third grade mathematics and science education students in the department of elementary education at the public universities in which the medium of instruction was English. There are two such universities in Turkey; Middle East Technical University and Bosphorus University. Each university included approximately 70 third grade students in mathematic and science education.

Each Elementary Education Department in these universities was invited to participate in this study. However, only Bosphorus University responded positively to the invitation. Even there was approximately 70 pre-service teachers in the third grade, only 63 pre-service teachers took “Math and Science Teaching Method” course offered in third year of the educational program as some of the pre-service teachers failed or did not take its prerequisite course or some had the quote problem related to the course load in one semester. One instructor (the researcher), one on-site helper and 63 pre-service teachers were involved in this quasi-experimental study.

The pre-service teachers at different achievement level could be distributed identically to the groups by using Grade Point Average (GPA) as matching criteria because it might affect the outcome of the study (Berge, 1999; Chellman & Duchastel, 2000; Downes, 2003). Pairs of pre-service teachers were matched on their GPA mechanically. Researcher considered also increasing the likelihood that the group of the subjects would be equivalent on gender and department as much as possible. The members of each matched pair were then assigned to the groups at random (Fraenkel & Wallen, 1996). Each group was then randomly assigned, one to the WBII group (WBIIG) and one to the WBDI group (WBDIG). Of the pre-service teachers participated in the study, their GPA ranged from 1.63 to 3.74 with a mean of 2.41. The mean of the GPA of the WBDIG was 2.40 whereas that of the WBIIG was 2.41. Hence, the subjects were distributed over two groups of 32 and 31 pre-service teachers, respectively.

The 32 WBIIG pre-service teachers were composed of 12 male and 20 female, whereas the 31 WBDIG pre-service teachers were composed of 13 male and 18 female pre-service teachers. Both groups were composed approximately equal number of pre-service teachers from the departments, science and math. The number of pre-service teachers from math was 17 for WBIIG and 18 for WBDIG. Subjects in this study were third grade pre-service teachers whose ages range from 21 to 25. The mean of the ages was about 22 for both groups.

In analyzing pre-service teachers' prior experience in computer, 92 % of the pre-service teachers had previously completed at least one computer related course, such as, Computer Programming, Computer-Assisted Instruction. Moreover, 56 % of them owned a computer in home or in dormitory. About three fourths of the pre-service teachers for both groups described themselves as having sufficient keyboarding skills. As shown in Table 3.1, almost all of the pre-service teachers used computer in a lesson. Moreover, about half of the pre-service teachers in both groups surf the Internet/web frequently. Although there was some variation in the amount of previous use, exposure, and/or experience that pre-service teachers had with computer applications, the majority of the pre-service teachers enrolled in the study could be described as fairly experienced with computer and Internet.

Table 3.1 Pre-Service Teachers' Characteristics about the Use of Computer and Internet

Characteristics		WBIIG n (%)	WBDIG n (%)
Computer was used for/as/in	Video Games	21 (66)	17 (53)
	Analyzing data	5 (16)	9 (29)
	Writing programs	1 (3)	5 (16)
	Word processor	27 (84)	28 (90)
	Lesson/tutorial/ lab	29 (91)	30 (97)
	A work station	7 (22)	6 (19)
Internet	I am novice	4 (12)	3 (10)
	Occasionally surf the web	7 (22)	6 (19)
	Frequently surf the web	15 (47)	17 (55)
	Use of the central to my studies	6 (19)	5 (16)

3.2 Measuring Tools

For this study, six instruments were used in order to gather data. These are Midterm (ME) and Final Exam (FE), Computer Attitude Scale (CAS), General Web-based Course Attitude Scale (GWBAS), General Metacognition Questionnaire (GMQ) and Observation Checklist.

3.2.1 Midterm Exam of Teaching Method Course

ME, used in this study, were developed by the researcher to assess pre-service teachers' understanding in the chapters "Effective Teacher, Questioning in the Classroom, Direct Instruction, Discovery Learning and Problem Solving". The questions were prepared according to the chapters covered by using the textbooks (Borich, 1997; Chambers & Sprecher, 1996; Clark & Starr, 1996| Cruickshank, Bainer & Metcalf, 1995), by surveying Google, Yahoo and other metasearch tools to identify frequently asked questions about the teaching methods and lastly, by using

the exams applied in the faculty of education in Middle East Technical University and Bosphorus University.

The questions in the ME were in the form of True/False, Fill-in-the-Blanks, Matching, Multiple-Choice and Open-ended questions. Reasons for preferring Multiple-Choice, True/False, Fill-in-the-Blanks, and Matching are that it is easy and quick to administrate and it enables the researcher to score objectively. The reasons to put essay questions are to reveal the knowledge constructed, to provide a platform for the pre-service teachers to clarify their opinion or stand on an issue with supporting rationale and to struggle students thinking critically (Haladayna, 1997). The ME was in-class examinations, which included routine exercises and non-routine problems. The routine exercises that focused on basic procedures, concepts and skills, similarly found in books, in classroom applications and examinations. The non-routine problems included problems for which the pre-service teachers had not been taught a method of solutions as well as questions in which pre-service teachers had to explain course concepts and relationships between such concepts in their own words.

The original 32 questions for the ME were submitted to a three member validation panel composed of the lecturer who had given this course for eight years and two teachers in English language, respectively. The lecturer's judgments regarding the content coverage of the related chapters, clarity of items, language level and cognitive level measured, and the content coverage of the forum discussions in both groups and two English teachers' judgments regarding the language level and clarity of items were used to modify and to select the items for the ME among the questions prepared. 16 items were selected from the item pool (32 items) to represent the five chapters (content domain) for the ME (See Appendix A). The distribution of the 16 questions to the five chapters was given in Table 3.2. Most of these items were directly taken or were slightly adapted from the different sources [five questions (1, 4, 13, 15, 16) from the item pools of the instructor, four questions (6, 10, 11, 14) from the teaching method books (Borich, 1997; Clark & Starr, 1996), and three questions (8, 9, 12) from the Internet sources] and the researcher developed the rest of them. The deleted specimen item from the original 32 questions for the

ME was as following: The original True/False item was deleted because it was not clear.

"T F . Facts are either observed, heard or read. As such, there is no discovery method for acquiring them"

The multiple-choice item was also deleted since its alternatives were contradictory and not clear.

Which of the following is NOT a characteristic of the Direct-Instruction Model?

a. *Teaches concepts and skills*

b. *Teacher-centered strategy*

c. *The teacher assumes primary responsibility for students' learning progress*

d. *The teacher's role is primarily facilitative*

The scoring of the ME was seen in Appendix B. The researcher evaluated the pre-service teachers' exams by using this scoring rubric. The Cronbach alpha value for the internal consistency reliability calculated was as $\alpha = .71$. Possible scores could range from 0 to 100, with higher scores indicating greater performance.

3.2.2 Final Exam of Teaching Method Course

The FE, used in this study, were developed by the researcher to assess pre-service teachers' understanding in the chapters covered in the ME and last five chapters "Cooperative Learning, Discussion, Computer-assisted Instruction, Project-based learning and Drama". The questions were prepared according to the chapters covered by using the textbooks (Borich, 1997; Chambers & Sprecher, 1996; Clark & Starr, 1996; Cruickshank, Bainer & Metcalf, 1995), by surveying Google, Yahoo and other metasearch tools to identify frequently asked questions about the teaching methods and lastly, by using the exams applied in the faculty of education in Middle East Technical University and Bosphorus University.

The original 34 questions for the FE were submitted to a three-member validation panel composed of the lecturer who had given this course for eight years and two teachers in English language, respectively. Her judgments regarding the

content coverage of the related chapters, clarity of items, language level and cognitive level measured, and the content coverage of the forum discussions in both groups and two English teachers' judgments regarding the language level and clarity of items were used to modify and to select the questions for the FE among the questions prepared. The questions in the FE were also in the form of True/False, Fill-in-the-Blanks, Matching, Multiple-Choice and Open-ended questions. The FE was also in-class examinations, which included routine exercises and non-routine problems.

The FE had questions on all of the teaching method chapters. 21 items were selected from the item pool (34 items) for the FE by considering the judgments of the validation panel (See Appendix C). The distribution of the 21 items to the ten chapters (content domain) was as in Table 3.2. Most of these items were directly taken or were slightly adapted from the different sources as in the ME [six questions (1, 2, 6, 17, 18, 20) from the item pools of the instructor, five questions (8, 9, 12, 16, 21) from the teaching method books (Clark & Starr, 1996; Cruickshnak, Bainer, & Metcalf, 1995; Duatepe, 2004) and four questions (4, 10, 11, 13) from the Internet sources]. The researcher developed five questions.

Table 3.2 Questions' Distribution in the ME and FE

Questions	Chapters														
	ME					FE									
	1	2	3	4	5	1	2	3	4	5	6	7	8	9	10
1	-	√	-	-	-	-	-	-	-	-	-	-	-	√	-
2	-	√	-	-	-	-	-	-	-	-	-	-	-	√	-
3	-	-	√	-	-	-	-	-	-	-	√	-	-	-	-
4	-	√	√	√	√	-	√	-	-	-	-	-	-	-	-
5	√	-	-	-	-	-	-	-	-	-	-	√	-	-	-
6	-	√	-	-	-	-	-	-	-	-	√	-	-	-	-
7	-	-	√	-	-	-	√	-	-	-	-	-	-	-	-
8	-	-	√	-	-	-	-	-	-	-	-	√	-	-	-
9	-	-	√	-	-	-	-	-	-	-	-	-	-	-	√

Table 3.2 (Continued)

Questions	Chapters														
	ME					FE									
	1	2	3	4	5	1	2	3	4	5	6	7	8	9	10
10	-	-	√	-	-	-	√	-	-	-	-	-	-	-	-
11	-	-	√	-	-	-	-	-	√	-	-	-	-	-	-
12	-	-	√	-	-	-	-	-	-	-	-	-	-	-	√
13	√	-	-	-	-	-	-	-	√	-	-	-	-	-	-
14	√	-	-	-	-	-	-	-	-	-	-	-	√	-	-
15	-	-	-	-	√	√	-	-	-	-	-	-	-	-	-
16	-	-	-	√	-	-	-	√	-	-	-	-	-	-	-
17	-	-	-	-	-	-	-	-	-	√	-	-	-	-	-
18	-	-	-	-	-	-	-	-	-	-	-	√	-	-	-
19	-	-	-	-	-	-	-	-	-	-	-	-	√	-	-
20	-	-	-	-	-	-	-	-	-	-	-	-	-	√	-
21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	√

The deleted specimen item from the original 34 questions for the FE was as following: The Fill-in-the-Blank question was deleted because it was knowledge level and requires memorizing.

The types of the computer-assisted instruction are ----------, ----------, ----------, ---------- *and* ----------.

The open-ended question was also deleted since it was not clear and required more knowledge level information.

How would you structure a cooperative task? List the five variables of this structuring with a short explanation!

The scoring of the FE was seen in Appendix D. The researcher evaluated the pre-service teachers' exams by using this scoring rubric. The Cronbach alpha value

for the internal consistency reliability calculated was as α = .78. Possible scores could range from 0 to 100, with higher scores indicating greater achievement.

3.2.3 Computer Attitude Scale

Attitudes toward computer were measured by a 40-item Likert questionnaire developed by Lyord and Gressard (1984). CAS was designed to assess anxiety or fear of computers; liking of computers or enjoying working with computers; confidence in ability to use or learn about computers and usefulness of computers in life (importance). Each of the items uses a 4-point scale (Strongly agree, slightly agree, slightly disagree, and strongly disagree). Positively and negatively worded statements are included throughout the CAS (Lyord & Gressard, 1984). At the beginning of the scale, there are also five survey-type questions to determine the subjects' experience in computer (See Appendix E).

The Cronbach alpha values for the internal consistency reliability calculated on the basis of the pretest and posttest scores was as α = .93 and α = .91, respectively. Possible minimum and maximum CAS scores are 40 and 160, respectively and higher scores indicate positive attitude towards computer.

3.2.4 General Web-Based Course Attitude Scale

The GWBAS developed by Yıldırım (2000) was used to determine students' attitude towards web-based course. There are four subscales: (1) Current Feelings about WWW (items from 2 to 9); (2) Online Course Support (items from 13 to 19); (3) Level of Communication (items from 20 to 37) and (4) Perception of Satisfaction and Success (items from 38 to 51). These four subscales are a Likert-type scale. The GWBAS has 47 items and eight survey-type questions. First one at the beginning of the scale was designed to obtain the current experience in WWW and three questions (10, 11 and 12) at the beginning of the second subscale were designed to obtain the support level in the online course. The rest of them was at the end of the fourth subscale and was used to obtain students' feelings about the online course application and to obtain the students' motivation level for the success.

The subscale entitled, Current Feelings about WWW (CFWS), contains eight items that uses a 5-point scale, but each item associated with different phrase. For example, “stimulating” stand for 5 point and “dull” stand for 1 point in the first item, whereas “non-threatening” stand for 5 point and “threatening” stand for 1 point in the sixth item. Internal-consistency reliability estimates of .79 and .82 were obtained for this 8-item subscale on the basis of the pretest and posttest scores. The subscales entitled, Online Course Support; Level of Communication and Perception of Satisfaction and Success, have 7, 18 and 14 items, respectively. Each of the items in the subscales uses a 5-point Likert - type scales (strongly disagree, disagree, neutral, agree, and strongly agree). For these three subscales and these three as one subscale “Web-based Course Attitude” (WBAS), internal consistency reliability (alpha) estimates were .70 (Online Course Support), .83 (Level of Communication), .71 (Perception of Satisfaction and Success) and .90 (WBAS). Possible minimum and maximum CFWS and WBAS scores (WBASS) are 8 and 40, and 39 and 195, respectively. Higher scores indicate positive attitude towards WWW and WBC (See Appendix F).

3.2.5 General Metacognition Questionnaire

GMQ developed by Topçu and Ubuz was designed to assess the students’ metacognitive abilities. It was developed to cover the three different components theorized by Flavell (1979), Browns, Bransford, Ferrara and Campione (1983), and Reeve and Brown (1984); metacognitive knowledge, metacognitive judgments and monitoring, and self-regulation and control. The items 1, 2, 3, 4, 6, 7, 16, 22 are belonging to the metacognitive knowledge, whereas the items 8, 14, 19, 20, 23, 24, 25, 26, 27, 28, 30 are belonging to the metacognitive judgments and monitoring. The rest of the items are pertaining to the self-regulation and control. This instrument is a self-reporting questionnaire in which students are asked to respond to thirty items with a 5-point Likert type format ranging from Not True for me (1) to Very True for me (5). GMQ scores could range from 30 to 150. Internal consistency reliability estimates of .80 and .79 were obtained for this questionnaire on the basis of the

pretest and posttest scores, respectively. Higher scores indicate higher metacognition ability (See Appendix G).

3.2.6. Observation Checklist

Observation checklist developed by the researcher was designed to determine whether web based asynchronous "Science and Math Teaching Method" course was conducted according to the instructional approaches or not. The items are the most important characteristics of the WBII and WBDI determined by considering the literature related to them (Jonassen, 2000; Osman & Hannafin, 1994; Tam, 2000; Willis, 1995). Items contain the instructor (four items), students (seven items) and medium (four items) related criteria. It includes 15 items and each item uses a five point Likert type format: (1) Strongly Disagree, (2) disagree, (3) uncertain, (4) agree and (5) strongly agree (See Appendix H).

3.3 Variables

There are fourteen variables involved in this study, which are categorized as dependent and independent variables. There are six dependent variables and eight independent variables.

3.3.1 Dependent Variables

The dependent variables of this particular design are pre-service teachers' "Teaching Method Course" performance in ME, and in FE, pre-service teachers' computer attitude posttest (POSTCAS), pre-service teachers' WBASS, pre-service teachers' current feelings about WWW posttest (POSTCFW), and pre-service teachers' metacognition posttest (POSTGMQ). The POSTCAS, POSTCFW and POSTGMQ were measured by the CAS, CFWS and GMQ, respectively whereas WBASS were measured by WBAS. These dependent variables were determined as continuous variables and measured on interval scale.

3.3.2 Independent Variables

The independent variables of the study were collected in two groups as covariates and group membership (main effect); Block 1 and Block 2. Pre-service teachers' age, gender, department, GPA, pre-service teachers' prior attitude toward computer (PRECAS) and pre-service teachers' prior feelings about WWW (PRECFW), pre-service teachers' prior metacognitive ability level (PREGMQ) within Block 1 as covariates. Treatment (Methods of instruction) was included in Block 2 as main effect. PRECAS scores were measured by the CAS whereas PRECFW scores were measured by the first subscale of the GWBAS "Current Feelings about WWW" subscale (CFWS). PREGMQ scores were measured by the GMQ. The treatment and pre-service teachers' gender and department were discrete variables and were measured on the nominal scale, whereas the pre-service teachers' GPA, PRECAS, PRECFW and PREGMQ were continuous variables and were measured on interval scale. The pre-service teachers' gender was coded as zero for female and one for male. Department was coded as one for math education and two for science education. Lastly, treatment was coded as one for WBDI and two for WBII.

3.4 Data Collection and Analysis

The aims of the study were to investigate the effects of web based course uses the direct instructional approach and indirect instructional approach (constructivist) on pre-service teachers' "Science and Math Teaching Methods" course achievement, attitude towards computer, WWW and WBC, and metacognition. The definitions for direct and indirect instruction were adopted from Willis (1995). WBDI is teacher-centered and linear, and objectives guide development whereas WBII is student-centered, recursive and non-linear, and objectives emerge from development work. In order to define the research problem clearly, a computer search was conducted using Educational Resources Information Center (ERIC), Ebscohost, and Internet (Google, Yahoo). The following keywords were submitted to be searched: Web-based course, constructivism, direct instruction, attitudes towards computer, WWW, metacognition and combinations of them. Several books (Bates, 1995; Jonassen,

2000; Keagan, 1997; Morgan & O'Reilly, 1999; Moore & Thompson, 1997) were searched in Middle East Technical University and Bosphorus University library to get some idea of what was already known about the concepts. Then, the articles (Chellman & Duchastel, 2000; Clark, 1999; Hill & Hannafin, 1997; Kearsley, 1998; Russell, 1999) that were thought to be useful were taken.

In May 2002, the main research problem was defined clearly. After some modifications in the keyword list, ERIC, International Dissertation Abstracts, Social Science Citation Index (SSCI), Ebscohost, Proquest and Internet (Google, Yahoo) were searched systematically. All of the papers were read; results of the studies were compared with each other. In case of new recent articles on this topic the researcher continuously followed the literature.

Before the treatment began, the pre-service teachers were categorized into two groups according to their GPA. Their GPA was taken from the registration office. The researcher was assigned by the faculty to be regular instructor of both groups. CAS, CFWS and GMQ scales were posted to the pre-service teachers by email attachment and pre-service teachers were required to return the completed scales to the researcher between February 23 and 27. During the semester, pre-service teachers were given two in-class examinations, ME and FE. The ME and FE were conducted on April 21st and on June 10th, respectively. They were administered in two classrooms. For each classroom there was one observer and the researcher. Pre-service teachers from the two groups were distributed randomly into two classrooms in considering that each classroom had equal number of pre-service teachers from two groups. The POSTCAS, POSTCFW, WBAS and POSTGMQ were also administered by email attachment between June first and June tenth. These, in-class examinations and all of the scales, were the same for both groups. To sum up, the outline of the study can be seen in Table 3.3.

The software SPSS 10.0 was used for all of the statistical computations. The descriptive statistics; mean, median, standard deviation, skewness and kurtosis were calculated for the WBIIG and WBDIG to summarize, organize and simplify the data and to control the assumptions of the inferential statistics. Statistical technique named multivariate analysis of covariance (MANCOVA) was used since it is an

extension of analysis of covariance that incorporates two or more dependent variables in the same variables (Fraenkel & Wallen, 1996). Table 3.4 shows all variables and the variable set entry order that were used in the statistical analyses.

Table 3.3 General Outline of the Data Collection

	WBIIG	WBDIG	Date
Pretests	CAS –CFWS - GMQ		23 – 27 February 2004
Face to face Meeting	Introduction of WBC Tools		25 February 2004
Treatment	WBII on Math and Science Teaching Methods Course: Chapter 1 - 5	WBDI on Math and Science Teaching Methods Course: Chapter 1 - 5	01 March – 9 April 2004
Test	ME		21 April 2003
Treatment	WBII on Math and Science Teaching Methods Course: Chapter 6 - 10	WBDI on Math and Science Teaching Methods Course: Chapter 6 - 10	12 April – 28 May 2004
Tests	CAS – CFWS – WBAS – GMQ		1-7 June 2004
	FE		10 June 2004

Design of the study was single-factor design. The treatment, independent variable; WBII and WBDI, had to levels, Variance due to the GPA, PRECAS, PRECFW, PREGMQ, gender, department and age was removed prior to entry of the treatment variable. As shown in Table 3.4 Block 1 (covariates) was entered first in the MANCOVA model. Block 2 (group membership-treatment) was entered second in the analysis while Block 1X2 (covariate*group interaction) was entered third Block to determine covariate*groupmembership interactions. This set must be statistically non-significant for MANCOVA model to be valid. Block 1X2 yielded non-significant increase in total variance for the overall MANCOVA model.

Therefore, the interaction set was discarded from the inferential statistical analysis. After MANCOVA analysis, follow-up ANCOVA's were used for significant main effects.

Table 3.4 MANCOVA Variable-Set Design and Statistical Model Entry Order

Variable set	Entry order	Variable name
Block 1 (Covariates)	First	X1 = Age X2 = GPA X3 = PRECAS X4 = PRECFW X5 = PREGMQ X6 = Gender X7 = Department
Block 2 (Group membership)	Second	X8 = Treatment (Methods of Instruction)
Block 1*2 (Covariates * group interactions)	Third	X9 = X1*X8 X10 = X2*X8 X11 = X3*X8 X12 = X4*X8 X13 = X5*X8 X14 = X6*X8 X15 = X7*X8

3.5 Development of the Web-based Course: Teaching/Learning Materials

For the implementation of the WBDI and WBII in Teaching Methods Course, (1) content of the lecture in the web pages format were developed, (2) the course web pages were uploaded on the NET-Class Course Management Platform, (3) episodes that narrate real classroom cases and video clips that demonstrate real classroom cases were embedded into the course web site, (4) questions for the purposes of

practice, guidance and facilitation in the forum discussions were prepared, (5) list of the sites that contains information related to each chapter was formed and (6) the WBC was piloted and modification according to the results were carried out.

Lecture Notes were prepared as web pages by benefiting from the materials of the previous "Teaching Methods Course" instructors and by using the textbooks about teaching methods course (Borich, 1997; Chambers & Sprecher, 1996; Clark & Starr, 1996; Cruickshank, Bainer & Metcalf, 1995). The topics in the lecture note were chosen by the researcher and the experienced lecturer in considering (1) that are suitable for both math and science education students, (2) that are in common in all of the previous course content and (3) that are dominant methods in science and math teaching in last decade. Lecture note were reviewed and corrected by three-member validation panel composed of the experienced lecturer and two lecturers in English language. The experienced lecturer's judgments regarding the content coverage of areas of interest, clarity of the content and language level and two English teachers' judgments of language level and clarity of content were used for the review and correction process.

The NET-Class was used to manage the online course. NET-Class is a learning management system that provides an asynchronous learning environment for instructors and students. It allows the instructors to manage their courses without the need of extensive technical knowledge. All components of the NET-Class system is being developed by METU Informatics Institute since 1997, by taking into account the faculty and student feedbacks in campus wide asynchronous learning network courses. NET-Class is not an authoring tool. Lecture notes are prepared using standard HTML editors such as FRONTPAGE or DREAMWEAVER, and JAVA or FLASH for animations/interactive examples. Prepared notes are uploaded to NET-Class using file transfer programs

Pre-service teachers in either WBIIG or WBDIG enter the course site provided by NET-Class with using their username and password through the same address: http://online.metu.edu.tr (Figure 3.1). Pre-service teachers from different groups can only do the activities on their own course site and can not interact with each other.

Pre-service teachers can go into the courses with the link “Courses”, can have the information about their grading from the “Gradebook”, can post messages to the technical staff of METU in the “General Forum” link, can find out news in the “Latest News” link, can change easily their username and password by using “Profile” link and can have the information about the “NET-Class”. These links are contained in the main page after the entering the METU Online (Figure 3.2).

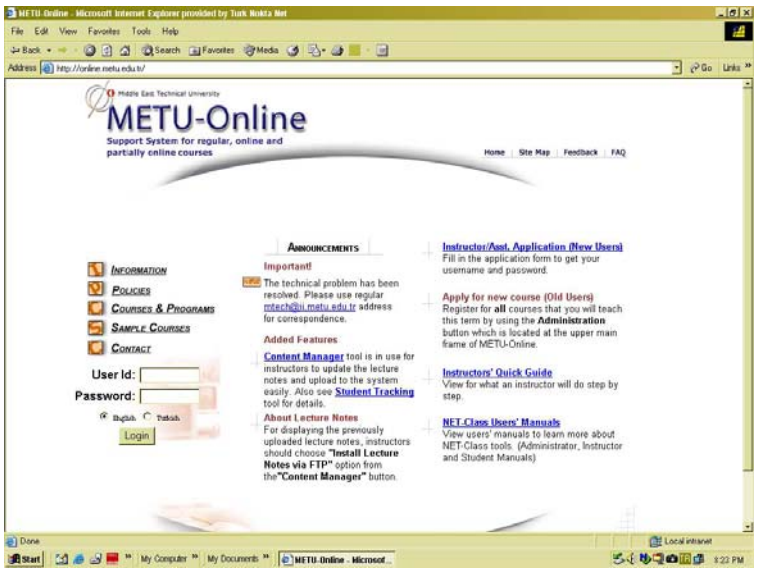


Figure 3.1 First Interface of Net-Class at METU

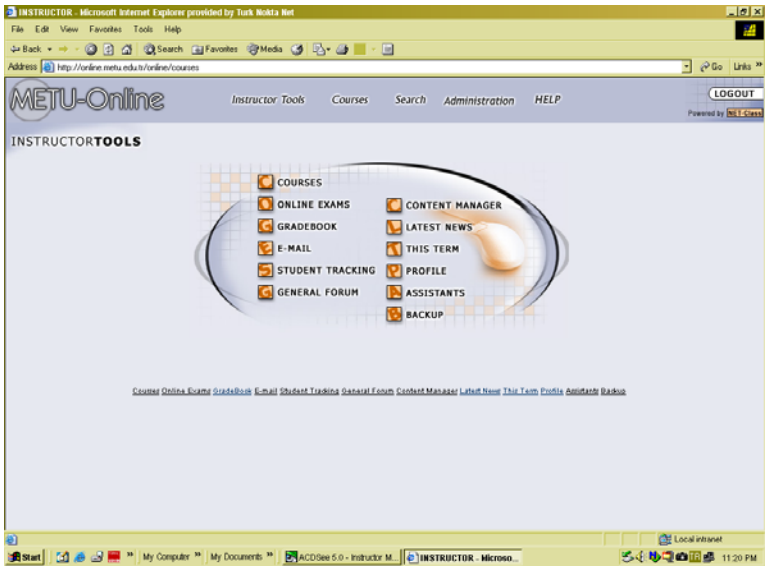


Figure 3.2 METU-Online Main Page

The pre-service teachers click on the “courses” and enter the third page, “Course Main Page”. It has nine links as shown in the Figure 3.3.

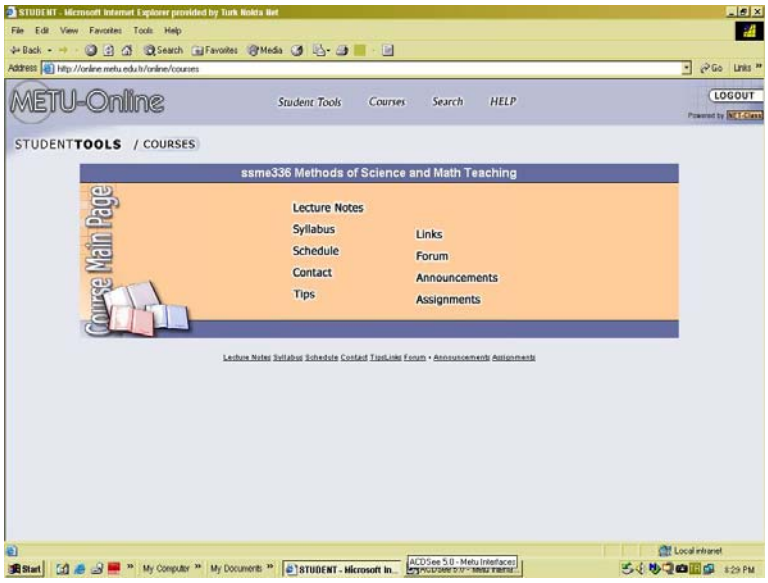


Figure 3.3 Course Main Page

“Lecture Notes” have the content of the chapters, real case episodes or video clips and examples (Figure 3.4 and Figure 3.5). Each chapter in the lecture note has an outline that shows the content of the topics, the content itself, the links that pre-service teachers could do the routine exercises and the web page that contains real case classroom environment in the form of video clip or episode. Pre-service teachers could click directly to any one of the topics by benefiting the non-linear characteristics of the web sites. Besides this tool, pre-service teachers had a site map in lecture note part.

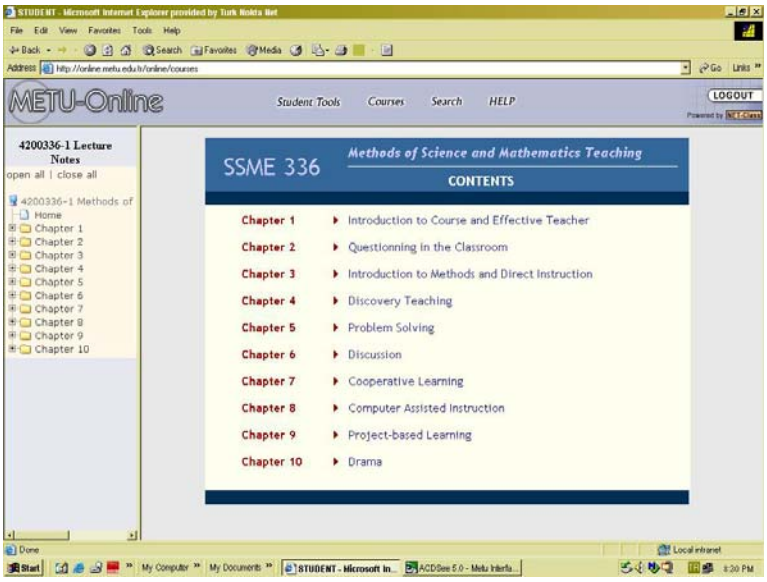


Figure 3.4 Lecture Notes Page

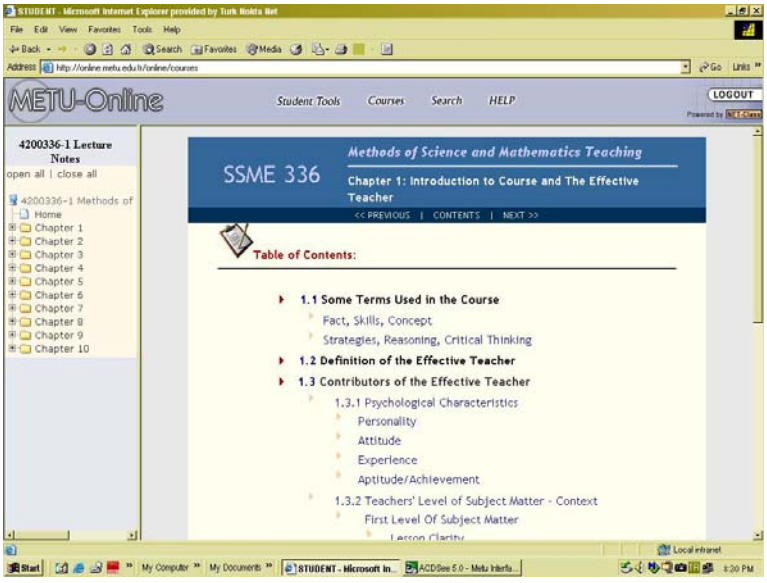


Figure 3.5 Lecture Note Chapter 1 Index Page

"Syllabus" page contains all of the information related to the course; instructors, objectives, main textbooks, references and grading policy. Pre-service teachers can find out the flow of the course along the semester in the link "Schedule". They can communicate with the instructor in "Contact" page to solve

any kind of problems: content related or technical. “Links” page contains Internet sites related to each chapter.

Discussions are conducted on the “Forum” pages by the participation of all of the pre-service teachers or group of pre-service teachers about the different course topics asynchronously (See Figure 3.6). And there are also “announcements”, “assignments” and “tips” pages for the pre-service teachers. By this tool, they could control of their activities and positions on the course main pages.

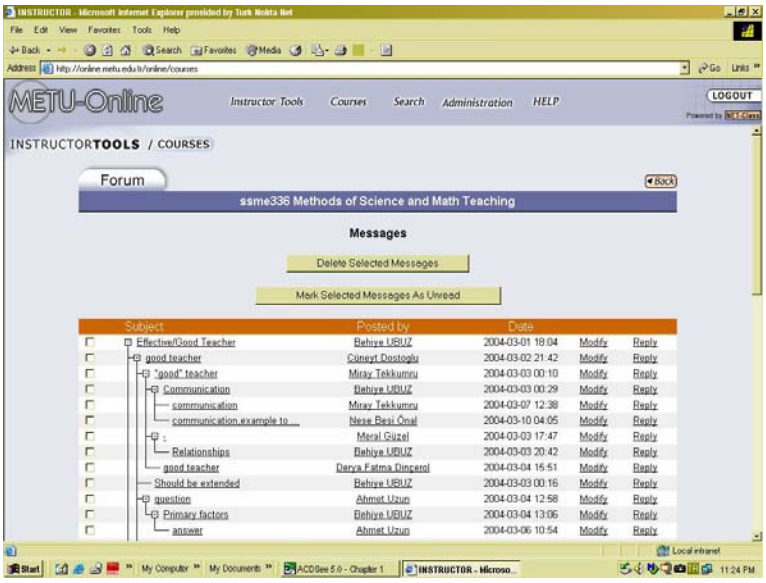


Figure 3.6 Forum Pages

Video clips were taken from different resources in considering (1) that they were suitable for the content of the lecture notes, (2) that they cause efficient discussions about the topics, (3) that they take attention and (4) that their file’s volume has small amount. Video clips file format were transformed from MPEG into WMV by software to decrease the files’ volume and to make them more compatible with the Internet Explorer, and some fitting processes were conducted on them. Video clips for the first, fifth and eight chapters were taken from the classroom application of Üstün (2003), video clip of the sixth and seventh chapter were taken from the site “http://pbs-mathline.virage.com”. Episodes of chapter two, three and four were taken from the textbook (Cooney, Davis & Henderson, 1975). Episode of

chapter 9 that was prepared by Rita Lane was taken from the site "www.glef.org" and lastly the episode of chapter 10 was taken from the classroom application of Duatepe (2004). Episodes or videos clips were directly used as in the original state for both groups. These video clips were embedded into the web pages and the episodes were put on the web as either image (s) file or as text.

Questions for exercise or clarification and questions for facilitative and guiding purposes were prepared before the treatment for the WBIIG and WBDIG differently. These questions were developed by making use of wide range of resources; books above and the Internet sites. During the treatment, the prepared questions were directed or new questions were composed for clarification or for facilitating of the construction of the knowledge or for guiding of the pre-service teachers in relation to the directions of the development in the forum discussions. Some specimen questions for WBDI are as followings:

Give an example for the convergent / divergent question from your area and give reasons why it is convergent/divergent (Chapter "Questioning in the Classroom")

What can the leader do to start a discussion when the group seems reluctant to participate? (Chapter "Discussion")

Analyze the project given according to the following step "Essential Questions" (Chapter "Project-based Learning")

Some specimen questions for WBII are as following:

What is question Can the same question have different effects on the learning process? Why? Exemplify!. (Chapter "Questioning in the Classroom")

Discussion is an indirect instruction method. How can be defined a true discussion? How does it differ from a recitation? (Chapter "Discussion")

Develop a rubric to monitor the students and the progress in project given on the web site (Chapter "Project-based Learning")

The list of the Internet sites was presented in the "link" on the course site. As in the research problem, a keyword list (the titles of the chapters) was constructed to prepare the list of the Internet sites. Search engines, Google, Yahoo and the like,

were used in terms of these keywords. The sites (1) that have the definitions of the concepts and procedures in the lecture notes, (2) that have applications (software) related to the content of the lecture notes, (3) that have visual materials about teaching methods, (4) that have lesson plans related to the teaching methods, (5) that are user-friendly and (6) that do not include harmful and useless links, materials and tools, were determined as valid and reliable sites to be included in the list. Pre-service teachers could do the research and look at the lesson plan examples related to the methods in each chapter. They could find the same 10 most related sites in each chapter for WBIIG and WBDIG.

Lastly, to eliminate the possible problems related to the content or administration of the online course, it was piloted. The researcher appealed for the consent of the online course opening under the NET-Class to the Informatics Institute of Middle East Technical University. The pilot study of the course was conducted for one-week with the eight in-service English teachers on only first chapter in December 2003. Four of them enrolled for the WBIIG and the other four enrolled for the WBDIG. The implications of the pilot study were put on the life during the period December 2003 - January 2004. They were as followings:

Administrative implications were that (1) pre-service teachers should have a platform to do informal interactions (For these purpose, a Yahoo group was constructed for each group and the messages in the Yahoo group were not assessed by the instructor because of the informal structure) and (2) announcements should be made in both “Announcement” link and “email” tool on the NET-class.

Instructional implications were listed as (1) some parts of the texts that cannot be understood, therefore two lecturers in English reviewed it again and (2) Links related to the each chapter shouldn’t be added at the end of the list in the “link” site, because it caused some confusion. It was determined that the links related to previous chapter were posted to the students as an attachment file. There were only links in the “Links” that related to the chapter of that week.

Technical implications were that (1) the source of the display problems related to script should be corrected (2) Video clips should be downloadable and (3)

Video player version should be announced. The researcher found solutions for these problems in the treatment.

3.6 Treatment of the Study.

First meeting of the class was in face to face format to inform about the online course and the tools of the NET-Class. There wasn't any face to face meeting after the first one except for the purpose of the midterm and final in-class examinations. On the other hand, pre-service teachers could take help about the technical problems from the on-site helper in campus and technical staff of the NET-Class.

General comparison of the WBIIG and the WBDIG in terms of learning environments, instructor and pre-service teachers' role and pre-service teachers' interaction is given in Table 3.5. Table 3.6 presents the comparisons of the learning activities/materials for the groups. Both groups covered the same topics.

Table 3.5 The Comparison of the Learning Environments

Category	WBIIG	WBDIG
Learning Environment	Web-based asynchronous learning environment	
Instructor role	Facilitator: helping pre-service teachers to explore, develop, express, discuss, and criticize ideas Guider: taking initiatives to foster communication and control pre-service teachers easily	Information presenter, model
Pre-service teachers role	Active participants: participating; exploring; deciding, criticizing, discussing, justifying, and expressing ideas	Passive receivers, give answer to the questions, do the exercises
Pre-service teachers' interaction	Support and enhance interaction by using facilitative and guiding questions	No special effort to increase interactions

Table 3.6 Learning Materials/Activities through the Courses

Categories	WBIIG	WBDIG
Lecture Notes	Lecture Note constructed by the pre-service teachers	Lecture Note prepared by the instructor
Questions	The aim is to cause discussions centered on the introductory or guiding questions (find solutions about the problems-experience).	The aim is to cause discussions about the Lecture Note
The real/ill-structured case	Questions are directed by the instructor about the same video clip or episode	
	Aim of the questions is to analyze the ill-structured case in the light of previously discussed information and to facilitate the construction of the knowledge.	Aim of the questions about the real case is to analyze the real case in relation to the Lecture Note and to practice.
Summaries (As assignment)	It depends on the forum discussions and the investigations. Pre-service teachers construct these summaries depending on these activities.	It is a chapter review, and depends on the lecture note, investigations and discussions. Pre-service teachers do these summaries.
Assignments	Making lesson plan as assignments for the chapters (3 to 10).	
Exams	Midterm and final exam in the face to face format	

Besides the forum discussion, email (one-to-one, one-to-many and many-to-one) was also used to enhance the interactivity among the pre-service teachers and instructors. The sequence in the treatment including course content and application of the tests/scales for the WBIIG and the WBDIG is shown in Table 3.7.

Table 3.7 The Sequence in the Treatments

Week and Date	Chapter	Outline (The Threads in Forum Discussion)
1 23-27 February	1. PRECAS – PRECFW - PREGMQ 2. Introduction of the Online Course Tools	

Table 3.7 (Continued)

Week and Date	Chapter	Outline (The Threads in Forum Discussion)
2-3 1-12 March	Introduction to Course and The Effective Teacher (ET)	1.2. Some Terms Used in the Course 1.2. Definition of the ET 1.3. Contributors of the ET 1.3.1 Psychological Characteristics 1.3.2 Teachers' Level of Subject Matter
4 15-19 March	Questioning in the Classroom	2.1 Introduction to Questioning 2.2. Definition of the Question 2.3. Types of Questions 2.4. Classroom Questioning Features to Develop 2.5. Ineffective Question Types
5 22-26 March	Introduction to Methods and Direct Instruction	3.1. Introduction to Methods 3.2. Direct Instruction: Lecturing and Expository Teaching 3.3. Expository Teaching 3.4. Other Forms of Direct Instruction
6 29 March – 02 April	Discovery Teaching (DL)	4.1. Definition of DL 4.2. Conducting of DL 4.3. Advantages of DL 4.4. Limitations of DL
7 05-09 April	Problem Solving	5.1. Definition of Problem Solving 5.2. Value of Problem Solving 5.3. A Three Part Lesson Formats 5.4. Designing and Selecting Effective Task 5.5. Attending Problem Solving Goals
8 12-16 April	Discussion	6.1. Definition of Discussion 6.2. Conducting of Discussion 6.3. Conducting Panels, Symposia, Round Tables, Forums and Debates
9 21 April	ME	
10 03-07 May	Cooperative Learning (CL)	7.1. Definition 7.2. Reasons for Cooperation 7.3. Components of a (CL) 7.4. Types of CL Activities

Table 3.7 (Continued)

Week and Date	Chapter	Outline (The Threads in Forum Discussion)
11 10-14 May	Computer Assisted Instruction (CAI)	8.1. What is the CAI? 8.2. Major Types of CAI 8.3. Developing a Plan For Effective Use of CAI
12 17-21 May	Project-based Learning (PBL)	9.1. What is PBL? 9.2. Why is PBL important? 9.3. Conducting of a PBL
13 24-28 May	Drama	10.1 Definition of Drama 10.2 Conducting of Drama 10.3 Types of Drama
14 01-10 June	POSTCAS – POSTCFW – WBAS –POSTGMQ – FE	

3.6.1 Treatment in the WBDIG

Figure 3.7 shows the flow of the course in the WBDIG. The Lecture note was opened on the web on Sunday. Pre-service teachers clicked the "Lecture Note" link and read it. They could make investigations about the topics by using "Link" and meanwhile they could carry out their searching by using book list given in the "Syllabus" link. By this way, they could find the necessary information about the subject that was going to be discussed. The examples of the links were as follows:

http://www.nwrel.org/scpd/esp/esp95.html (Factors that influence how we teach)

http://www.ilr.cornell.edu/tac/toolbox/tips/effective.html (Effective Teacher)

http://people.uncw.edu/kozloffm/DI.html (Direct Instruction)

http://www.simpson.edu/dal/faculty/Discussion.htm (Discussion)

http://pblmm.k12.ca.us/PBLGuide/WhyPBL.html (Project-based Learning)

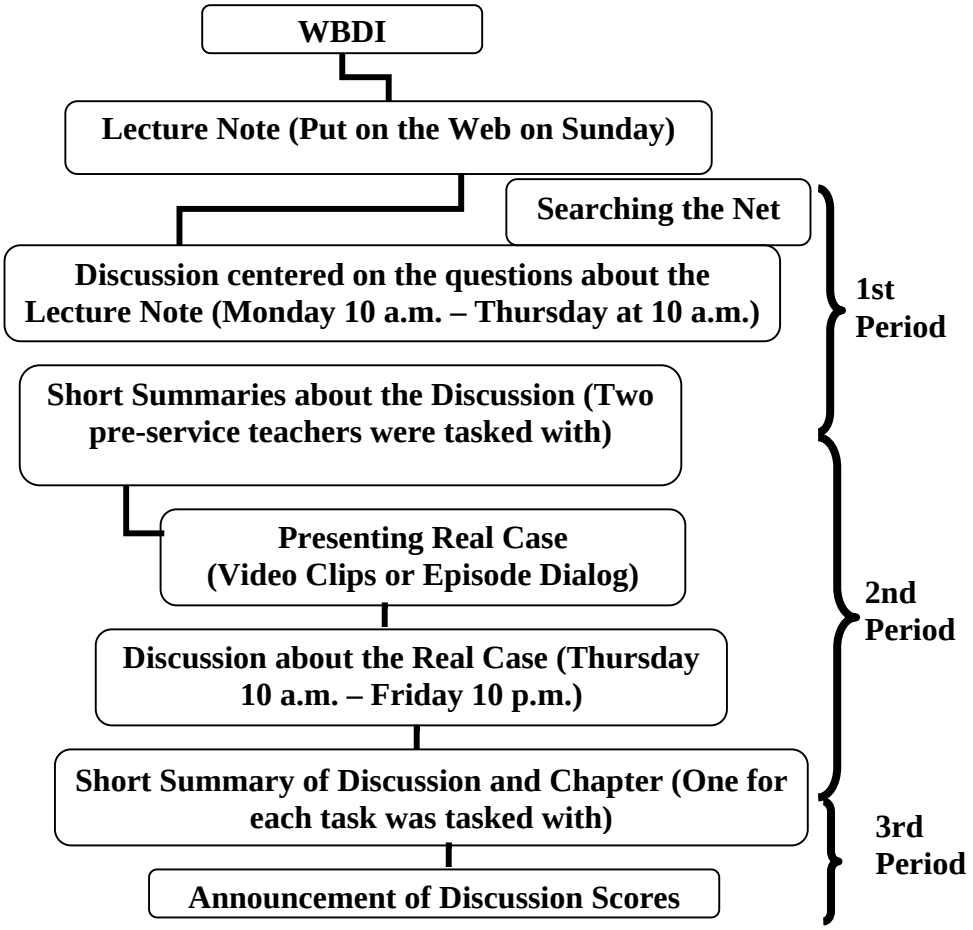


Figure 3.7 WBDI Course Flow

The questions centered on the lecture note were put under three or four discussion threads on the forum discussion. The threads were the topics of the chapter in Table 3.7. In other words, three or four questions were directed to the pre-service teachers under these threads. The aim of the questions is to exemplify and to analyze the lecture note. For example, for the first chapter, four threads were opened: (1) Some terms used in the course (2) Effective Teacher (3) Teacher's level of subject matter (4) Psychological Characteristics. The following question for the second thread "Effective Teacher" was posed:

"Give an example of the "good" or "effective" teacher. Give the reasons for your example!

Another example, for the sixth chapter, three threads was opened: (1) Definition of CAI, (2) Types of CAI and (3) Planning in CAI. The following question for the thread "Types of CAI" was posed:

"What are the instructional objectives in a simulation? Analyze the simulation in the example (in lecture note) as an instructional tool."

Questions-answer period was conducted among pre-service teachers and instructor about the lecture note.

Each time, two pre-service teachers were tasked with the summarization of the forum discussion in the first period. The summaries covered the messages in the forum in consistency with the lecture note. Who were responsible for making the summarization were determined before the completion of the discussion and announced by posting email and putting the message on the "announcement" link on the Wednesday 10 a.m. Due date of the summarizations was Friday 10 p.m.

Pre-service teachers watched a real case video clip or read real case episode dialog at the start of the second period. The three or four threads and their questions about the real case, video clip or episode dialog, were put on the forum on Thursday 10 a.m. The aim of these questions was to make analysis of the real case situation under the perspective of the lecture note. By this way, second period of the week began. Pre-service teachers could participate in discussion anytime after watching the video clip or reading episode dialog. For example, in chapter one, a video clip about a classroom environment was presented on the course site. The following conversation was carried out between pre-service teachers and teacher:

Conversation from video clip of chapter one: 1' 25'' (Time)

Teacher: OK. What is the degree of the angle C....Ebru?

Ebru:.....

Teacher: You can do it by this way but what is the simpler form.....

.....

Following questions for this period in the third thread "Teacher's Level of Subject Matter Knowledge" was forwarded about the conversation above:

Is the instruction for this period effective if you consider the behavior "using student ideas and contribution"?

Another example is for the chapter four. An episode in which a classroom environment was narrated was presented on the course site to be read. Three threads, namely (1) Definition of Discovery Learning (DL), (2) Conducting DL and (3) Limitations and Advantages of DL, were opened. Following question in the second thread "Conducting DL" was posed:

"What are the main differences between the two examples? (For inductive and deductive discovery)"

Instructor directed also new probing questions or hints along the discussion when needed.

One pre-service teacher was also tasked with the summarization of the forum discussion in the second period. Moreover, one pre-service teacher chosen by the instructor prepared a short summary of the chapter in relation to the lecture note and forum discussions. The announcement of the above tasks was made by posting email and putting the message on the "announcement" link on the Friday 10 a.m. Due date of the summarization of the second period and whole chapter were on Saturday 10 p.m. and on Sunday 10 p.m., respectively.

Each pre-service teacher should participate at least one time to each period; however each pre-service teacher must participate at least three times to the discussions in total in each week. The pre-service teachers' performance in the forum discussion was assessed by the coding technique developed by McKinnon (2000). After coding the messages in the forum discussion according to the McKinnon criteria, the instructor used a rubric developed by the researcher to score the pre-service teachers' messages under these codes. The discussion scores of the pre-service teachers were announced on Sunday 10 p.m. for each week. The pre-service teachers took a discussion grade by the sum of the discussion scores of each week. Moreover, the instructor also graded the short summaries and chapter summaries. All of the scores –forum discussions (25 percent) and summaries (15 percent)- and the ME (20 percent) and FE (40 percent) constituted the total course grade.

3.6.2. Treatment in the WBIIG

Even the lecture notes related to each chapter were not made available to the pre-service teachers till the completion of each chapter, the outline were opened beforehand as shown in Table 3.7. Figure 3.8 shows the flow of the course in the WBIIG. The pre-service teachers began searching the Internet and the links made available at the "links" by considering the topics given in the outline of each chapter and thinking about the main concepts in the facilitative and guiding questions directed in the forum platform. In addition, they carried out their searching by using the book list given in the "Syllabus" link. By this way, they could find the necessary information about the subject that was going to be discussed. The examples of the links were as follows:

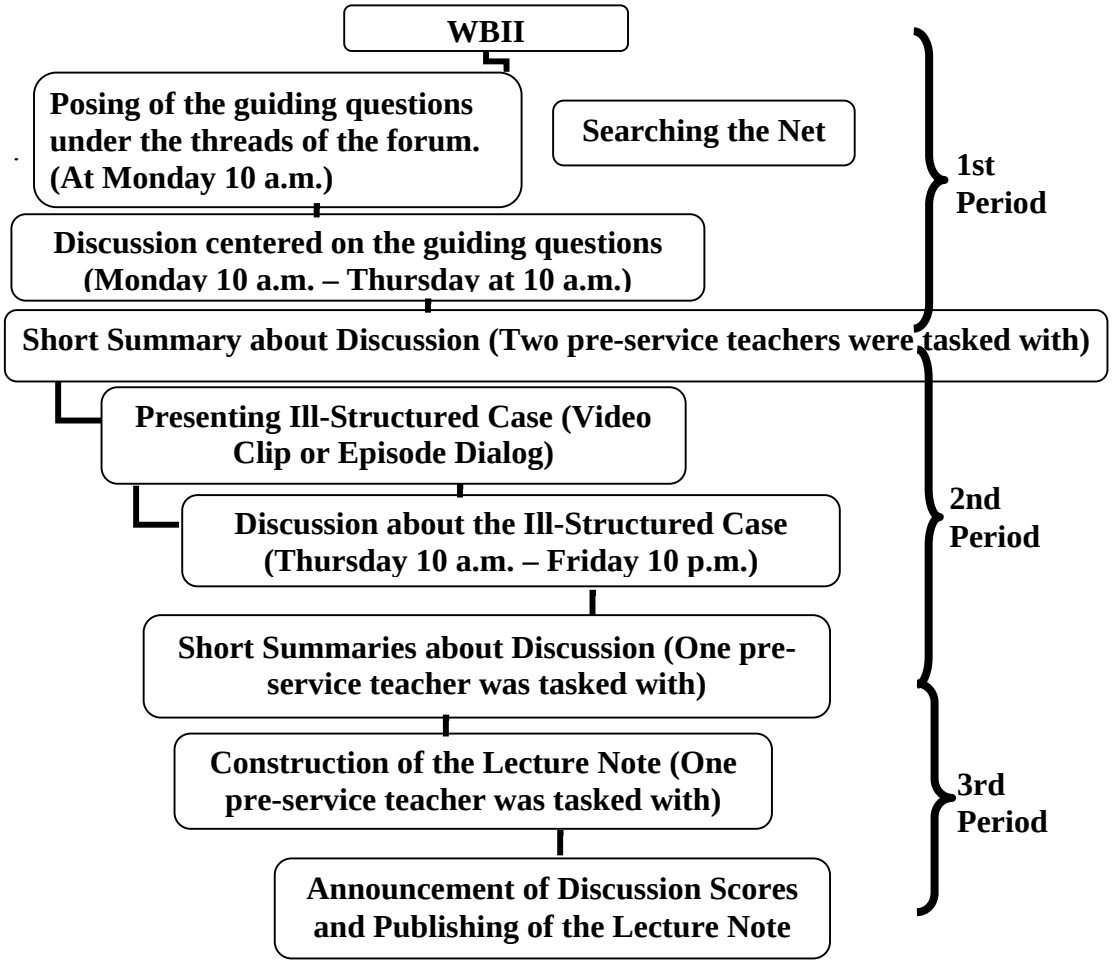


Figure 3.8 WBII Course Flow

http://www.questioning.org/Q7/toolkit.html (Questioning in the Classroom) http://www.wku.edu/~susan.rouse/discovery.html (Discovery Learning)

http://www.co-operation.org/pages/cs.html (Cooperative Learning)

http://www.sciencesshareware.com (CAI-Simulation)

http://www.dramaed.net/dgfpurpose.htm (Drama)

The guiding questions were put on the forum discussion through three or four threads that were the main topics of the chapter. Under each thread, three or four main guiding questions were directed. By these questions, pre-service teacher were guided to think about the main concepts relating to their experience and real life situations

Pre-service teachers participated in the discussions with the information already had, the experience, and the investigations on the Net or library. The guiding questions for the first period were posed on the forum platform on Monday 10 a.m. For example; for the first chapter, four threads were opened: (1) Some terms used in the course (2) Effective Teacher (3) Teacher's level of subject matter (4) Psychological Characteristics. The following guiding question for the second thread "Effective Teacher" was posed:

"*Recall both effective and ineffective teachers you may have had! To what extent did they seem to differ with respect to the knowledge of how to teach the subject, or knowledge of how people learn?"*

Another example is for the tenth chapter. Three threads were opened: (1) Definition of drama, (2) Conducting of the Drama and (3) Types of Drama. The following question for the thread "Definition of Drama" was posed:

How can we define drama as an instructional method? What can be the differences between drama in education and theatre?

The forum discussion started with such posed questions. The interaction among the instructor, pre-service teachers, content and interface continued during the discussions. Instructor directed new facilitative probing questions or hints along the discussion when needed.

Each time, two pre-service teachers were tasked with the summarization of the forum discussions in the first period. Who were responsible for making the summarization were determined before the completion of the discussion and announced by posting email and putting the message on the "announcement" link on the Wednesday 10 a.m. Due date of the constructed summarizations was Friday 10 p.m.

The ill-structured case, video clip or episode dialog, and the main guiding questions related to them were put on the forum platform on Thursday 10 a.m. By this way, second period of the discussion began. Pre-service teachers could participate in discussion anytime after watching the video clip or reading episode dialog. For example, in chapter one, a video clip about a classroom environment was presented on the course site. The following conversation was carried out between pre-service teachers and teacher:

Conversations from video clip: 0.07 (Time)

Teacher: Where are the angles equal to the 64?

Answer:……

Teacher: Show the equal angles with the same flag (while student solve the question on the blackboard, teacher makes some explanations)

Following guiding questions for this period in the third thread "Teacher's Level of Subject Matter Knowledge" was forwarded about the conversation above:

Is the instruction for this period effective if you consider the "teacher task orientations" and "student engagement"? Why or why not?"

Another example is from the chapter six "Cooperative Learning". Four threads were opened in the forum discussions. They are (1) Definition of the CL, (2) Reasons for Cooperation, (3) The Components of the CL and (4) The Types of CL. The pre-service teachers watched a conversation in the video clip about the classroom environment in which the instructor used cooperative learning method. The following question was posed in the third thread:

Exemplify the strategy "skillful questioning" in the video clip

Instructor directed also new facilitative probing questions or hints along the discussion when needed.

One pre-service teacher was also tasked with the summarization of the forum discussion in the second period. Moreover, one pre-service teacher chosen by the instructor constructed a lecture note for the chapter in relation to the forum discussions and investigations. The announcement of the above tasks was made by posting email and putting the message on the "announcement" link on the Friday 10 a.m. Due date of the summarization of the second period and the construction of the lecture note were on Saturday 10 p.m. and on Sunday 10 p.m., respectively. Lecture notes were put on the course site on Monday 10 p.m.

Each pre-service teacher should participate to each period at least one time; however each pre-service teacher must participate at least three times to the discussions in total in each week. Pre-service teachers' performance in the forum discussion was assessed by the coding technique developed by McKinnon (2000). After coding the messages in the forum discussion according to the McKinnon criteria, the instructor used a rubric developed by the researcher to score pre-service teachers' messages under these codes. The discussion scores of the pre-service teachers were announced on Sunday 10 p.m. for each week. The pre-service teachers took a discussion grade by the sum of the discussion scores of each week. Moreover, the instructor also graded the short summaries and constructed lecture note. All of the scores –forum discussions (25 percent) and summaries (15 percent)-, the ME (20 percent) and FE (40 percent) constituted the total course grade.

3.7 Power Analysis

An essential and primary decision in the power analysis is the determination of the effect size. Cohen and Cohen (1983) offered the following values; small, ES = .20; medium, ES = .50; and large ES = .80 [ES = (Mean of the WBII group – Mean of the WBDI group / SD of WBDI group)]. At the beginning of the study, effect size was set to high (f^2= 0.33 for variance and 0.8 for mean difference), because hypermedia environments are suitable for the WBII and after 1990's many studies on hypermedia environments proposed that constructivist approach was the most

suitable method for them (Jonassen, 1995; Willis, 1997; Keagan, 1997). During the analyses, the probability of rejecting true null hypothesis (probability of making type-1 error) was set to .05 as a priori to our hypothesis testing, because it is mostly used value in educational studies. This study conducted 63 pre-service teachers and the number of variables was 13. Then the power for that sample size and large effect size was calculated for 13 variables. Power of this study was calculated as .80. Therefore, the probability of failing to reject the false null hypothesis (probability of making Type 2-error) was found as .20.

3.8 Treatment Verification

Observation checklist was developed by the researcher as a WBDI and WBII theory implication survey. Although the content of both courses was quite similar, the flow of the instruction was quite different. The observation checklist focuses on the instructional flow on the online classes in relation to the instructor and pre-service teachers' behaviors, learning activities and course site elements. The same observation checklist was used for both groups. The researcher rated the web site instructional activities according to this checklist six times at the different chapters. Two other experienced in-service English language teachers - one for WBII and one for WBDI - verified also the web site instructional activities on these criteria.

3.9. Internal Validity

Internal validity is the extent to which detected differences on the dependent variables are associated with the independent variables-treatment- and not some uncontrolled variables (Fraenkel & Wallen, 1996), Threats to internal validity are alternative explanations of the results that are not related to the treatment.

Many possible subject characteristics (prior experience with computer and Internet, age, department, gender and the like) might affect pre-service teachers' achievement in the WBC. Hence, the researcher determined the pre-service teachers' prior attitude towards computer and WBC, pre-service teachers' age, gender and department as critical variables based on previous researches (Jonassen, 2000;

Manuel, 2001; Russell, 1999) and minimized their effects. These variables were included in a covariate set. By this statistical remedy, individual differences were partially minimized and group equivalency was established.

In this study, the treatment was carried out in the same asynchronous web based learning environment and pre-service teachers from different groups can not interact with each other. Moreover, midterm and final exam was conducted in the two similar classrooms at the University and pre-service teachers distributed into two classrooms randomly in equal number from each group. However, the other scales were administered by email. Therefore, the physical environment of the pre-service teachers was not under the control of the study while completion of these scales. On the other hand, it can be considered that the scales were in electronic format and pre-service teachers might complete them most probably in a room with computer, home or lab, and therefore it can be assumed that the location was similar or not a thread to internal validity.

The exposure to pretests might alter the subject performance. Firstly, the achievement test had no pretest and the items of the midterm and final were completely different. Moreover, presumably the pretest would affect both groups equally. Besides these, there were thirteen weeks between the implementation of pretest and posttest. This time period reduces the pretest effect on the posttest. Above all, the pretest was treated as a covariate. Thus the effects of these earlier pretesting were partialled out statistically. In addition the above mentioned about testing effect, on occasion unanticipated and unplanned for, events might occur during the course of the study. However, pre-service teachers experienced same events in the asynchronous web site and similar occasions occurred in the campus environment in relation to the teaching and learning. Therefore, history effect cannot be a threat for the study.

Mortality and maturation are counted as internal validity threat in many studies. To control mortality threat, absence of data was treated as a research factor. There were no missing data in all pretests and posttests except one pre-service teacher in the PREGMQ. Since the number of missing data was less than five percent of the sample, it was replaced by the mean. Along the same line, maturation was not

an issue because the length of the study can not cause a positive or negative development in the achievement, attitude or metacognition of the pre-service teachers, because time span in the treatment was not a number of years. Moreover, for both groups the same amount of time passed.

Another important threat coming from the implementation of the treatment and it might cause any observed differences in outcomes. This threat may be the results of instructor differences (e.g. teacher gender, teaching ability, attitude or biases toward the treatment, encouragement, verbal reinforcement). However, the instructor was the researcher and was the same for each group. In fact, the researcher verified the treatment for both groups with a checklist and statistical outputs also proved that the study was implemented properly. Instructor, researcher, might not unconsciously distort the data in favor of one group, because the design of the study was not aimed to show one of the groups higher than the other one. So, the design has not an experimental and a control group and the purpose was not to show that the experimental group was better. On the other hand, the characteristics of the instructor as a data collector, if exist, affected both groups.

The researcher previously determined the scoring of all instruments. All of the data from the instrument were scored according to the rubric, and then recorded on the computer. Calculations were conducted by the software, Excel and SPSS. Besides this, the scoring of the achievement test was completed item-by-item for each pre-service teacher to eliminate the fatigue of the researcher, such as being tired or being rigorous.

Furthermore, outcomes of an experimental research might be affected by the way in which the subjects view the study (attitudes). However, the study took place as a course out of other courses in a regular semester and as a course that pre-service teachers must take because of their educational program. So, pre-service teachers took this course as a normal course among the others. Moreover the pre-service teachers did not know that they were the subjects of a study.

3.10 Limitations and Assumptions of the Study

The study was subject to the following limitations:

1. The variability in technologies that pre-service teachers used during the treatment was a limitation. Examples: Speed of the Internet connection (broad or narrow bandwidth), used software to display video files (Media player's versions or Real player), the capacity of the processors and the capacity computer hordes and the like)

2. Pre-service teachers' forum interactions in all type are limited at least three participations and short-constructed response.

The researcher made the following assumptions for this study:

1. The subjects of the study answered the items of the tests honestly and accurately.

2. The instructor (researcher) was not biased during the treatment and administration.

CHAPTER 4

RESULTS

This chapter is divided into four sections. The first section presents descriptive statistics of the data. The second deals with the inferential statistics results produced by testing null hypothesis. The third and fourth present the exploratory analyses of the midterm and final exam and treatment verification analysis. The last one summarizes the findings of the study.

4.1 Descriptive Statistics

4.1.1 Descriptive Statistics of the Midterm and Final Exams

Table 4.1 presents the descriptive statistics of the ME and FE in the study. This table illustrates differences among the groups on each exam, as well as differences within groups across assessment times (midterm-final). The WBIIG showed increase in the performance from ME to FE whereas the WBDIG showed decrease in the performance from ME to FE. Although all kurtosis and skewness values of the ME and FE are in the limit of the normality, the scores in the frequency distribution graph of the ME and FE except the ME of the WBIIG pile up slightly on the right-hand side and the tails taper off to the left.

The clustered boxplots of the ME and FE are plotted in Figure 4.1. The box contains mid 50 % percent and each whisker represents upper and lower 25 % of the cases. According to that, the mid 50 percent in the ME for WBIIG was quite smaller than that of the WBDIG. Therefore, the ME scores of the WBIIG imply that the pre-

service teachers took the scores close to each other. The lower 50 % of the FE for the WBIIG ranged between 45.5 and 68.5 whereas the upper 50 % of the FE for the WBDIG scores lied between 55 and 73. In other word, the maximum score of the WBDIG was about the median score of the WBIIG in the FE

Table 4.1 Descriptive Statistics of the ME and FE

	WBIIG		WBDIG	
	ME	FE	ME	FE
N	32	32	31	31
Mean	60.16	67.48	59.15	54.85
Median	59.00	68.50	60.70	55.00
Standard Deviation	13.40	10.97	12.43	9.93
Skewness	0.41	-0.35	-0.25	-0.14
Kurtosis	0.02	-0.69	-0.46	-0.06
Maximum	89.60	85.50	79.50	73.00
Minimum	37.00	45.50	30.00	30.00

Possible maximum and minimum scores for both exams: 100 and 0.

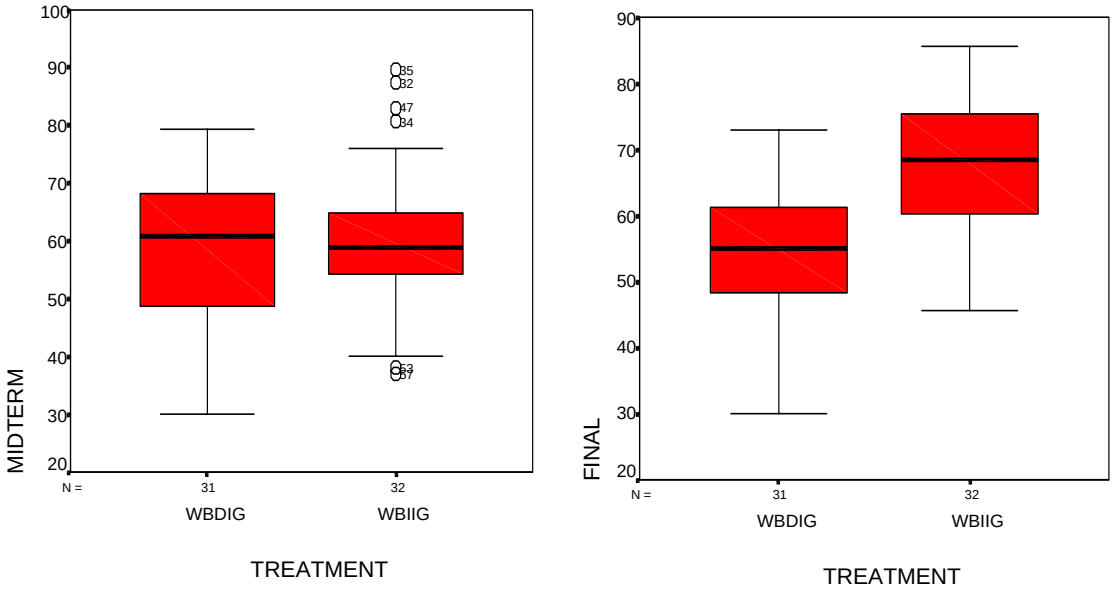


Figure 4.1 Boxplot of the ME and FE

4.1.2 Descriptive Statistics of the Computer Attitude Scale

Table 4.2 presents descriptive statistics of the groups on the pretest and the posttest scores of the CAS. Based on initial responses to the CAS it appeared that, overall, pre-service teachers tended to have relatively positive attitudes towards computers (average item scores = 2.6 for the WBDIG and 2.7 for the WBIIG). The mean scores on the posttests of both groups are approximately same and the pre-service teachers from both groups have positive attitude towards computer (average items scores = 2.7 for both groups). It is evident that there was no treatment effect on the pre-service teachers' attitude towards computer. The frequency distribution graph of the PRECAS and POSTCAS showed that their kurtosis and skewness values were in normal ranges.

To compare the distribution of the CAS scores visually, the clustered boxplots of the pretest and the posttest were constructed (see Figure 4.2). These figures illustrate almost same characteristics on the pretest and posttest for both groups. The number of the pre-service teachers in the lower 25% of the PRECAS and POSTCAS for the WBIIG is approximately two times of that for the WBDIG.

Table 4.2 Descriptive Statistics of the PRECAS and POSTCAS

	WBIIG		WBDIG	
	PRECAS	POSTCAS	PRECAS	POSTCAS
N	32	32	31	31
Mean	107.06	108.59	104.61	107.58
Median	105.50	108.00	100.00	108.00
Standard Deviation	17.65	18.69	18.39	17.32
Skewness	-0.23	-0.46	0.76	0.56
Kurtosis	-0.17	-0.22	-0.38	-0.49
Maximum	139.00	139.00	142.00	142.00
Minimum	69.00	68.00	79.00	83.00

Possible maximum and minimum scores for both exams: 160 and 40.

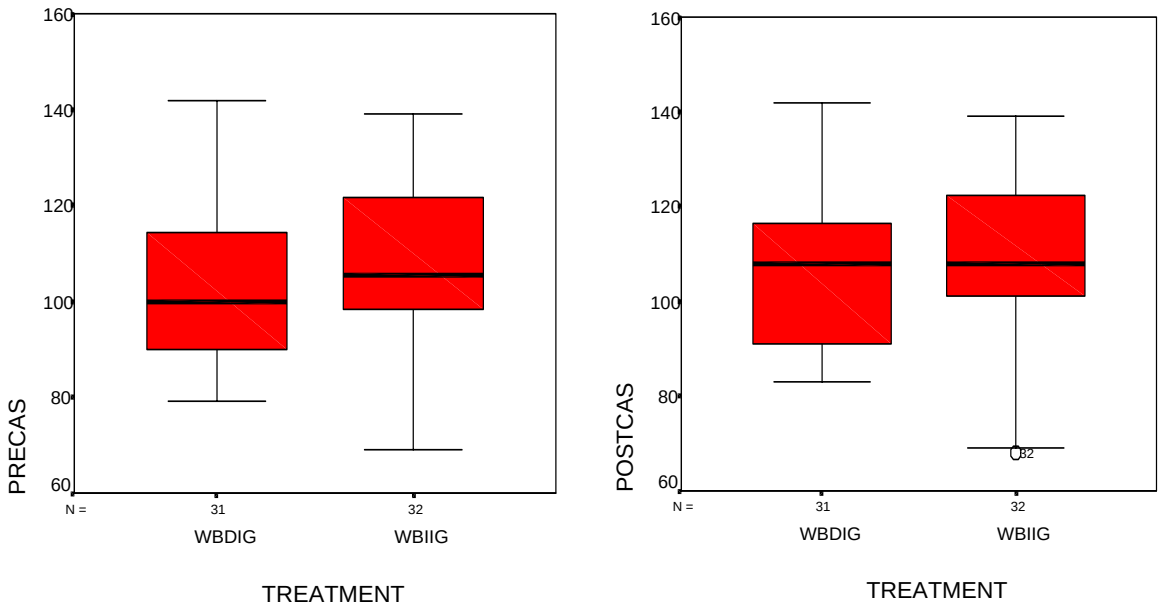


Figure 4.2 Boxplot of the PRECAS and POSTCAS

4.1.3 Descriptive Statistics of the Attitude towards WWW and Web-based Course

Table 4.3 and Table 4.4 present descriptive statistics of the groups on the scores of the CFWS and WBAS. The mean and median values of both groups for the CFWS are almost the same. Although the values of the kurtosis and skewness of the PRECFW and POSTCFW are in the limit of the normality, the scores in the frequency distribution graph of the PRECFW and POSTCFW except PRECFW of the WBIIG pile up slightly on the left hand side and the tails taper of the right.

The mean score of the WBIIG in WBAS is quite lower than that of the WBDIG and the same case is also valid for the median scores of the group. Frequency distribution graph is in the limit of the normality because all skewness and kurtosis values are in the normal ranges.

Table 4.3 Descriptive Statistics of the PRECFW and POSTCFW

	WBIIG		WBDIG	
	PRECFW	POSTCFW	PRECFW	POSTCFW
N	32	32	31	31
Mean	29.97	139.59	27.94	153.90
Median	29.50	138.50	29.00	149.00
Standard Deviation	4.25	28.39	5.43	21.45
Skewness	0.31	0.43	-0.83	0.36
Kurtosis	-0.68	-0.72	0.36	-0.48
Maximum	39.00	203.00	36.00	200.00
Minimum	23.00	96.00	14.00	118.00

Possible maximum and minimum scores for both exams: 40 and 8.

Table 4.4 Descriptive Statistics of the WBASS

	WBIIG	WBDIG
N	32	31
Mean	111.72	129.03
Median	109.50	128.00
Standard Deviation	24.76	18.60
Skewness	0.19	0.09
Kurtosis	-1.00	-0.42
Maximum	160.00	166.00
Minimum	76.00	89.00

Possible maximum and minimum scores for both exams: 195 and 39.

The clustered box plots of the pretest and the posttest of the CFWS was in Figure 4.3. It is very interesting that although the PRECFW scores of the WBIIG are in the upper 75 percent of the WBDIG, the reverse case was seen on the POSTCFW scores. Moreover, the dispersion of the POSTCFW scores of the WBIIG is very high with respect to the PRECFW scores of the WBIIG.

The whole scores in WBAS for the WBDIG are in the upper 75 percent of the scores of the WBIIG. The upper 25 percent and lower 25 percent of the WBDIG have approximately same range. Moreover, the mid 50 percent of the WBIIG is less than the median of the WBDIG (see Figure 4.4).

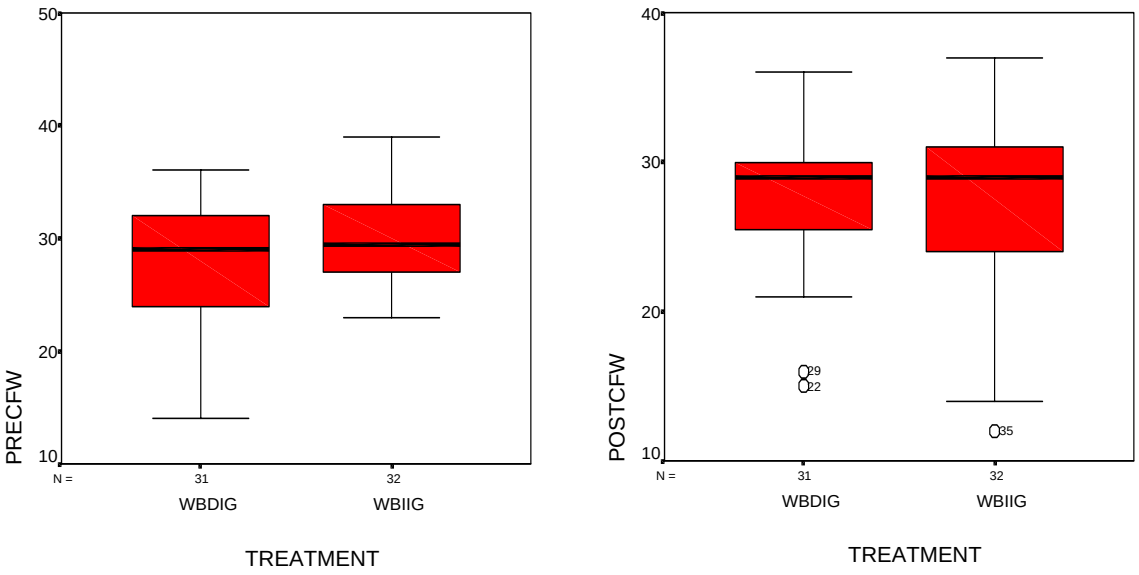


Figure 4.3 Boxplot of the PRECFW and POSTCFW

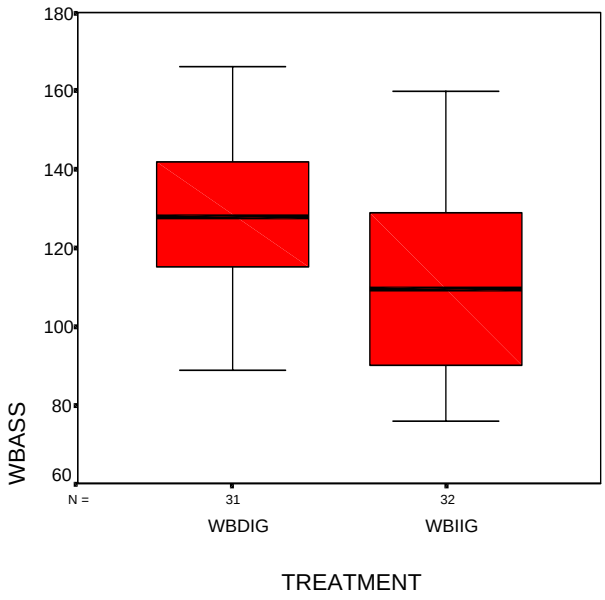


Figure 4.4 Boxplot of the WBASS

4.1.4 Descriptive Statistics of the General Metacognition Questionnaire

Table 4.5 shows descriptive statistics of the pretest and posttest of the GMQ. As it is seen from the table, the pretest and posttest mean scores of the WBIIG and WBDIG were almost the same. On the other hand, while the median scores of the WBDIG increased from 98.5 to 99.5, median scores of the WBIIG increased from 99 to 104 from pretest to posttest. Above all, the graphs of the frequency distributions from the pretest to the posttest become from the slightly negative skewness to the normal for the WBIIG, though they become from the slightly positive skewness to the slightly negative skewness for the WBDIG. It should be noted that all skewness and kurtosis values for both groups are in normality range.

Table 4.5 Descriptive Statistics of the PREGMQ and POSTGMQ.

	WBIIG		WBDIG	
	PREGMQ	POSTGMQ	PREGMQ	POSTGMQ
N	32	32	31	31
Mean	99.59	101.03	99.39	101.71
Median	98.50	99.50	99.00	104.00
Standard Deviation	14.21	16.41	14.40	14.95
Skewness	-0.36	0.06	0.10	-0.25
Kurtosis	0.15	-0.09	0.04	0.17
Maximum	122.00	135.00	133.00	133.00
Minimum	63.00	64.00	73.00	63.00

Possible maximum and minimum scores for both exams: 150 and 30.

Figure 4.5 shows the clustered boxplot of the pretest and the posttest for the WBIIG and WBDIG. There was one outlier in the pretest for each of the group, upper outlier for the WBDIG and lower outlier for the WBIIG, respectively. The mid 50 percent on the pretest and posttest were almost the same for the groups. On the other hand, the width of the mid 50 percent is increased from 17 to 20 for the WBDIG and increased from 14.25 to 23.5 for the WBIIG.

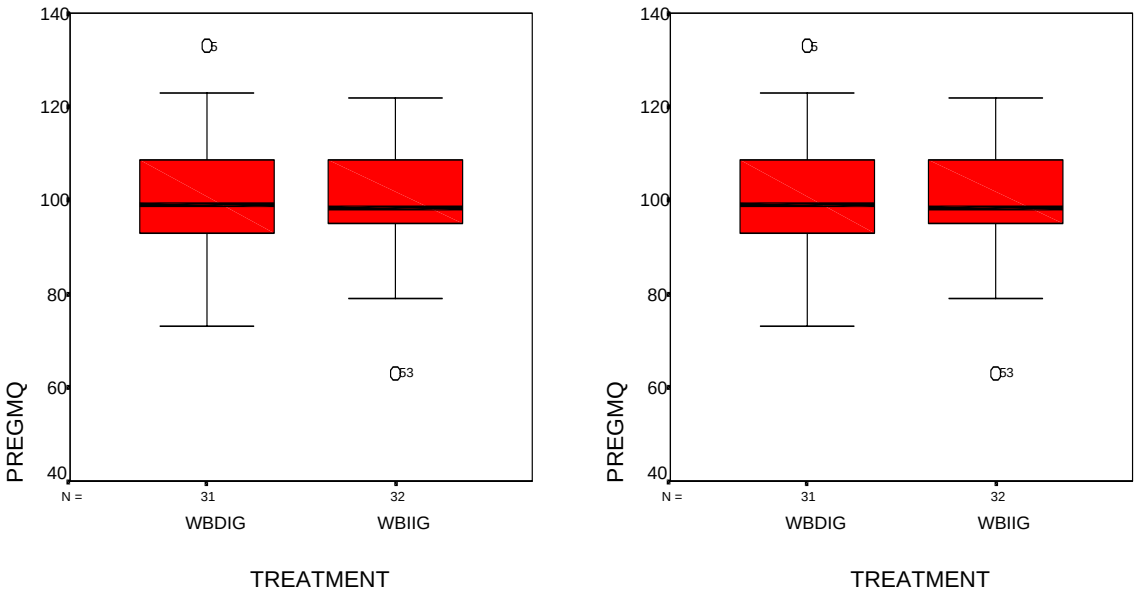


Figure 4.5 Boxplot of the PREGMQ and POSTGMQ

4.2 Inferential Statistics

4.2.1 Missing Data Analysis

The issue of missing data was addressed before examining the inferential tests used in this study. Initial data were gathered for 63 third grade math and science education students. There were no missing pre-service teachers on the date of posttests. However, one of the 63 pre-service teachers who took the posttest did not returned on the date of the GMQ pretest. Therefore, there was one missing data for the pre-service teachers' general metacognition pretest scores. Missing data in the PREGMQ constituted 1.5 % of the whole data. Since the missing data in this independent variable constituted a range less than 5 % of the whole data, it was directly replaced with the series mean of the entire subjects as suggested by Cohen and Cohen (1983). Some pre-service teachers did not answer some questions of the ME and FE. These missing questions were coded as incorrect during the analyses.

4.2.2 Determination of Covariates

Prior to conducting the MANCOVA used for comparing the ME, FE, POSTCAS, POSTCFW, WBASS and POSTGMQ, eight independent variables; pre-service teachers' ages, department, gender, GPA, the PRECAS, the PRECFW and the PREGMQ were determined as potential confounding factors. In order to determine which of these should be considered as covariates, these potential covariates were correlated with the dependent variables. The correlations and their significance appear in Table 4.6.

Table 4.6 Correlation Coefficients between Independent and Dependent Variables

Independent Variables	Dependent Variables					
	ME	FE	POSTCAS	POSTCFW	WBASS	POSTGMQ
Ages	-.154	-.143	.258*	-.010	-.157	-.021
Department	.059	.156	-.007	-.051	-.051	-.180
Gender	-.274*	-.305*	.129	.142	.014	.088
GPA	.450*	.391*	-.119	.040	.117	.299*
PRECAS	-.153	-.204	.884*	.446*	.051	.062
PRECFW	-.026	.086	.120	.087	-.292*	-.219
PREGMQ	.377*	.282*	-.091	.196	-.264*	.702*

* Correlation is significant at the .05 level (2-tailed).

As it is presented in Table 4.6, Gender, Ages, GPA, PRECAS, PRECFW and PREGMQ had significant correlations with at least one dependent variable. These variables were used as covariates to statistically equalize the differences among the groups.

4.2.3 Assumptions of the MANCOVA

All the dependent variables were tested for the assumptions of the MANCOVA. These assumptions are normality, homogeneity of regression, equality of variances, multicollinearity, and independency of observations.

For the normality assumption, skewness and kurtosis values of the scores should be checked (Fraenkel & Wallen, 1996), the values between –2 and +2 can be assumed as approximately normal for skewness and kurtosis (Tabachnick & Fidell, 1989). As it is seen in Table 4.1, 4.2 4.3, 4.4, and 4.5, skewness and kurtosis values were in the acceptable range for a normal distribution. These are an evidence for the normal distribution of the dependent variables.

Table 4.7 display the Box's test of equality of covariance matrices for the MANCOVA used for comparing the tests on the dependent variables. According to these tables, observed covariance matrices of the dependent variables were across groups. This indicates that the multivariate normality assumption for the analysis was satisfied.

Table 4.7 Box's Test of Equality of Covariance Matrices for the MANCOVA

Box's M	21.04
F	0.90
df1	21
df2	1365.52
Sig.	0.60

Homogeneity of regression assumption requires that the regression of dependent variables on covariates must be constant over different values of the group membership. In order to check this assumption, Multivariate Regression and Correlation (MRC) was conducted. For the MANCOVA, five interaction terms were produced by multiplying the group membership with the covariates of ages, gender, GPA, PRECAS, PRECFW, and PREGMQ, separately. Covariate variables were set to Block 1, group membership was set to Block 2 and the interaction terms were set to Block 3. Then, to test the significance of R^2 change, the MRC was performed using enters method for each variable. Table 4.8 shows the result of the MRC. As it is seen from this table, the contribution of Block 3 is not significant for the ME, FE, POSTCAS, POSTCFW, WBASS, and POSTGMQ [F (6, 49) = 1.768, p= .125, F (6,

49) = .186, p= .980, F (6,49) = 1.718, p= .137, F (6,49) = 1.758, p= .118 and F (5,51) = .673, p= .672, F (6,49) = 1.074, p= .391 respectively]. These results indicated that, there were no significant interactions between covariates and the group membership; therefore the interactions (Block 3) can be dropped. This implied that the homogeneity of regression assumption is validated for this analysis.

Table 4.8 Results of the MRC Analysis of Homogeneity of Regression

Model	Change Statistics				
	R^2 Change	F Change	df1	df2	Sig. F Change
ME					
Block 1	.315	4.291	6	56	.001
Block 2	.001	.080	1	55	.779
Block 3	.122	1.768	6	49	.125
FE					
Block 1	.302	4.041	6	56	.002
Block 2	.255	31.725	1	55	.000
Block 3	.010	.186	6	49	.980
POSTCAS					
Block 1	.843	50.032	6	56	.000
Block 2	.000	.159	1	55	.691
Block 3	.027	1.718	6	49	.137
POSTCFW					
Block 1	.264	3.354	6	56	.007
Block 2	.007	.566	1	55	.455
Block 3	.104	1.758	6	49	.118
WBASS					
Block 1	.159	1.770	6	56	.122
Block 2	.112	8.412	1	55	.005
Block 3	.056	.673	6	49	.672

Table 4.8 (Continued)

Model	Change Statistics				
	R^2 Change	F Change	df1	df2	Sig. F Change
POSTGMQ					
Block 1	.510	9.703	6	56	.000
Block 2	.000	.011	1	55	.916
Block 3	.057	1.074	6	49	.391

The equality of variance assumptions was satisfied by the result of the Levene's Test of Equality. Table 4.9 presents the Levene's Test of Equality of Error Variances for the MANCOVA. As it is seen from this table, all F values are non-significant which mean that the error variances of the dependent variables across groups were equal for both analyses. For the multicollinearity assumptions, the correlations between covariates were checked. Correlations between covariates and their significance are given in Table 4.10. Since the correlations between covariates were smaller than .8, assumption of multicollinearity was satisfied

Table 4.9 Levene's Test of Equality of Error Variances for the MANCOVA

	F	df1	df2	sig
ME	.072	1	61	.789
FE	.331	1	61	.567
POSTCAS	.022	1	61	.883
POSTCFW	.016	1	61	.898
WBASS	3.455	1	61	.068
POSTGMQ	3.367	1	61	.071

Table 4.10 Correlations among Covariates and Dependent Variables

	AGES	GENDER	GPA	RECAS	PRECFW	PREGMQ	ME	FE	POSTCAS	POSTCFW	WBASS	POSTGMQ
AGES	1	-.366*	-.243	.155	.032	-.011	-.154	-.143	.258*	-.010	-.157	-.021
GENDER		1	.264*	.007	-.007	.066	-.274*	-.305*	.129	.142	.014	.088
GPA			1	.089	.056	.537*	.450*	.391*	-.119	.040	.117	.299*
PRECAS				1	.224	.101	-.153	-.204	.884*	.446*	.051	.062
PRECFW					1	-.182	-.026	.086	.120	.087	-.292*	-.219
PREGMQ						1	.377*	.282*	.091	.196	.264	.702*
ME							1	.552*	-.278*	-.073	.075	.229
FE								1	-.303*	-.030	.011	.180
POSTCAS									1	.572*	.113	.165
POSTCFW										1	.302*	.300*
WBASS											1	.344*
POSTGMQ												1

* Correlation is significant at the .05 level (2-tailed).

Independency of observations was not a statistical assumption, simply means that the observation obtained for one individual is not influenced by the observation obtained for another individual (Gravetter & Wallnau, 1996). However, in some instances, this assumption might be violated as a function of something, such as time or distance, associated with the order of cases (Tabachnick & Fidell, 1989). For example, the pre-service teachers shared the computer in the lab or dormitory and the response of each subject might be influenced by the responses of the subject in the same lab. On the other hand, this probability of nonindependence was not higher than in the face-to-face case. Independency of observations assumption was supplied by the observations of the researcher during the administration of all the tests. All subjects did the exams by themselves and the scales were sent to each subjects' email accounts.

4.2.4 Inferential Statistics

In this part, the findings of the analyses to answer the research question will be presented. The question was as following:

What are the differences between the pre-service teachers exposed to the WBII and those exposed WBDI on the population means of the collective dependent variables of pre-service teachers' scores on the midterm exam, final exam, attitude towards computer posttest, attitude towards WWW posttest, attitude towards web-based course, metacognition posttest when the effects of pre-service teachers' GPA, attitude towards computer, attitude towards WWW pretest scores, metacognition pretest scores, age, department and gender have been accounted for?

In order to answer this question, data were analyzed by using the MANCOVA model. As can be seen from their respective multivariate Fs in Table 4.11, the covariates used in this study performed the function for which they were intended. All counted for a significant portion of model variance. This provided good evidence that the participants were adequately matched by the inclusion of these covariates. The table also shows a significant main effect for the methods of instruction, Wilk's $\lambda = .509$; $F(6, 50) = 8.043$; $p < .05$.

Table 4.11 Multivariate Tests Results for the MANCOVA

Effect	Wilks' Lambda	F	Hypothesis df	Error df	Sig.	Eta Squared	Observed Power
Intercept	.880	1.138	6	50	.354	.120	.406
AGES	.883	1.105	6	50	.400	.092	.394
GENDER	.840	1.588	6	50	.170	.160	.556
GPA	.778	2.379	6	50	.042	.222	.763
PRECAS	.157	44.842	6	50	.000	.843	1.000
PRECFW	.928	.644	6	50	.694	.072	.233
PREGMQ	.569	6.320	6	50	.000	.431	.997
TREATMENT	.509	8.043	6	50	.000	.491	1.000

In order to test the effect of the methods of instruction on dependent variables; the ME, FE, POSTCAS, POSTCFW, and POSTGMQ, a univariate analysis of covariance (ANCOVA) was conducted as follow-up tests of the MANCOVA. The results of the ANCOVA can be seen in Table 4.12. As it is seen from the table, a statistically significant difference was seen for the FE in the favor of WBIIG [$F (1, 55) = 31.725$, $p < .05$], in contrast, significant difference was found for the WBASS between groups in favor of the WBDIG [$F (1, 55) = 8.412$, $p <. 05$]. On the other hand, the table also shows a nonsignificant effects for the ME, $F (1, 55) = .080$; $p > .05$, for the POSTCAS, $F (1, 55) =. 159$, $p > .05$, for the POSTCFW, $F (1, 55) = .566$, $p > .05$, and for the POSTGMQ, $F (1, 55) = .011$; $p > .05$. This means that pre-service teachers taught by the WBII got higher scores on the final exam than the pre-service teachers instructed by the WBDI. Moreover, the pre-service teachers in the WBDIG developed more positive attitude towards web-based course than the pre-service teachers in the WBIIG. In other words, the effect sizes in terms of eta squared for the FE, and WBASS were .37 (large) and .13 (medium), respectively.

Table 4.12 Tests of Between-Subjects Effects

Source	Dependent Variable	df	F	Sig.	Eta Squared	Observed Power
Corrected Model	ME	7	3.629	.003	.316	.955
	FE	7	9.896	.000	.557	1.000
	POSTCAS	7	42.263	.000	.843	1.000
	POSTCFW	7	2.933	.011	.272	.897
	WBASS	7	2.919	.011	.271	.895
	POSTGMQ	7	8.172	.000	.510	1.000
Intercept	ME	1	.197	.659	.004	.072
	FE	1	.665	.418	.012	.126
	POSTCAS	1	.010	.010	.000	.051
	POSTCFW	1	2.301	.135	.040	.320
	WBASS	1	5.611	.021	.093	.643
	POSTGMQ	1	1.436	.236	.025	.218
AGES	ME	1	.055	.815	.001	.056
	FE	1	.308	.581	.006	.085
	POSTCAS	1	.825	.368	.015	.145
	POSTCFW	1	1.649	.204	.029	.243
	WBASS	1	1.515	.224	.027	.227
	POSTGMQ	1	.197	.659	.004	.072
GENDER	ME	1	3.310	.074	.057	.432
	FE	1	5.797	.019	.095	.657
	POSTCAS	1	.218	.643	.004	.074
	POSTCFW	1	1.424	.238	.025	.216
	WBASS	1	.147	.702	.003	.066
	POSTGMQ	1	.051	.822	.001	.056
GPA	ME	1	3.619	.077	.056	.425
	FE	1	4.616	.036	.077	.560
	POSTCAS	1	11.824	.001	.177	.922
	POSTCFW	1	.599	.442	.011	.118
	WBASS	1	.033	.858	.001	.054
	POSTGMQ	1	.639	.428	.011	.123

Table 4.12 (Continued)

Source	Dependent Variable	df	F	Sig.	Eta Squared	Observed Power
PRECAS	ME	1	3.450	.069	.059	.446
	FE	1	10.133	.002	.152	.878
	POSTCAS	1	254.098	.000	.822	1.000
	POSTCFW	1	13.841	.000	.201	.955
	WBASS	1	.125	.725	.002	.064
	POSTGMQ	1	.046	.831	.001	.055
PRECFW	ME	1	.085	.772	.002	.059
	FE	1	.250	.619	.005	.078
	POSTCAS	1	.493	.485	.493	.106
	POSTCFW	1	.274	.603	.005	.081
	WBASS	1	1.978	.165	.035	.282
	POSTGMQ	1	.593	.445	.011	.118
PREMETA	ME	1	3.830	.055	.065	.485
	FE	1	2.972	.090	.051	.395
	POSTCAS	1	3.164	.081	.054	.416
	POSTCFW	1	2.109	.152	.037	.297
	WBASS	1	2.184	.145	.038	.306
	POSTGMQ	1	37.188	.000	.403	1.000
TREATMENT	ME	1	.080	.779	.001	.059
	FE	1	31.725	.000	.366	1.000
	POSTCAS	1	.159	.691	.003	.068
	POSTCFW	1	.566	.455	.010	.115
	WBASS	1	8.142	.005	.133	.813
	POSTGMQ	1	.011	.916	.000	.051
Error	ME	55				
	FE	55				
	POSTCAS	55				
	POSTCFW	55				
	WBASS	55				
	POSTGMQ	55				

Table 4.12 (Continued)

Source	Dependent Variable	df	F	Sig.	Eta Squared	Observed Power
Total	ME	63				
	FE	63				
	POSTCAS	63				
	POSTCFW	63				
	WBASS	63				
	POSTGMQ	63				
Corrected Total	ME	62				
	FE	62				
	POSTCAS	62				
	POSTCFW	62				
	WBASS	62				
	POSTGMQ	62				

4.2.5 Follow-up Analyses

In order to determine the unique importance of each dependent variable in the model that were found to be significantly affected by the methods of instruction, step-down analyses were performed because it stated that the limitation in using univariate F tests as the follow-up procedure is that it ignores any correlation between dependent variables as cited by Eryılmaz (2002). This may give a greater degree of importance to a single dependent variable than truly warranted. Step-down analysis as described by Tabachnick and Fidell (1989) was used as a second follow-up procedure to test this. With this analysis, any overlap between dependent variables is eliminated and absolute effect is revealed.

The previous analyses revealed that method of instruction had significant effect on the FE and the WBASS. But, there was no significant correlation between the FE and WBASS. Therefore, there was no need to conduct a follow-up test for these variables. For the MANCOVA, two step-down analyses were conducted.

because the FE had significant correlation with the dependent variables; ME and POSTCAS, and the WBASS had significant correlation with the dependent variables; POSTCFW and POSTGMQ, these dependent variables were included as covariates to the step-down analysis. Step-down tests were performed at an alpha level of .025 (i.e..05/2).

The results of the step-down analysis for the final exam as the dependent variable of highest priority, and the midterm exam and the attitude towards computer were as additional covariates are presented in Table 4.13. The results showed that, the effect of method of instruction had significant effect on the FE [F (1.53) = 35.925, p= .000]. This implies that after accounting its effect on midterm exam and the attitude towards computer, the effect of instructional method on pre-service teachers' final exam is still significant.

Table 4.13 Step-down ANCOVA for the FE

Source	df	Mean Square	Step-down F	Sig.
ME	1	730.196	11.763	.001
POSTCAS	1	3.195	.051	.821
TREATMENT	1	2230.119	35.925	.000

In the second step-down F test, the WBASS were analyzed with the metacognition scores and attitude towards WWW scores acting as additional covariate since it has significant correlation with the WBASS so that any variance overlap between them was taken into consideration. As can be seen in Table 4.14, the effect of the treatment was also significant, F (1.53) = 7.817, p= .007. This indicates that the effect of the instructional method on the attitude towards WBC accounting its effect on the metacognition and attitude towards WWW was significant. In other words, the pre-service teachers' attitude towards WBC was significantly and uniquely affected by the instructional method after its effect on the pre-service teachers' metacognition and attitude towards WWW.

Table 4.14 Step-down ANCOVA for the WBASS

Source	df	Mean Square	Step-down F	Sig.
POSTCFW	1	1587.639	3.845	.055
POSTGMQ	1	673.849	1.632	.207
TREATMENT	1	3227.779	7.817	.007

4.3. Exploratory Analyses of the Midterm and Final Exams

The interesting results in the exam were that important differences between the groups were found about the answers given. While these results are interesting, it should not be unexpected.

The pre-service teachers in both groups had identical achievement level in the ME with respect to the types of the questions: True/False (TF), Fill-in-the-Blanks (FB), Matching (M) and Multiple Choices (MC). On the other hand, the pre-service teachers' responses differ in the open-ended (OE) questions as can be seen from the Table 4.15. The 50 percent of the pre-service teachers in the WBDIG took 0 or 1 out of 16 points for the OE question 14 whereas only 21 percent of the pre-service teachers took 0 or 1. Similarly, the numbers of the pre-service teachers in the WBIIG and WBDIG who took 10 or above out of 16 points for the OE question 16 were 14 and 7, respectively. Item 14 was about the "Effective Teacher" and item 16 was about "Discovery Learning". The groups produce identical performance for the OE question 13 that was about "Effective Teacher". Contrary to these, the number of pre-service teachers of the WBIIG who took 10 and above out of 16 have slightly higher than the number of pre-service teachers of the WBIIG for the OE question 15 that was about "Problem Solving" whereas the number of pre-service teachers who had 0, 1 or 2 have identical for both group. It should be noted that question 15 required knowing the problem solving steps. Some pre-service teachers in the WBIIG could not infer these steps. In particular, it is very interesting that the pre-service teachers from the WBIIG gave good responses to the questions for the first chapter even though they might have more trouble at the beginning of the course because of the structure of the WBII.

Table 4.15 Performance of the Groups on the Questions in the ME

Chapters	Item # and (Type)	Max. Point	Points									
			0	1	2	4	6	8	10	12	14	16
			Numbers of pre-service teachers for each point WBIIG (WBDIG)									
Introduction to Course and Effective Teacher	5 (M)	12	0 (1)	0 (0)	0 (1)	3 (4)	8 (6)	16 (16)	3 (2)	2 (1)	-	-
	13 (OE)	8	3 (3)	2 (0)	3 (3)	8 (11)	13 (11)	3 (3)	-	-	-	-
	14 (OE)	15	4 (5)	3 (11)	2 (4)	3 (3)	3 (2)	4 (2)	7 (0)	3 (0)	1 (1)	2 (3)
Questioning in the Classroom	1 (TF)	2	20 (18)	0 (1)	12 (12)	-	-	-	-	-	-	-
	2 (TF)	2	13 (9)	9 (12)	10 (9)	-	-	-	-	-	-	-
	6 (FB)	4	7 (2)	16 (13)	9 (16)	-	-	-	-	-	-	-
Introduction to Methods and Direct Instruction	3 (TF)	2	17 (14)	6 (5)	9 (12)	-	-	-	-	-	-	
	7 (FB)	2	16 (13)	0 (0)	16 (18)	-	-	-	-	-	-	-
	8 (MC)	2	5 (4)	-	27 (27)	-	-	-	-	-	-	-
	9 (MC)	2	19 (17)	-	13 14)	-	-	-	-	-	-	-
	10 (MC)	2	5 (7)	-	27 (24)	-	-	-	-	-	-	-
	11 (MC)	2	12 (15)	-	20 (16)	-	-	-	-	-	-	-
	12 (MC)	2	20 (15)	-	12 (16)	-	-	-	-	-	-	-
Discovery Learning	4 (M)	12	0 (0)	0 (0)	0 (0)	1 (4)	7 (7)	14 (10)	9 (10)	1 (0)	-	-
	16 (OE)	16	4 (3)	2 (2)	2 (2)	0 (3)	2 (4)	8 (10)	2 (3)	9 (3)	3 (1)	0 (0)
Problem Solving	15 (OE)	15	2 (1)	1 (1)	1 (0)	5 (3)	3 (2)	5 (2)	7 (9)	6 (8)	2 (4)	0 (1)

The similar performance for both groups was found for the question types in the FE: True/False, Matching and Multiple Choice. As shown in the Table 4.16, the number of the pre-service teachers in the WBIIG who took 4 or above out of 6 for the OE questions 15, 16 and 18, 6 or above out of 8 for OE question 17 and 21, and 10 or above out of 12 for the OE questions 19 and 20 was higher than the number of the pre-service teachers in the WBDIG. Moreover, the number of pre-service teachers in both groups for the 0 and 1 point for these OE questions was approximately same. Interestingly, there were considerable differences in favor of the WBIIG in the Fill-in-the-Blanks questions 8 and 9 that were about the "Cooperative Learning" and "Drama", respectively. The number of pre-service teachers who took exact scores for these questions quite higher than the number of pre-service teachers of the WBDIG and also the number of pre-service teachers in the WBIIG who took zero for these questions was quite lower than the number of pre-service teachers of the WBDIG.

Table 4.16 Performance of the Groups on the Questions in the FE

Chapters	Item # and Type	Max. Point	Points							
			0	1	2	4	6	8	10	12
			Number of pre-service teachers for each Point WBIIG (WBDIG)							
Introduction to Course and Effective Teacher	15 (OE)	6	8 (5)	9 (15)	5 (5)	9 (5)	2 (0)	-	-	-
Questioning in the Classroom	4 (TF)	2	5 (9)	20 (14)	7 (8)	-	-	-	-	-
	7 (FB)	2	8 (9)	14 (9)	10 (13)	-	-	-	-	-
	10 (MC)	2	12 (11)	-	20 (20)	-	-	-	-	-

Table 4.16 (Continued)

Chapters	Item # and (Type)	Max. Point	Points 0	1	2	4	6	8	10	12
			Numbers of Pre-service teachers for each Point WBIIG (WBDIG)							
Introduction to Methods and Direct Instruction	16 (OE)	6	2 (6)	12 (11)	11 (10)	6 (4)	1 (0)	-	-	-
Discovery Learning	11 (MC)	2	15 (13)	-	17 (18)	-	-	-	-	-
	13 (MC)	2	16 (22)	-	16 (9)	-	-	-	-	-
Problem Solving	17 (OE)	8	0 (1)	2 (2)	1 (3)	2 (2)	25 (22)	2 (1)	-	-
Cooperative Learning	3 (TF)	2	5 (5)	-	27 (26)	-	-	-	-	-
	6 (M)	12	0 (0)	0 (0)	0 (1)	2 (2)	2 (3)	11 12)	11 (7)	6 (6)
Discussion	5 (M)	6	0 (1)	3 (3)	5 (8)	19 (13)	5 (6)	-	-	-
	8 (FB)	2	6 (11)	3 (8)	23 (12)	-	-	-	-	-
	18 (OE)	6	2 (0)	0 (0)	3 (7)	18 (20)	9 (4)	-	-	-
Computer-Assisted Instruction	19 (OE)	12	1 (0)	0 (0)	0 (0)	2 (2)	7 (7)	9 (13)	12 (8)	1 (1)
	14 (MC)	2	2 (5)	-	30 (26)	-	-	-	-	-
Project-Based Learning	1 (TF)	2	0 (2)	-	32 (29)	-	-	-	-	-
	2 (TF)	2	5 (6)	17 (16)	10 (9)	-	-	-	-	-
	20 (OE)	12	1 (0)	0 (0)	2 (3)	6 (7)	7 (10)	6 (8)	9 (3)	1 (0)

Table 4.16 (Continued)

Chapters	Item # and (Type)	Max. Point	Points							
			0	1	2	4	6	8	10	12
			Numbers of Pre-service teachers for each Point WBIIG (WBDIG)							
Drama	9 (FB)	2	6 (11)	-	26 (20)	-	-	-	-	-
	12 (MC)	2	15 (10)	-	17 (21)	-	-	-	-	-
	21 (OE)	8	6 (6)	0 (1)	0 (2)	7 (6)	15 (14)	4 (2)	-	-

Not only are the scores taken from the questions interesting, they have important implications for the topics taught. The pre-service teachers from the WBIIG have higher performance whatever are the types of the items in the topics; discovery learning, discussion, cooperative learning, project-based learning and computer-assisted instruction. It is interesting that these topics are taught after the midterm. In other words, these topics were taught in the second part of the semester. The number of pre-service teachers in the WBIIG who took high scores increased from midterm to final for the questions about the chapter “Problem Solving” and “Effective Teacher” which were taught before the midterm and also the number of pre-service teachers in the WBIIG who took high scores was higher than the number of pre-service teachers in the WBDIG. In the first part of the semester, it cannot be found an important difference on the performance with respect to the topics, except that the pre-service teachers in the WBIIG have higher performance on the open-ended questions.

4.4. Observation of the Online Classes

Throughout the study, the researcher observed whole web based environment in order to compare the WBIIG with the WBDIG in terms of the criteria inspired

from the theory of the instructional approaches. Six observations for each group were applied for the purpose of the treatment verification. The researcher observed all of the forum activities, emails, and other NET-Class tools and took notes based on the criteria about the flow of the lesson. Through the treatment period, the researcher completed observation checklist for six lessons of both groups by using the notes taken during the implementation. Table 4.17 presents the scores of each item for WBIIG and WBDIG. The researcher completed observation was compared by those completed by the outside observers; one teacher for each group and the interrater reliabilities for the WBII and WBDI were .92 and .88, respectively.

Table 4.17 Observation Checklist Scores of the Researcher and Outside Observers

	Criteria WBII (WBDI)														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
RO1	5 (2)	5 (1)	2 (3)	4 (1)	1 (4)	4 (4)	4 (4)	4 (1)	4 (2)	4 (2)	2 (4)	4 (2)	3 (1)	4 (4)	1 (4)
RO2	4 (2)	5 (1)	3 (4)	3 (1)	1 (5)	5 (5)	5 (3)	3 (2)	3 (2)	4 (1)	2 (3)	5 (3)	3 (1)	5 (5)	1 (5)
RO3	3 (1)	4 (2)	3 (3)	4 (1)	1 (5)	5 (4)	3 (4)	4 (3)	4 (3)	5 (2)	1 (4)	5 (3)	4 (1)	5 (5)	1 (4)
RO4	4 (2)	5 (3)	2 (4)	3 (2)	1 (5)	5 (5)	4 (2)	5 (2)	4 (2)	4 (1)	2 (4)	4 (3)	3 (2)	5 (5)	1 (5)
RO5	4 (2)	4 (2)	2 (4)	5 (3)	1 (4)	5 (4)	4 (5)	5 (2)	4 (2)	4 (1)	2 (4)	5 (2)	4 (1)	5 (5)	1 (4)
RO6	5 (1)	4 (3)	2 (4)	3 (2)	1 (5)	5 (4)	4 (5)	4 (3)	3 (2)	4 (1)	2 (4)	5 (3)	3 (2)	5 (4)	1 (5)
OO**	4 (1)	4 (1)	2 (3)	4 (2)	1 (4)	4 (5)	4 (5)	3 (3)	3 (2)	4 (2)	1 (3)	4 (2)	3 (1)	5 (4)	1 (4)

* RO: Researcher Observations, OO: Outside Observer

** Outside observation was conducted with RO5 at the same time.

As can be seen in Table 4.18, means of WBII criteria 1, 2, 4, 8, 9, 10, 12 and 13 were greater than 3.00 for the WBII and the means of these criteria for the WBDI were almost less than 2.00 except 9 that the mean was 2.33. On the other hand, the

means of the WBDI criteria 3, 5, 11 and 15 were greater than 3.00 for the WBDI. Moreover, the means of criteria numbers 6, 7, and 14 (for any proper web-based course) were greater than 3.00 for both instructional methods.

According to these observation scores for each group, it could be assumed that teaching method course in both groups was conducted according to the treatment requirements. To compare the six researcher observations for the two courses, t-test was conducted and it was found that there was significant difference between two instructions on each item of the observation checklist except items 6, 7 and 14. So, it means that the two courses were administered significantly different from each other on the base of the instructional methods.

Table 4.18 Comparison of the Observations for the WBII and WBDI

Criteria	Means of WBII	Means of WBDI	t-test (n=6)
1	4.17	1.67	-6.71*
2	4.50	2.00	-5.84*
3	2.33	3.83	3.10*
4	3.33	2.17	-4.24*
5	1.00	4.67	17.39*
6	4.33	4.83	1.86
7	4.67	4.00	-0.31
8	3.83	2.17	-4.60*
9	3.50	2.33	-2.91*
10	4.17	1.33	-10.54*
11	1.83	3.83	8.49*
12	4.67	2.67	-6.71*
13	3.33	1.33	-6.71*
14	4.67	4.83	0.62
15	1.00	4.50	15.65*

* t-test is significant at the .05 level (2-tailed).

4.5 Summary of the Results

In the light of the findings, the results could be summarized as followings:

1. There was significant difference between the pre-service teachers exposed to the WBII and those exposed WBDI on the population means of the collective dependent variables of pre-service teachers' scores on the midterm exam, final exam, attitude towards computer posttest, attitude towards WWW posttest, attitude towards web-based course, metacognition posttest when the effects of pre-service teachers' GPA, attitude towards computer, attitude towards WWW pretest scores, metacognition pretest scores, age, department, and gender have been accounted for.

2. There was no significant difference between the pre-service teachers exposed to the WBII and those exposed WBDI on the population means of the dependent variables of pre-service teachers' scores on the midterm exam when the effects of pre-service teachers' GPA, attitude towards computer, attitude towards WWW pretest scores, metacognition pretest scores, age and gender have been accounted for.

3. There was significant difference between the pre-service teachers exposed to the WBII and those exposed WBDI on the population means of the dependent variables of pre-service teachers' scores on the final exam when the effects of pre-service teachers' GPA, attitude towards computer, attitude towards WWW pretest scores, metacognition pretest scores, age and gender have been accounted for.

4. There was no significant difference between the pre-service teachers exposed to the WBII and those exposed WBDI on the population means of the dependent variables of pre-service teachers' scores on the attitude towards computer posttest when the effects of pre-service teachers' GPA, attitude towards computer, attitude towards WWW pretest scores, metacognition pretest scores, age and gender have been accounted for.

5. There was no significant difference between the pre-service teachers exposed to the WBII and those exposed WBDI on the population means of the dependent variables of pre-service teachers' scores on the attitude towards WWW posttest when the effects of pre-service teachers' GPA, attitude towards computer, attitude towards WWW pretest scores, metacognition pretest scores, age and gender have been accounted for.

6. There was significant difference between the pre-service teachers exposed to the WBII and those exposed WBDI on the population means of the dependent variables of pre-service teachers' scores on the attitude towards web-based course test when the effects of pre-service teachers' GPA, attitude towards computer, attitude towards WWW pretest scores, metacognition pretest scores, age and gender have been accounted for.

7. There was no significant difference between the pre-service teachers exposed to the WBII and those exposed WBDI on the population means of the dependent variables of pre-service teachers' scores on the metacognition posttest when the effects of pre-service teachers' GPA, attitude towards computer, attitude towards WWW pretest scores, metacognition pretest scores, age and gender have been accounted for.

8. The effect of method of instruction had significant effect on the FE after accounting its effect on midterm exam and the attitude towards computer.

9. The effect of the instructional method on the attitude towards web-based course after accounting its effect on the metacognition and attitude towards WWW was significant.

10. There was a significant positive correlation between the GPA and exams (FE and ME). However, non-significant correlation was found between the GPA and attitudes. There was also significant correlation between the GPA and POSTGMQ

11. The ages had significant correlation only with attitude towards computer posttest. On the other hand, there was non-significant correlation between the department and any one of the dependent variables.

12. Attitude towards computer pretest scores had significant correlation with its postest scores and attitude towards WWW posttest.

13. Attitude towards WWW pretest scores had significant correlation with the attitude towards web-based course subscale scores

14. There was significant correlation between PREGMQ and exams (FE and ME), between PREGMQ and POSTGMQ and also between PREGMQ and WBASS.

15. The ME and FE had significant correlation with the POSTCAS and also between themselves.

16. There was almost any change in the means of the CAS and CFWS scores through the treatment.

17. The mean of GMQ scores for WBIIG and WBDIG was almost the same for the pretest and the posttest. The change in the GMQ scores from pretest to posttest for each group is also quite little.

18. The pre-service teachers from the WBIIG have higher success on the open-ended type questions.

19. The pre-service teachers from the WBIIG have higher success on the topics in the second part of the semester whatever are the types of the questions.

20. There was significant interrater reliability for both of the WBII and WBDI.

CHAPTER 5

CONCLUSIONS, DISCUSSIONS AND IMPLICATIONS

The main goal of this study was to investigate the effects of web-based direct and indirect instruction of the "Science and Math Teaching Method Course" on pre-service teachers' achievement, metacognition and, attitudes toward computer, WWW and web-based course. In the following sections; firstly, conclusions are presented; secondly, discussion of the results are given. Finally, implications of the study and recommendations for further studies are announced.

5.1 Conclusions

Internal validity threats of the study were sufficiently controlled by the settings of the study. Treatment and administration of the instruments were carried out in the web based asynchronous learning environment in both groups. Midterm and Final exams were conducted in the classroom for both groups. So, all the conditions were the same for both groups. Conclusion offered in this study can have implications for a broader population of similar sample.

The vast majority of the research studies were based on the comparison of students' achievement in classes using a web based learning environment with that of students receiving traditional instruction. They found that no discernible difference between distance teaching and face to face instruction on the K-12 students (Laube, 1992; Schimdt, Sullivan & Hardy, 1994), on undergraduate students (Kanuka, et al., 2002) and on pre-service teachers (Jiang & Ting, 1998; Thompson, 1998). Many researchers, however, mentioned that the important thing is what you did as the

instructional methodology during the web based course (Clark, 1994; Cyrs & Conway, 1997; Yıldırım, personal interview, May 15, 2002). This study supported this idea with its results: WBII increased pre-service teachers' achievement more than WBDI did. In other words, there was significant difference on the pre-service teachers' final achievement between WBIIG and WBDIG when the pre-service teachers' gender, department, GPA, metacognition and prior attitude toward computer, WWW and WBC were controlled. Moreover, this difference was still significant after accounting the effect of the midterm exam and attitude toward computer that had significant correlation with the final exam.

Pre-service teachers in the WBIIG and WBDIG did not differ on the attitude toward computer and WWW and their attitude toward them did not change much for both groups at the end of the study as reported in the other studies (Howland & Moore, 2002; McIsaac, Blocher, Mahes & Vrasidas, 1999). But, there was significant difference on the attitude toward WBC between WBIIG and WBDIG and this difference was in favor of the WBDIG. This difference at the end of the study was still significant when the effect of the pre-service teachers' metacognition and attitude toward WWW that had significant correlation with the attitude toward WBC were controlled. Moreover and in contrast to the result in the final achievement, WBDI caused positive attitude toward web-based course as the other studies reported (Hislop, 2000; Richardson, 2003).

Lastly, there was no significant difference between the pre-service teachers in the WBIIG and WBDIG on the metacognition. Moreover, their metacognitive characteristics did not change at the end of the web-based course. This finding was supported by many researchers (Bransford, Brown, & Cocking, 1999; Hill & Hannafin, 1997; Shraw, 2000) who reported that the change in the metacognitive strategies of the students needs long time and training about their use form.

5.2 Discussions

As described before, large treatment effect size for the total model was expected. The observed value of effect size was calculated by SPSS 10.0 for each dependent variable. The SPSS calculated eta squared as .512 for the total model, as

.383 for FE and as .142 for the WBASS. Olson & Wisher (2002) reported the results of the 15 studies between the years 1996 and 2002 about the effects of the Web-based instruction on the students' outcomes such as learning, performance, and satisfaction. In their analysis that provided sufficient information to calculate effect sizes, effect sizes ranged from -.16 to .40. The grand mean for all 15 effect sizes was .24. So, this study supported previous researchers' findings. The treatment effect sizes measured in this study matched the large effect size for the total model and FE, and medium effect size for WBASS. So, our results for the FE and for the total model were of practical significance for similar populations. The power of this study was calculated as .80 at the beginning of the study. Multivariate analysis of covariance calculated power as 1.00, which was higher than the preset value.

As shown in Table 4.1, there is significant mean difference in the FE between WBIIG and WBDIG although there was no difference on the ME. The finding agrees with the findings about effectiveness of the WBII on the undergraduate students in the math course (Sorg, 2000), undergraduate students in educational course (Pevato, 2003), undergraduate students in educational course (Matuga, 2001; Johnson, 2001, 2003; Tsai, 2004), graduate students in the management course (Gagne & Shepherd, 2001), graduate students in the educational course (Goggin, Finkenberg, & Morrow, 1997). Moreover, the different findings for the exam performances in the study supported also by the findings of previous studies (Chellman & Duchastel, 2000; Cyrs & Conway, 1997), which reported that the learning environment has a novice effect on the students if they take the web-based course for the first time. The difference between two groups was small at the midterm exam and increased at the end of the semester in favor of the WBIIG.

The significant difference between WBIIG and WBDIG in achievement in this study was partly attributable to corporatist and constructivist view of learning of WBII. Generative problem-solving task in the form of facilitative questions produce highly meaningful learning environment. The facilitative questions in the WBII focus on the students' experiences, readings about the concepts and ill-structured cases (videos or episodes) not on the definitions and concepts in the lecture notes as in the WBDI. They were the centre of the forum discussions and students presented their investigation's results by focusing on these questions. Therefore they produced

analytic high level thinking. It is a developmental process beginning from duality, moving to an understanding of multiple views, and finally acknowledging the context wherein the solution is given (Jonassen, 1997; Jonassen, Davidson, Collins, Campbell & Haag, 1995; King & Rosenshine, 1993). Salomon and Perkins (1998) and Jonassen (1999) also supported this finding of the study. They said that asking students to individually explore the underlying concepts and issues in advance, and connecting them with their own previous experience helped students to better understand the collaborative task and to be prepared to formulate ideas and participate in large group discussion. The whole process in this WBII creates an environment in which pre-service teachers construct shared knowledge and products, and formulated and negotiated understanding of the content. The study of McGrath and Hollingshead (1993) reported that these activities encourage the students to find the right ways from available information.

It is important to note that the significant difference on the final achievement might be caused by more and various interactions about the facilitative questions, links and research materials in the WBIIG. The pre-service teachers in WBIIG posted more messages to the forum, clicked on the links on the course sites and offer more help from their friends than the pre-service teachers in the WBDIG. Consistent with the literature, since students construct their knowledge in the forum discussions of the lesson, students became a better negotiators and communicators and were better able to express their own opinions and ideas as proposed by many studies (Herring & Smaldino 1997; Hillman, Willis, & Gunawardena, 1994; Hughes, 2001). Communication allows students opportunities to talk about their ideas, get feedback for their thinking and hear others points of view. Students became consciously aware of what they were studying on. Having time to reflect their ideas allowed students to make and test conclusions that related the concepts. Hannafin, Land & Oliver (1999) stated that communicating at the same condition focusing on the main exploratory ideas provided students understanding topics meaningfully.

Along the same line, another reason for this important difference could be due to the fact that pre-service teachers did a lot of research about the concepts by using books, links on the course site without any lecture notes. To understand the topics and to participate in the forum discussion, pre-service teachers had to make excessive

amount of study about teaching methods in advance. They could have more than one aspect of the concepts by this way and they had to make connection among their findings. Therefore the integration of the information to the knowledge might be facilitated. This finding was supported by the exploratory analysis of the midterm and final exam. The pre-service teachers in the WBIIG answered the open-ended questions deeper, in more detail and through every aspect and took higher scores than pre-service teachers in the WBDIG though both groups took approximately the same scores for the type of questions; multiple choice, true/false, completions. In fact, the pre-service teachers in WBIIG took higher scores for some of the questions in the final exam even they related to the first chapter of the course. Moreover, the number of the pre-service teachers in the WBIIG who did the open-ended questions completely wrong was lower than that of the WBDIG.

Above all, the difference in the achievement would be quite big if the one major restriction related to the application of constructivist approach wouldn't be. Size of groups is important factor on the effectiveness of interactive web based learning (Owston, 1997; Trentin & Sciecen, 1999). Instructors must understand the cognitive strategies of their students and know how best to structure content, that is, know what to do when to facilitate learning. In this study, the instructor spent approximately 4-5 hours a day to manage this course. The instructor could direct more facilitative questions, in turn produce more interactive discussion medium in the forum if the sample size were small. If fewer students were in the courses, the meaningful learning environment could be created in more depth and longer period of time through the excessive amount of participation among the actors of the teaching/learning process and, in turn, the difference between WBII and WBDI would be more in favor of the WBII. This result was supported by the studies (Trentin & Benigno, 2000; Trentin, 2000).

The treatment had no effects on the students' attitude toward computer and their attitude did not change at the end of the semester. It might be caused by the students' prior experience in the computer and they differ the web-based course experience from the computer experience (use of the office program or tutorials or simulation programs etc.). The 92 % of students in both groups completed a computer related course and most of them used computer for different purposes.

Therefore, they separated the computer from the web-based course. Many of them mentioned in the nonformal forum discussion: “Computer facilitates my course work, but the course on the web loads much work”. Some of the researchers supported these results and reported similar findings (Jiang, 1998; Lin & Lehman, 1999; Lyord & Gressard, 1984). On the other hand, Maddux and Johnson (2004) found that web based course applications produced positive attitude toward computer at the end of the course by proposing that it increases students’ satisfactions with the computer applications and that it increases the time on task with the computer if they sufficient experience in the web based course.

In this study, pre-service teachers of both groups had approximately same attitude toward WWW and they did not differ at the end of the web-based course as reported by other researchers (Matuga, 2001; Russell, 1999; Oliver & Omai, 2001; Serban, 2000). In fact, students’ prior web experience produced high attitude toward WWW and most of them (70 %) had benefited from WWW as various purposes. Therefore, they did not limit features or functions of the WWW to the web-based course or its achievement. This finding might be accepted as expected results of the study as in the attitude toward computer.

On the other hand, the study reported that there is significant difference between WBIIG and WBDIG on the attitude toward web-based course. Findings of this study added an empirical support for the positive effect of the WBDI on web based course attitude. The reaching to the content easily and the less effort to obtain the knowledge can explain the difference in attitude toward web-based course in favor of WBDI. WBDI provided students reading and analyzing the content through the link “lecture note”. Moreover, they could use many links in which student could find necessary related information. In overall, these conditions affected the progress in the attitude toward web based course. As literature suggested, the development of positive attitudes is linked to the easy involvement of students in the activities (Manuel, 2001; Matuga, 2001). The relatively low attitude toward web-based course of WBIIG might be caused by the students’ inexperience in the asynchronous discussion within academic framework while they also must gather and construct the necessary knowledge about the topics (Tam, 2000).

Moreover, the significant difference in attitude toward WBC in this study was partly attributable to the needs of more effort to acquire the content of the course at the beginning of the WBII than of the WBDI and it resulted the need of more time for the familiarity. Familiarity with WBC, in general, highly correlated with initial attitudes toward WBC. However, they had no experience in the web based learning environment and the high amount of time-on-task about the challenging subjects caused frustrations as previous researches reported (Chellman & Duchastel, 2000; Cyrs & Conway, 1997). This finding was also supported by the messages in the informal forum discussion of the course, such as “I studied this course as three times as any other course” or “If I were study for any one of my course as much as for this course, I certainly took a credit AA.” But, this high effort to acquire the content, in turn, produced high performance in the FE for WBIIG.

Another reason for the significant difference can be sourced from the students’ need to become knowledgeable about the search engines that drive the search for specific information. The use of a search engine requires critical thinking skills. The pre-service teachers in the WBIIG were forced to navigate through large pools of information and make appropriate and relevant selections on their own. They were then responsible for identifying the benefits and disadvantages of the selection. Additionally, the pre-service teachers must have the “ability to diagnose one’s own learning needs and to identify the next steps”. These also caused frustrations in the pre-service teachers as reported in the study (Scardamalia & Bereiter, 1994).

Students in highly interactive web based learning should possess certain skills and knowledge as well as an understanding of the time commitment and scheduling. WBII requires much more time, involvement, participation, and interaction than most students anticipates. Pre-service teachers in WBIIG must construct their writing in the messages and it needs extra effort and skills to compose a complete and integrative writing. Some of the pre-service teachers in WBIIG said that “each message is like a journal writing or homework including tasks calling on other skills and it takes much time”. Pre-service teachers in WBIIG respondents overwhelmingly agreed that additional time was required and they highlighted the need for the developments of time-sensitive planning strategies as reported many studies of the

researchers (Driscoll, 2002; Land & Hannafin, 1996; Leggett & Persichitte, 1998; Mangan, 1999; Navarro & Shoemaker, 1999)

Another important result of this study showed that there was no significant difference between the two groups with respect to general metacognition strategies. There are studies about the effect of the WBDI or WBII on the metacognition or correlations among them (Ge & Land, 2003; Hill & Hannafin, 1997; Brush & Saye, 2002). These studies show that constructivist approach stimulates and need more metacognitive strategies and also that web-based course need more use of metacognitive strategies because of their nature (Jonassen, 2000; Spiro, Feltovich, Jacobsen & Coulson, 1991). But, this study could not find any effects of instructional methods on the metacognitive strategies or any changes in the metacognitive strategies of the students for both groups. It might be caused by the short period of the teaching/learning process. Many studies on metacognition reported that they need longitudinal research to observe the change and development in the metacognitive strategies depending on the training on them (Osman & Hannafin, 1994; Hill & Hannafin, 1997; Shraw & Moshman, 1995; Shraw, 2000). Miller (1999) conducted a research to determine the effect of WBDI on students' metacognition in a web based learning environment. She found that there was no significant effect on the metacognitive strategies of the students. However, unlike this study, McEachern (1999) conducted a qualitative research and he reported that WBII changed students' metacognition positively.

The mean scores from pretest to posttest in the metacognition did not indicate a difference for both groups. The expectation was an increase in the metacognitive score for the WBIIG, because encouraging a constructive approach when handling information can help hone and improve information retrieval and synthesis. A logically and clearly organized database might help learners to see crucial elements, which will match and ultimately stretch the learner's awareness of their own cognitive abilities. Although the change in metacognition was not realized for both groups, the significant correlation between PREGMQ and ME and between PREGMQ and FE imply that metacognition of the students might have an effect on the achievement in the web based learning environment. As Hill & Hannafin (1997) said that weak metacognitive knowledge and skill may limit learners in

defining learning needs and evaluating available resources while strong metacognitive knowledge and skill are likely to improve learning via WBC. Therefore the studies should include metacognition as an important variable for the effectiveness of the web based course.

Lack of experience in a web based environment produce lack of self-interrogation, an inability to monitor, or a failure to make effective task analyses. Therefore, the instructor can offer an experience through guidance in executive control in the new technology in order to affect the selection and use of various control processes and to exert influence over many different learning processes (Hill & Hannafin, 1997; Romizovski, 1997). However, it is important to note that the analysis detect still significant difference on web based course attitude between groups after accounting the effect of general metacognition and attitude toward WWW. It means that the students developed positive attitude toward web based course whether or not they have the capacity of control their learning or knowledge of the strategy or have the capacity of regulation of the use of their strategy and whether or not they have positive or negative attitude toward WWW. WBDI provides students the confidence in the reaching the necessary knowledge as supported by the findings of the many studies (Hmelo, Kinzer & Secules, 1999; Kearsley, 1998; Lin & Lehman, 1999). In other words, this instruction provides students imaginary control on their learning.

The indifferences on metacognition for both groups might be also attributable to the human-computer-interface interactions in the direction of lessening the metacognitive strategies. The course interface provides students a sense of controlling of their learning, finding the ways for new information and exercising with its tools. These could have two types of effect on the students' metacognitive strategies. In one aspect, this interface stimulates the use of metacognitive strategies, but in another aspect, interface remains metacognitive abilities inactive because it takes the role of them. This study supports the former, because the difference in the discussion scores of the low and high metacognitive control having students was small. So, further studies should investigate that how the interface takes the role of the metacognitive strategies or how the interface facilitates the use of the metacognitive strategies.

As a result, there is significant difference on the achievement and attitude toward web-based course between the WBIIG and WBDIG when the effects of the instructional methods have considered.

5.3 Implications of the Study and Recommendations

Based on the findings of this study and literature review following suggestions can be offered:

•Course in Education can be taught effectively and efficiently in the specified period of time given in the curriculum by carefully developed asynchronous web based learning environment with the indirect or direct instructional method. Future quantitative research could be performed as a replication of this study using different educational courses.

•The significantly better performance of the WBIIG in this study suggests that other educational courses should be developed as suitable to this instructional method.

•The metacognitive abilities of the pre-service teachers in these groups were high. The study should be repeated among the students who have low, medium and high metacognitive ability.

•The pre-service teachers in this study took a web-based course for the first time. This study might give different results on the attitude toward web based course if it were conducted in the group of students who took web based course several times.

•The groups of the study (WBIIG and WBDIG) were not compared with the face-to-face format of the same course since previous researches found that there is no significant difference between web-based environment and face-to-face environment. However, the study comparing WBII and their face to face format by including the students' metacognition as a variable should be conducted since web tools might have interesting effect on the metacognition and, indirectly, on the achievement in the course.

•As this study implied that the components of metacognition could have interactions with the course interface. Therefore future studies should investigate the interactions among the components of the metacognition, course interface and discussion performance in the forum.

•Almost all of the pre-service teachers in both groups have sufficient amount of computer experience. Previous computer experiences contribute to students' competency and have an effect on their attitudes. Therefore, students' computer competency should be assessed before they enroll in a web-based course.

•Gender and age were significantly correlated with the dependent variables of the study. Therefore, future studies should control these variables. Furthermore, the possible study for the in-service teacher should investigate the effect of the age on the dependent variables.

•GPA is an important variable for all of the studies in web based learning environment (Jonassen, 2000; Tam, 2000). For pre-service teachers or in-service teachers, their past success or achievement might have effect on the web based course achievement or attitude. Therefore, the replication of the study on the different sample should include GPA as the covariate variable.

•The exam in the WBII should be as much as possible in the form of open-ended type of questions. The researcher prepared approximately 30% of the exam questions as open-ended because of the reasons explained. But, different assessment types other than exam that reveals creative thinking could support knowledge building and learning. So, this study also implies that instructors should measure progress of students with a variety of assessments: portfolios, checklists, rubrics and performance assessments.

•The students should be stimulated or motivated by the encouraging messages in the formal or nonformal forum discussion to participate in the discussion. Thus, the transactional distance might be lower.

•This study was about undergraduate students that have educational language, English. Future study could examine the effects of WBII on students' achievement and attitudes toward computer, WWW and web based course in all universities.

•As it is applied in the study, all of the messages were assessed by using a rubric. Furthermore, student should write the messages in a standard form as in the study such as (1) having a topic, (2) obeying writing principles (introduction, development and conclusion), (3) writing the type of the interaction in the McKinnon' rubric. Future studies might put these standards as requirements for writing message. Therefore, the messages in the formal forum discussion should have a standard format to be able to be read and assessed by instructor easily. Students' scores obtained from the forum discussion should be included in their grading for both types of the instructions. Moreover, the evaluation results should be announced to the students on time.

•The instructor should require a minimum number for the participation in the forum discussion as applied in the study. This requirement promotes ongoing contributions to reciprocal knowledge building.

•Future research should include forum discussion performance as dependent variables. Moreover, it should be investigated the effect of the metacognitive training or using messages that stimulate the students' metacognitive strategies on the forum discussion performance.

•As the preparing the Web based course requires a long process; preparing the course content, embedding them into web pages, arrangement and design of the web pages, preparing the questions for the forum discussion, preparing the multimedia materials, instructors should be provided with the carefully planned web based course materials. Instructor should account the interactions of multiple technologies and the impact of individual technologies in the web-based environment, such as the condition of the broadband, media players' types and versions, alternative ways of the obtaining video files etc.

•As this study showed that the students need excessive amount of time to be able to manage the course requirements. The web-based course should be carefully

planned in relation to the students' course load in the semester. Moreover, the instructor should identify the requirements of the web-based course in relation to the students' course load (because it needs much time). Furthermore, instructor also need time to collaborate, develop and expand their instructional methods to insure that their lessons are appropriate for all students. Therefore, school administrator should give sufficient time also for the instructor who opens a web-based course.

•As this study showed that to be able to manage the course effectively in a normal time range, the instructor should have two assistants: One for administrative purposes (such as introducing the web tools, announcing the scores, putting the course materials into web pages etc.) and one for applications in the course (such as evaluating the messages according to the rubric, putting the questions in the forum after the opening threads, putting the new links at the beginning of each week, opening the multimedia , etc.)

•As Moore (1989) said that there is no physical distance, but there is transactional distance. This study showed that the instructor should encourage students to post autobiography at the beginning of the course to make them feel they know each other. Ideally, an initial face-to-face meeting or some information gathering during the course establish a sense of community and facilitate an active participation. These behaviors make the students and instructor close to each other and decrease the transactional distance.

• This study also showed that the instructor should interact with the students on a one-to-one and regular basis, especially for those who fall behind. It means that the students who took low scores in the discussion and did not participate in the discussion sufficiently. Thus the students could have a feel of closeness. The instructor should set a time period in a week to discuss or help the students in the web-based environment synchronously. Moreover, the instructor should create also some informal places where students can ask each other for help and should create an open forum where students can ask questions directly to the instructor (or assistant).

•Considering the difficulty of controlling the students' ideas in the right direction in WBII, it would be better to use WBII in group with smaller number of students per one instructor.

•Further research should be conducted for larger sample size by including a team of the instructors and assistants to increase the power of the study.

•This study continued for one semester. In fact, this "teaching method course" is a prerequisite course to another course about similar, but extended content and also lasts for one semester. The content materials for the following course can be developed as in this web based course. After that, future study through these courses followed each other might examine the effect of WBII and WBDI on students' achievement, attitudes toward web-based course and metacognition for one year (two semesters).

•As a result of the study, it can be said that authors and textbooks publishers should develop easily used activities based on the WBII. Particularly, they should modify the instructor edition books.

•Informatic Institute should develop the NET-Class platform by embedding into it the tools for conducting synchronous learning activities (discussions, taking help etc.) and for observing students's course site activities from all of the class personnel.

•Through this study, instructor in the WBII directs facilitative questions, does not give complete answer for the students' questions, and guides students to the results by using the problem-tackling cases or ill-structured cases. On the other hand, the instructor in the WBDI gives answer for the students' questions directly and the instructor's questions require exemplifying and analyzing of the information in the lecture note. So, this study implies that instructor's training is a critical element for the students' achievement and proper application of these courses. To increase instructors' awareness of the WBII or WBDI, they should apply the principles of the instructional methods to modify their teaching styles and strategies.

•Scale on the Web based course can include additional questions that ask for better understanding of which components of Web-based instructional resources (links, informal and formal forum, email systems etc.) are beneficial for student learning.

•Teacher education programs should provide technology training for preservice teachers that can satisfy their specific needs in the schools at which they work. Moreover, schools districts should also design technology-training curricula to meet in service teachers' specific technology needs.

REFERENCES

Alexander, J. M., Carr, M. & Schwanenflugel, P. J. (1995). Development of metacognition in gifted children: Directions for future research. Developmental Review, 15, 1-37

Alexander, P., Schallert, D., & Harei, V. (1991). Coming to terms: How researchers in learning and literacy talk about knowledge. Review of Educational Research, 61, 315-343.

Aleven, V., Elmar, S., Silke, S., Frank, F. & Raven, W. (2003). Help seeking and help design in interactive learning environments. British Journal of Educational Technology, 73 (3), 277-294.

Andersen, D.L. (1999, April). Heuristics for educational use and evaluation of electronic information: A case of searching for shaker history on the World Wide Web. Journal of the Association for History & Computing [Online], 2 (2), Available: http://www.mcel.pacificu.edu/JAHC/JAHCII2/INDEX.html

Anderson, D. K. & Reed, W. (1998). The effects of Internet instruction, prior computer experience and learning style on teachers' Internet attitudes and knowledge. Journal Educational Computing Research, 19 (3), 227 – 246.

Arndt, S., Feltes, J., & Hanak, J. (1983). Secretarial attitudes towards word processors as a function of familiarity and locus of control. Behavior and Information Technology, 2, 17–22.

Bandura, A. (1998). Organizational applications of cognitive theory. Australian Journal of Management, 13, 275-302.

Barker, B. O., & Dickson, M. W. (1996). Distance learning technologies in K-12 schools: Past, present, and future practice. Techtrends, 41 (6), 19-22.

Basile, A & D'aquila, J. M. (2002). An experimental analysis of computer-mediated instruction and student attitude in a principle of accounting course. Journal of Educational Business, 77 (3), 137 – 143.

Bates, A. W. (1995). Technology, open learning and distance education. New York: Routledge.

Bessant, K. C. (1997). The development and validation of scores on the mathematics information processing scale. Educational and Psychological Measurement, 57 (5), 841-858.

Belanger, F. & Jordan, D. H. (2000). Evaluation and implementation of distance learning: technologies, tools and techniques. Hershey, PA: Idea Group Publishing.

Bennett, S., Priest, A. & McPherson, C. (1999). Learning about online learning: An approach to staff development for university teachers. Journal of Educational Technology. 15 (3), 207-221.

Berge, Z. L. (1999). Interaction in post-secondary Web based learning. Educational Technology, 39 (1), 5-11.

Borich, G. D. (1997). Effective teaching methods (4th Ed). New Jersey: Prentice Hall.

Boshier, R. W., Mohapi, M., Moulton, G., Qayyum, A., Sadownik, L. & Mary W. (1997). Best and Worst-Dressed Web Courses: Strutting Into the 21st Century in Comfort and Style. Distance Education, 18 (2), 327-349.

Bourne, J. R., McMaster, E., Rieger, J., & Campbell, O. (1997). Paradigms for on-line learning: A case study in the design and implementation of an asynchronous learning networks (ALN) course. Journal of the Asynchronous Learning Network [Online], 1 (2), Available: http://www.aln.org/alnweb/journal/ issue2 /assee.htm

Bransford, J. D., Brown, A. L., & Cocking, R. R. (1999). How people learn: Brain, mind, experience. and school. Washington, D.C.: National Academy Press.

Brown, J. R. (1999). Skills teachers' need to successfully integrate technology into their classrooms. Unpublished PhD Thesis, University of New Mexico, United States.

Brown, A. L. Campione, J. C. & Barclay, C. (1979). Training self-checking routines for estimating test readiness: Generalization from list learning to prose recall. Child Development, 50, 501-512

Brown, A. L., Bransford, J. D., Ferrara, R. A., & Campione, J. C. (1983). Learning, remembering and understanding. In J. H. Flavell & M. Markman (Eds.), Handbook of child psychology, Cognitive development, 3(4th.ed.) (pp.515-529). New York: Wiley.

Bruner, J. S. (1996). The culture of education. Harvard University Press, Cambridge.

Brush, T. A., & Saye, J. W. (2002). A summary of research exploring hard and soft scaffolding for teachers and students using a multimedia supported learning environment, Journal of Interactive Online Learning, 1(2), 67-81.

Butler, D. L. & Winne, P. H. (1995). Feedback and self-regulated learning: A theoretical synthesis. Review of Educational Research, 65 (3), 245-276.

Cantelon, J. E. (1995). The Evolution and Advantages of Distance Education. In M. H. Rossman and M. E. Rossman (Eds.), Facilitating Distance Education, San Francisco, Jossey-Bass Inc.

Chambers, J. A. & Sprecher, J. W. (1996). Computer-assisted Instruction: Its Use in the Classroom. New Jersey, Prentice-Hall.

Chandler, B. & Maddux, C. D. (1998). Students' use of instructors' web sites. In S. McNeil, J. D. Price, S. Boger-Mahall, B. Robin, & J. Willis (Eds.), Technology and teacher education annual 1998. Charlottesville, VA: Association for the Advancement of Computing in Education. Retrieved online at 11/12/02, Available: www.coe.wh.edu/insite/elec-pub/html/1998/.

Chellman, A. R. & Duchastel, P. (2000). The ideal online course. British Journal of Educational Technology, 31 (3), 229-241.

Chen, Y. J., & Willits, F. K. (1999). Dimensions of educational transactions in a videoconferencing learning environment. The American Journal of Distance Education, 13 (1), 45-59.

Clark, D. (1999). Getting, Results with Distance Education. The American Journal of Distance Education, 12 (1), 38 – 51.

Clark, R. E. (1994). Media will never influence learning. Educational Technology Research and Development, 42 (2), 21-29.

Clark, L. H. & Starr, I. S. (1996). Secondary and Middle School Teaching Methods. New Jersey: Prentice Hall.

Cohen, J., & Cohen, P. (1983). Applied multiple regression/correlation analysis for the behavioral sciences (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum Associates.

Collins, M. (2000). Comparing Web, correspondence and lecture versions of a second-year non-major biology course. British Journal of Educational Technology, 31 (1), 21-27.

Cooney, E. M., Davis, E. & Henderson, J. W. (1975). Dynamics of Teaching Secondary School Mathematics. Boston: Houghton Mifflin Co.

Cronin, P. (1997). Learning and assessment of instruction. Unpublished report, Edinburgh: University of Edinburgh Centre for Cognitive Science. Retrieved online at 11/03/03, Available: http://www.cogsci.ed.ac.uk/~paulus/Work/Vranded/litconsa.htm.

Crossman, D. M. (1997): The evolution of the World Wide Web as an emerging technology tool. In: Kahn, B. H. (ed.): Web-based Instruction. (pp. 19-25). NJ, Englewood Cliffs: Ed. Techn. Publ.

Cruickshank, D. R., Bainer, D. & Metcalf, K. (1995). The act of teaching. New York, NY: McGraw Hill, Inc.

Crusius, T. W. & Channell, C. E. (2000). The aims of argument: A rhetoric and reader (3rd. ed.). Mountain View, CA: Mayfield.

Cyrs, T. E., & Conway, E. (1997). Teaching a distance with merging technologies: An instructional systems approach. Las Cruces, MN: Center for Educational Development, New Mexico State University.

Davies, R. B., & Mendenhall, R. (1998). Evaluation comparison of online and classroom instruction for HEPE 129 – Fitness and lifestyle management course. (Eric Document Reproduction Service No. ED 427 752)

Davis, E.A., & Linn, M. (2000). Scaffolding students' knowledge integration: Prompts for reflection in KIE. International Journal of Science Education, 22 (8), 819-837.

Dominguez, P. S., & Ridley, D.R. (1999). Reassessing the assessment of distance education: A proposal for an alternative framework in higher education. T.H.E. Journal, 27 (2), 70-76.

Downes, S. (2003). Public Policy, Research and Online Learning. Retrieved online at 29/03/04, Available:http://www.acm.org/ubiquity/views/nv4i25_downes.html.

Draves, W. A. (2000). Teaching online, LERN Books, River Falls, Wisconsin.

Driscoll, M. (2002). Web-based training: creating e-learning experiences. San Francisco: Jossey-Bass/Pfeiffer.

Duatepe, A. (2004). The Effect of Drama based Instruction on seveth grade stuents' geometry achievement, Van Hiel geometric thinking level, attitude towards mathematics and geometry. Unpublished Doctoral Thesis, Middle East Technical University, Ankara.

Eastmond, D. V., & Ziegahn, L. (1995). Instructional design for the online classroom. In Z. L. Berge & M. P, Collins (Eds.) Computer-mediated communication and

online classroom, Vol. III Distance Learning, Cresshill, NJ: Hampton Press, 53-68.

Ertmer, P.A., Evenbeck, E., Cennamo, K.S., & Lehman, J.D. (1994). Enhancing self-efficacy for computer technologies through the use of positive classroom experiences. Educational. Technology Research & Development, 42 (3), 45-62.

Eryilmaz, A. (2002). Effects of conceptual assignments and conceptual change discussions on students' misconceptions and achievement regarding force and motion. Journal of Research in Science Teaching, 39 (10), 1001-1015.

Farrington, G. (1999). The new technologies and the future of residential undergraduate education. In R. Katz. (Ed.), Dancing with the devil: Information technology and the new competition in higher education. San Francisco: Jossey-Bass.

Flavell, J. H. (1979). Metacognitive monitoring: A new idea of cognitive development inquiry. American Psychologist, 34 (10), 906-911.

Fraenkel, J. R., & Wallen, N. E. (1996). How to design and evaluate research in education. (3rd ed.). New York: McGraw-Hill.

Fredericksen, E., Pickett, A., Pelz, W., Shea, P., & Swan, K. (2000). Student satisfaction and perceived learning with online courses: Principles and examples from the SUNY Learning Network. Journal of Asynchronous Learning Network [Online], 14 (2), http://www.aln.org/alnweb/journal/Vol14_issue2/le/Fredericksen/LE-fredericksen.htm

French, D. (1999). Internet based learning: an introduction and framework for higher education and business. Stylus Publishing, Sterling, Virginia.

Gagné, R. (1985). The conditions of learning and theory of instruction, (4th Ed.). New York : Holt, Rinehart and Winston.

Gagné, M., & Shepherd, M. (2001). Distance learning in accounting: A comparison between a distance and traditional graduate accounting class. T.H.E. Journal, 28 (9), 58-65.

Garner, R., & Alexander, P. (1989). Strategic processing of text: An investigation of the effects on adults' question-answering performance. Journal of Educational Research, 75, 144-148.

Garrison, D. R. (1997). Self-directed learning: Toward a comprehensive model. Adult Education Quarterly, 48(1), 18–33.

Ge, X. & Land, S. M. (2003). Scaffolding students' problem solving in an ill-structured task using question prompts and peer interactions. Educational Technology, Research and Development, 51 (1), 221-38.

Goggin, N. L., Finkenberg, M. E., & Morrow, J. R. (1997). Instructional technology in higher education teaching. Technology In Teaching, 280-290.

Goodwin, B. N. (1993). A study of the perceptions and attitudes exhibited by distance education students and faculty at the University of Phoenix online program (Doctoral Dissertation, University of Arizona, AZ, 1993). Dissertation Abstracts International, 55, 0939.

Grasel, C., Fischer, F., & Mandl, H. (2001). The use of additional information in problem-oriented learning environments. Learning Environments Research, 3, 287-305.

Gravetter, F. J. & Wallnau, L. B. (1996). Statistics for the Behavioral Sciences. West Publishing Company, St. Paul, MN.

Hackman, M. Z., & Walker, K. B. (1990). Instructional communication in the televised classroom: The effects of system design and teacher immediacy on student learning and satisfaction. Communication Education, 9, 196-206.

Haladayna, T. M. (1997). Writing test items to evaluate higher order thinking. Allyn & Bacon, MA.

Hannafin, M. L., Land, S. M., & Oliver, K. (1999).Open learning environments: Foundations, methods, and models. In C.M. Reigeluth (Ed.), Instructional design theories and model: A new paradigm of instructional theory (Vol. III) (pp. 115-141). Hillsdale, NJ: Lawrence Erlbaum Associates.

Hara, N., & Kling, R. (1999). Students' frustration with a Web-based distance education course: A taboo topic in the discourse (CSI Working Paper). Bloomington, IN: Indiana University. Retrieved online at 15/03/03, Available: http://www.slis.indiana.edu/ CSI/ wp99 01.html

Harasim, L. (1990). Online education. An environment for collaboration and intellectual amplification. In online education: Perspectives on a new environment (pp. 39-64), New York: Praeger.

Harasim L., Hiltz, S. R., Teles, L. & Turoff, M. (1995). Learning Networks: A Field Guide to Teaching and Learning Online, Massachusetts Institute of Technology, Cambridge.

Hardy, D. & Boaz, M. (1997). Learner development: beyond the technology. In T.E. Cyrs (ed.), Teaching and learning at a distance: what it takes to effectively

design, deliver and evaluate programs, San Francisco: Jossey-Bass Publishers.

Harris, G. L., Pearlman, N. & Wilcox, P. (1977). Achievement test items – Method of Study, CSE Monograph 6,

Herring, M., & Smaldino, S. (1997). Planning for interactive distance education: A handbook. Washington, DC: AECT Publications.

Hesser, L. A., & Kontos, G. (1996-1997). Distance education: Applications in a masters and doctoral program. Journal of Educational Technology Systems, 25, 249-271.

Hill, J. R. & Hannafin, M. J. (1997). `Cognitive strategies and learning from the World Wide Web, Educational Technology Research and Development, 45 (4), 37-64.

Hillman, D. C. A., Willis, D. J. & Gunawardena, C. N. (1994). Learner-interface interaction in distance education: An extension of contemporary models and strategies for practitioners. The American Journal of Distance Education, 8 (2), 30-42.

Hiltz, S. R. (1997). Impacts of college-level courses via asynchronous learning networks: Some preliminary results. Retrieved online at 29/02/02, Available: http://eies.njit.edu/hiltz/workingpapers/philly /philly.htm.

Hislop, G. (2000). Working professional as part-time online learners. Journal of Asynchronous Learning Networks [Online], 4(2), Available: http://www.aln.org/alnweb/journal/vol4_issue2/le/hislop/LE-hislop.htm.

Hew, K. F. & Cheung, W. S. (2003). Evaluating the participation and quality of thinking of pre-service teacher. International Journal of Instructional Media, 30 (4). 355.

Hughes, I. (2001). Teaching action research on the web. Educational Technology & Society [Online], 4(3), Available http://ifets.massey.ac.nz/periodical/vol 3. 2001/huges.html .

Hunt, N. P., & Bohlin, R. M. (1993). Teacher education students' attitudes toward using computers. Journal of Research on Computing in Education, 25 (4), 487-497.

Howland, J. L. & Moore, J. L. (2002). Student perceptions as distance learner in Internet based courses. Distance Education, 23 (2), 183-195.

Inman, E., Kerwin, M. & Mayes, L. (1999). Instructor and student attitudes toward distance learning. Community College Journal of Research and Practice, 23 (6), 581-591.

Jiang, M. (1998). Distance learning, in a Web-based environment: An analysis of factors influencing – students' perceptions of online learning (Doctoral dissertation, State University of New York at Albany, NY, 1998). Dissertation Abstracts International, 59, 4044.

Jiang, M., & Ting, E. (1998). Course design, instruction, and students' online behaviors: A study of instructional variables and student perceptions of online learning. Paper presented at the Annual Meeting of the American Educational Research Association, April 13-17, 1998, San Diego, CA

Johnson, J. M. (2001). Evaluating technology resources. Learning and Leading with Technology, 29 (2), 58-61.

Jonassen, D., Davidson, M., Collins, M., Campbell, J. and Haag, B. B. (1995). Constructivism and computer-mediated communication in distance education. The American Journal of Distance Education, 9 (2), 17-25.

Jonassen, D. H. (1997). Instructional design models for well-structured and ill-structured problem-solving learning outcomes. Educational Technology Research and Development, 45 (1), 65-94.

Jonassen, D. H. (1999). Designing constructivist learning environments. In C.M. Reigeluth (Ed.), Instructional design theories and model: A new paradigm of instructional theory (Vol. II) (pp.215-241). Hillsdale, NJ: Lawrence Erlbaum Associates.

Jonassen, D. H. (2000). Computers as mindtools for schools. Prentice Hall, Upper Saddle, NJ.

Khan, B. (1997) Web-based Instruction, Educational Technology. Englewood Cliffs, NJ.

Kanuka, H., & Anderson, T. (1998). Online social interchange discord, and knowledge construction, Journal of Distance Education, 13 (1), 57-74.

Kanuka, H., Collett, D. & Caswell, C. (2002). University instructor perceptions of the use of asynchronous text-based discussion in distance courses, The American Journal of Distance Education, 16 (3), 131-151.

Keagan, D. (1997). Foundations of Distance Education. New York: Routledge.

Kearsley, G. (1995). The nature and value of interaction in distance learning. Retrieved online at 11/03/02, Available: http://www .gwu.edu/-etl/interact.html

Kearsley, G. (1998). Educational technology: A critique. Educational Technology, 38, 47-51.

Kearsley, G., & Lynch, W. (1996). Structural issues in Distance Education. Journal of Education for Business, 71 (4), 191-196.

Keller, A. (1997). Systems Management with Distributed Objects: Porting SNMP Agents to a CORBA Environment, Proceedings of the 4th Workshop of the OpenView University Association: OVUA'97.

King, A., & Rosenshine, B. (1993). Effect of guided cooperative questioning on children's knowledge construction. Journal of Experimental Education, 61 (2), 127-148.

Kruse, K., & Keil, J. (2000). Technology-based training: The art and science of design, development, and delivery. San Francisco: Jossey-Bass Pfeiffer.

Larson, M. R. & Bruning, R. (1996). Participant perceptions of a collaborative satellite-based mathematics course. The American Journal of Distance Education, 10 (1), 6-22.

Laube, M. R. (1992). Academic and social integration variables and secondary student persistence in distance education. Research in Distance Education, 4(1), 2-5.

Lauzon, A. C., & Moore, G. A. B. (1989). A fourth generation distance education system: Integrating computer-asissted learning and computer conferencing. The American Journal of Distance Education, 3 (1), 38-49.

Lawless, C. (2000). Using learning activities in mathematics: workload and study time. Studies in Higher Education, 25 (1), 97-112.

Leggett, W. R. & Persichitte, K. A. (1998). Blood, Sweat, and Tears: 50 Years of Technology Implementation Obstacles. Retrieved online at 12/03/04, Available: http://www.saskschools.ca/ ~parkland/ obstacles.htm.

Levine, T., & Donitsa-Schmidt, S. (1998). Computer use, confidence, attitudes, and knowledge: A causal analysis. Computers in Human Behavior, 14, 125–146.

Lin, X., Hmelo, C., Kinzer, C. K., & Secules, T.J. (1999). Designing technology to support reflection. Educational Technology Research and Development, 47 (3), 4362.

Lin, X., & Lehman, J. D. (1999). Supporting learning of variable control in a computer-based biology environment: Effects of prompting college students to reflect on their own thinking. Journal of Research in Science Teaching, 3 (7), 837-858.

Lyord, B. H. & Gressard, C. (1984). Reliability and factorial validity of Computer Attitude Scales. Educational and Psychological Measurement, 45, 903-980.

Maddux, C., & Johnson, L. (2004). Computer Attitude and Achievement: Is Time an Intermediate Variable?. Journal of Technology and Teacher Education [Online], 12 (4), 593-607, Available: http://dl.aace.org/16349.

Manathunga, C. (2002) Designing online learning modules: An Australian example in teacher education. International Journal of Instructional Media, 29 (2), 185-195.

Mangan, K.S. (1999). Top business schools seek to ride a bull market in online M.B.A.'s. Chronicle of Higher Education, 45 (19), 27- 43.

Manuel, K. (2001). Teaching an online information literacy course. Reference Services Review, 29 (3). 219.

Martinez, M. E. & Mead, N. A. (1988). Computer competence: The first national assessment. (Report No. ETS-17-CC-01). Princeton, NJ: National Assessment of Educational Progress. ((ERIC Document Reproduction Service No. ED 341 375).

Matuga, J. M. (2001). Electronic pedagogical practice: The art and science of teaching and learning online. Educational Technology & Society [Online], 4(3), Available http://ifets.massey.ac.nz/periodical/vol_3_2001/matuga.html.

McEachern, R. W. (December 1999). A metacognitive approach to business communication, Business Communication Quarterly, 62, (4), 80-83.

McGrath, J.E., & Hollingshead, A.B. (1993). Putting the "group" back in group support systems: Some theoretical issues about dynamic processes in groups with technological enhancements. In L.M. Jessup & J.S. Valacich (Eds.), Group support systems: New perspectives (pp. 78-96). NY: Macmillan.

McIsaac, M. S. & Gunawerdana, C. N. (1996). Distance education, In D. Jonassen, Handbook for Research on Educational Communications and Technology (pp. 403-437). Scholastic Press, New York, pp. 403-437.

McIsaac, M. S., Blocher, J. M., Mahes, V., & Vrasidas, C. (1999). Student and teacher perceptions of interaction in onlne computer-mediated communication. Educational Media International, 36 (2), 121-131.

McKinnon, G. R. (2000). The Dilemma of evaluating electronic discussion groups. Journal of Research on Computing in Education, 33 (2), 125-132

McLain, K.V., Gridley, B. E., & Macintosh, D. (1991). Value of a scale used to measure metacognitive reading awareness. Journal of Educational Research, 85 (2), 81-87.

McLoughlin, C., & Luca, J. (2002). A Learner-centered approach to developing team skills through web-based learning and assessment. British Journal of Educational Technology, 33 (5), 571-582.

McNabb, J. (1994). Telecourse effectiveness: Findings in the current literature. TechTrends, 39 (4), 39-40.

Merisotis, J. P. & Phipps, R. A. (1999). What's the Difference? – Outcomes of Distance vs. Traditional Classroom Based Learning. Change 31 (3), 12-22.

Miller, J. (1999). Critical thinking and asynchronous discussion. Inquiry: Critical Thinking Across the Disciplines, 19, 18-27.

Miller, B. (2000). Comparison of large-class instruction versus online instruction: Age does make a difference. Retrieved online at 01/02/03, Available: http: //leahi.kcc.hawaii.edu/org/ tcon2k/paper/ paper_millerb.html.

Moon, S. (1994). The relationship among gender, computer experience, attitudes toward computers. Paper presented at the annual meeting of the Mid-South Educational Research Association, Nashville, TN. (ERIC Document Reproduction Service No ED 381 142)

Moore, M. G. (1979). Toward a theory of independent learning and teaching. Journal of Higher Education, 44, 66-69.

Moore, M. G. (1986). Self-directed learning and distance education. Journal of Distance Education, 1(1), 7-24.

Moore, M. G. (1989). Editorial: Three types of interaction. The American Journal of Distance Education, 3 (2), 1-6.

Moore, M. G. (1991). Distance education theory. The American Journal of Distance Education, 5 (3), 1-6.

Moore, M. G.1993a). Three types of interaction. In K. Harry, M. John, & D. Keagan (Eds), Distance Education: New Perspectives (pp. 19-24), London & New York: Routledge.

Moore, M. G. (1993b). Theory of transactional distance. In D. Keagan (Ed), Theoretical Principles of Distance Education (pp. 22-38), London & New York: Routledge.

Moore, M. G. (1994). Editorial: autonomy and interdependence. The American Journal of Distance Education, 8 (2), 1-5.

Moore, M. G. (2002). Editorial: First Thoughts on Metaskills. The American Journal of Distance Education.16 (1), 1–4.

Moore, M. G. & Kearsley, G. (1996). Distance education: A systems view. NY: Wadsworth Publishing Co.

Moore, M. G. & Thompson, M. M. (1997). The effects of distance learning. (ACSDE Research monograph, 15). University Park, PA: American Center for the Study of Distance Education, Pennsylvania State University

Morgan, C. & O'Reilly, M. (1999). Assessing open and distance learners. London: Kogan Page.

Motiwalla, L., & Tello, S. (2000). Distance learning on the Internet: An exploratory study. The Internet and Higher Education, 2 (4), 253-264.

Muirhead, B. (1999). Attitudes toward interactivity in a graduate distance education program: A qualitative analysis. Parkland, FL: Dissertation.Co.

Mulligan, R. & Geary. S. (1999). Requiring writing, ensuring distance-learning outcomes. International Journal of Instructional Media, 26 (4), 387-395.

Navarro, P., & Shoemaker, J. (1999). The power of cyberlearning: An empirical test. Journal of Computing in Higher Education, 11, 29-54.

Neal, (1999). Distance education. National Forum: Phi Kappa Phi Journal, 79 , 40 - 43.

Nelson, T. O., & Narens, L. (1990). Metamemory : A theoretical framework and new findings. In G. Brower (Ed.), The psychology of learning and motivation (Vol. 26, pp.125-141). New York: Academic Press.

Norton, P. (2005). Scaffolding online learning: The ART of Mentoring. Paper Presented in Society for Information Technology & Teacher Education, March 1-5, 2005, Phoenix, AZ

Offir, B. & Lev, J. (2000). Constructing an aid for evaluating teacher-learner interaction in distance learning. Paper presented at the Ed Media & Ed-Telecom 2000.

Oliver, R., & Omari, A. (2001).Student responses to collaborating and learning in a Web-based environment. Journal of Computer-Assisted Learning, 17 (1), 34-47.

Olson, T. & Wisher, R. (2002). The Effectiveness of Web-Based Instruction: An Initial Inquiry. International Review of Research in Open and Distance Learning [Online], Available: http://www.irrodl.org/content/v3.2/olsen.html/.

Osman, M., & Hannafin, M. (1994). The effects of advance questions and prior knowledge on science learning. Journal of Educational Research, 88 (1), 5-13.

Owston, R. D. 1997, The World Wide Web: A technology to enhance teaching and learning? Educational Researcher, 26 (3), 27-33.

Ozen, K. (2000). A case study of students' experiences in an online college physics course. Unpublished Doctoral Thesis, University of Cincinati.

Parker, A. (1999). Interaction in distance education: The critical conversation. Educational Technology Review, 12, 13-17.

Pasceralla, E. T., Whitt, E. J., Nora, A., Edison, M., Hagedorn, L. S., & Terenzini, P. T. (1996). What have we learned from the first year of The National Study of Student Learning? Journal of College Student Development, 37 (2), 182-192.

Palloff, R. & Pratt, K. (1999). Building Learning Communities in Cyberspace: Effective Strategies for the Online Classroom, Jossey-Bass, San Francisco.

Perraton, H. (1988). A theory for distance education. In D. Sewart, D. Keegan, & B. Holmberg (Ed.), Distance Education: International perspectives (pp. 34-45). New York: Routledge.

Pevato, B. (2003). Method of instruction and award of credit to adult students at southwest Texas State University**.** International Journal of Instructional Media, 30 (1), 25.

Piaget, J. (1977). The development of thought: Equilibrium of cognitive structures. New York, Viking Press.

Piling-Cormick, J. (1997).Transformative and self-directed learning in practice. New Directions for Adult and Continuing Education, 74, 69-77.

Pintrich, P. R., & Schunk, D. H. (1996). Motivation in education: Theory, research, and application. Hillsdale, NJ: Prentice-Hall.

Pintrich, P. R., Wolters, C. A., & Baxter, G. P. (2000). Assessing Metacognition and self-regulated learning. In G. Schraw & J. C. Impara (Ed.), Issues in the measurement of metacognition (pp. 43-97). Lincoln: Buros Institute of Mental Measurements.

Potosky, D. & Bobko, P. (2001). A model of predicting computer experience from attitudes towards computer. Journal of Business and Psychology, 15 (3), 391-404.

Price, R. V. (1996). Technology doesn't teach. People do, TechTrends, 41 (6), 17-18.

Price, R., & Wniecki, D. (1995). Attitudes and skill levels of college students entering a typical introductory college compuitng course. Journal of Computing in Teacher Education, 12 (1), 20-25.

Rainer, Jr., R. K., & Miller, M. D. (1996). An assessment of the psychometric properties of the Computer Attitude Scale. Computers in Human Behavior, 12, 93–105.

Reeve, R. A., & Brown, A. L. (1984). Metacognition reconsidered: Implications for intervention research (technical Report No: 328) Urbana-Champaign, IL: University of Illinois at Urbana-Champaign.

Renkl, A. (2002). Learning from worked-out examples: Instructional explanations supplement self-explanations. Learning & Instruction, 12, 529-556.

Reynolds, R. E., Sinatra, G. M. & Jetton, T. L. (1996). View of Knowledge Acquisition and Representation: A continuum from experience centered to mind centered. Educational Psychologist, 31 (2), 93-104.

Richardson, J. T. E. (2003). Approaches to studying and perceptions of academic quality in electronically delivered courses. British Journal of Educational Technology, 34, 45-56.

Riel, M. (1998). Foreword: Conceptual order and collaborative tools-Creating intellectual identity, in C.J. Bonk & K.S. King (eds), Electronic Collaborators: Learner-Centered Technologies for Literacy, Apprenticeship, and Discourse, Erlbaum, Mahwah, NJ, pp. xvii-xx.

Ritchie, D. & Hoffman, B. (1997). Incorporating instructional design principles with the world wide web in Khan, B. H. (ed.) Web-based Instruction Educational Technology Publications, Englewood Cliffs, NJ, pp. 135-138.

Robey, D. (1979). User attitudes and management information system use. Academy of Management Journal, 22, 527–538.

Rodes, P., Knapczyk, D., Chapman, C. & Hacjin, C. (2000). Involving teachers in web based professional development. T.H.E. Journal [Online], 27 (10), Available: http://www.thejournal.com/magazine/vault/Λ2868.cfm.

Rogers, J. (2000). Communities of practice: a framework for fostering coherence in virtual learning communities. Educational Technology & Society [Online], 3 (3), Available: http://ifets.massey.ac.nz/periodicals/vol32000/c01.html.

Romainville, M. (1994). Awareness of cognitive strategies: The relationship between university students' metacognition and their performance. Studies in Higher Education, 19 (3), 359-367.

Romiszowski, A. J. (1997). "Web-based distance learning and teaching: Revolutionary invention or reaction to necessity?" in B.H. Khan (ed.) Web-based Instruction, Educational Technology, Englewood Cliffs, NJ, pp. 25-37. Rosenshine, Meister, & Chapman, 1996.

Russell, T. (1999). "No Significant Difference" Phenomenon as reported in 248 Research Reports, Summaries, and Papers Fourth Edition. North Carolina: North Carolina State University. Retrieved online at 12/02/05, Available: http://teleeducation.nb.ca./phenom/

Ryan, R. C. (2000). Student assessment comparison of lecture and online construction equipment and methods classes. T.H.E. Journal [Online], 27 (5), Available: http://www.thejournal.com/magazine/vault/A2596.cfm.

Saba, F., & Shearer, R.L. (1994). Verifying key theoretical concepts in a dynamic model of distance education. The American Journal of Distance Education, 8 (1), 36-59.

Salomon, G., & Perkins, D. (1996). Learning in wonderland: What do computers really offer education? In S. T. Kerr (Ed.), Technology and the future of schooling (Vol. Ninety-fifth yearbook of the National Society for the Study of Education, Part II). Chicago, IL: University of Chicago Press

Savery, J. R. and T. M. Duffy (1995). Problem based learning: an instructional model and its constructivist framework. Educational Technology, 35 (5), 31-38.

Scardamalia, M., & Bereiter, C. (1993). Computer support for knowledge-building communicaties. Journal of the Learning Sciences, 3 (3), 265-283.

Schmidt, K. J. Sullivan, M. J. & Hardy, D. W. (1994). Teaching migrant students algebra by audio conference. The American Journal of Distance Education, 8 (3), 51-63.

Schneider, D. (1994). Teaching and learning with internet tools: A position paper. Proceedings of the First International Conference on the World-Wide Web. Geneva: University of Geneva. Retrieved online at 02/02/02, Available: http://tecfa.unige.ch/edu-comp/edu-ws94/contrib/schneider/schneide.fm.html.

Schraw, G. (2000). Assessing Metacognition: Implications of the Buros Symposium. In G. Schraw & J. C. Impara (Ed.), Issues in the measurement of metacognition (pp. 297-321). Lincoln: Buros Institute of Mental Measurements.

Schraw, G., & Moshman, D. (1995). Metacognitive Theories. Educational Psychology Review,7, 351-371.

Schrum, L. (1995). Online teaching and learning: Essential conditions for success!, In Lau, L.(Ed.), Online teaching and learning, Idea Group Publishing, Hershey, PA, pp. 91-106.

Schulman, A. H., & Sims, R. L. (1999). Learning in an online format versus an in-class format: An experimental study. Retrieved online at 01/03/02, Available: http://www.thejournal.com/magazine/vault/a2090.cfm.

Serban, A.M. (2000). Evaluation of fall 1999 online courses. ED at a Distance [Online], 14(10), Available: http://www.usdla.org/html/journal/OCT00_Issue/story04. htm.

Selinger, M. (1997). Open Learning, electronic communications and beginning teachers. Europpan Journal of Teacher Education, 20 (1), 71-84.

Sener, J., & Stover, M.S. (2000). Integrating ALN into an independent study distance education program: NVCC case studies. Journal of Asynchronous Learning Networks [Online], 4(2), Available: http://www.aln.org/alnweb/journal/ Vol4_issue 2/le/sener /le-sener.htm.

Sherry, L. (1996). Issues in distance learning. International Journal of Educational Telecommunication, 1 (4), 337-365.

Shotsberger, P. G., Baker, L., Stammen, R., Velter, R. & Nelson, M. (1997). Web-based professional development: current implementations and future prospects. Retrieved online at 13/01/01, Available: http://www.coe.oh.edu/ insite/elec_pub / HTML1997/ tg_sho2htm.

Simonson, M.R. (1997). Evaluating teaching and learning at a distance. In T. Cyrs, Editor: Teaching and Learning at a distance: What it takes to effectively design, deliver, and evaluate programs (pp. 87-94). San Francisco: Jossey-Bass

Simonson, M., Smaldino, S., Albright, M., & Zvacek, S. (2000). Teaching and learning at a distance: Foundations of distance education. Upper Saddle River, NJ: Prenlice Hall, Inc.

Smith, B. N., & Neccassary, J. R. (1996). The computer ability scale: Replication and extension involving college computer literacy students. In D.H. Redman

(Ed.) AERA Business Education and Information Sysytems Resaecrh Special Interest Group proceedings. Washington, DC: American Educational Research Associtions (ERIC No. ED 395 218).

Sorg, J. J. (2000). A case study describing student experiences of learning in an interactive computer-mediated communication context in a distance education environment. Unpublished Doctoral Thesis, Ball State University.

Spiro, R, J., Feltovich, P. J., Jacobsen, M. J., & Coulson, R. L. (1991). Cognitive Flexibility, constructivism, and hypertext: Random acess instruction for advamced knowledge acquisition in ill-structured domains. Educational Technology, 31 (5), 24-33.

Spitzer, D.R. (2001). Don't forget the high-touch with the high-tech in distance learning. Educational Technology, 41 (2), 51-55.

Spratt, C., Palmer, S. & Coldwell, J. (2000). Using technologies in teaching an initiative in academic staff development. Educational Technology & Society [Online], 3 (3), Available: http:// ifets.ieee.org/periodical/vol3_2000/f03.html.

Steel, J. & Hudson, A. (2001). Educational technology in learning and teaching: the perceptions and experience of teaching staff, Innovations in Education and Teaching International, 38 (2), 103-111.

Streibel, M. J. (1991). Instructional plans and situated learning. In G.J. Anglin, (ed.), Instructional technology, past, present, and future (pp. 117-132). Englewood, CO: Libraries Unlimited.

Swan, K., Shea, P. & Fredericksen, E. (1999). Student satisfaction with online learning. Utica/Rome, NY: CIT '99: Supporting Instructional Technology: What Really Counts?, 100-102.

Tabachnick, B.G. & Fidell, L.S. (1989). Using multivariate statistics (2nd ed.) New York: Harper & Row.

Tam, M. (2000). Constructivism, instructional design, and technology: implications for transforming distance education. Educational Technology and Society [Online], 3(2), Available: http://ifets.ieee.org/ peridocal /vol_2_2000.html.

Taylor, J. A. & Mohr, J.. (2001). Mathematics for math anxious students studying at a distance. Journal of Developmental Education, 25 (1), 30-37.

Taylor, H. G. & Stuhlmann, J. M. (1998). The Clovis Project: enhancing student learning and teacher training with telecommunications. International Journal of Instructional Media, 25 (4), 357-366.

Temple, L., & Lips, H. M. (1989). Gender differences and similarities in attitudes toward computers. Computers in Human Behavior, 5, 215–226.

Thompson, M . M. (1998). Distance learners in higher education, in Distance Learners in Higher Education: Institutional Responses for Quality Outcomes. C.C. Gibson, Atwood, Madison, WI, pp. 9-24.

Trentin, G. (2000). The quality-interactivity relationship in distance education. Educational Technology, 40 (1), 17-27.

Trentin G. & Benigno V. (2000). The Evaluation of Online Courses, International Journal of Computer Assisted Learning, 16 (3), 259-270.

Trentin, G., & Science. S. (1999). The roles of tutors and experts in designing online education courses. Distance Education, 20 (1), 144-161.

Tsai, C.- C. (2004). Beyond cognitive and metacognitive tools: the use of Internet as an "epistemological" tool for instruction. British Journal of Educational Technology, 35 (5), 525-536.

Üstün, I. (2003). Developing the understanding of geometry through a computer-based learning environment. Unpublished Master Thesis, Middle East Technical University, Ankara.

Vygotsky, L. S. (1978). Mind in Society: The Development of Higher Psychological Processes. Harvard University, Cambridge, MA.

Yellen, R. E. (1997-1998). Distant learning students. A comparison with traditional studies. Journal of Educational Technology, 26 (3), 215-224.

Yıldırım, S. (2000). Effects of an educational computing course on preservice and inservice teachers: A discussion and analysis of attitudes and use**,** Journal of Research on Computing in Education, 32 (4), 479-496.

Wagner, E. D. (1994). In support of a functional definition of interaction. The American Journal of Distance Education, 8 (2), 6-29.

Wang, L, Ertmer, P. A. & Newby, T. (2004). Increasing Preservice Teachers' Self-Efficacy Beliefs for Technology Integration. Journal of Research on Technology in Education. Eugene: Spring 2004.36 (3), 231 –251.

Watabe, K., Hamalainen, M. & Whinston, A. B. (1995). An Internet based collaborative distance learning system: CODILESS. Computers in Education, 24 (3), 141-155.

Weems, G. H. (2002). Comparison of beginning algebra taught onsite versus online. Journal of Developmental Education, 26 (1), 10-18.

Wegner, S. B., Holloway, K. C., & Gordon, E. M. (1999).The effects of Internet-based instruction on student learning. Journal of Asynchronous Learning Network [Online], 3(2), Available: http://www.aln.org/alnweb/journal/vol3_issue2 /wegner.htm.

Welles, J. G. (1997). Learners in a telecommuncations course. Adoption, diffusions, and tages of concern. Journal of Resarch on Computing in Education, 30 (1), 83-105.

White, H. (1996). Dan tries problem-based learning: A case study. Retrieved online at 11/02/02, Available: http://www.udel.edu/pbl/ dancase3.html

Wideman, H., & Owston, R.D. (1999). Internet-based courses at Atkinson College: An initial assessment. Retrieved online at 17/01/01, Available: http://www.edu.yorku.ca/irlt/reports/ techreport99-1.htm.

Wilhelm, A. (1997). Latinos and technology: Key findings. Retrieved online at 01/03/01, Available: http://www.cgs.edu/inst/trc_latechno.html.

Willis, J. (1995). A recursive reflective instructional design model based on constructivist-interpretivist theory. Educational Technology, 35 (6), 5-23.

Wilson, B., Teslow, J. & Osman-Jouchoux, R. (1995). The impact of constructivism (and postmodernism) on ID fundamentals. In B. B. Seels (ed.) Instructional Design Fundamentals: A review and reconsideration, Englewood Cliffs NJ: Educational Technology Publications [Online], Available: http://ouray.cudenver.edu /~jlteslow/idfund.html.

Windschitl, M. (1998). The WWW and classroom research: What path should we take? Educational Researcher, 27 (1), 28-33.

Wishart, J. & Blease, D. (1999). Theories underlying perceived changes in teaching and learning after installing a computer network in a secondary school. British Journal of Educational Technology 30 (l), 25-41.

Wood, H., & Wood, D. (1999). Help seeking, learning and contingent tutoring. Computers and Education, 33, 153-169.

Woodrow, J. (1990). Locus of control and student teacher computer attitudes. Computers in Education, 14, 421–432.

Zirkin, B., & Sumler, D. (1995). Interactive or non-interactive? That is the question! An annotated bibliography. Journal of Distance Education, 10 (1), 95-112.

Zhang, Y. & Espinoza, S. (1998). Relationships among computer self-efficacy, attitudes toward computers, and desirability of learning computing skills. Journal of Research on Computing in Education, 30 (4), 421-436.

APPENDIX A

MIDTERM EXAM

PRED 356 Methods of Math and Science Teaching
Instructor: Abdullah TOPÇU
Midterm Examination
April 21, 2004; 05:30-07:00 pm

Instructions: This exam consists of 16 questions presented in 5 sections. The total score is 100. The sections and related points are as follows:

Part I: Questions 1-3: True/False (6 Points)

Part II: Questions 4-5: Matching (24 Points)

Part III: Questions 6-7 : Fill in the Blanks (6 Points):

Part IV: Questions 8-12: Multiple Choice (10 Points):

Part V: Questions 13-16: Essay (54 Points):

Part I (total: 6 points). TRUE/FALSE. You know the drill: It's either true or false. Circle the right one. If false, **write the correct form**.

1. (2 points) "Ali, do you think these triangles are congruent?" is a elliptical question.

True False

---

2. (2 points) "Who can tell me the cell division?" is a leading question. (Forum)

True False

---

3. (2 points) For a "incorrect due to carelessness" response, teacher should provide reinforcing statement and quickly restate the fact, rules, or step needed for the right answer.(Forum)

True False

Part II (total : 24 points). MATCHING

4. (12 points) Directions: Match the description in column A with the correct method in column B. Write the matching letter in the blanks provided in column A. The items in column B may be used once, more than once, or not at all. (2 points each)

Consider the primary characteristics of the method!

Column A	Column B
-------1. Teaching how to deal with new situation	A.Questioning
-------2. Helping students to evaluate their own progress	B.Problem Solving
-------3. Providing students a structured presentation.	C.Discovery
------ 4. Helping students to organize and built.	D.Lecturing
------ 5. Helping students to monitor and regulate their action.	E.Expository
------ 6. Helping students to recognize their environment	

5. (12 points) Directions: Match the statements in column A with the type of intelligence in Column B. Write the matching letter in the blanks provided in column A. The items in column B may be used once, more than once, or not at all. (2 points each)

Column A	Column B
Student can say that	Student who has
------ 1. "After reading a text I picture the whole page in my mind."	A.Bodily/Kinesthetic Intelligence
------ 2. "If I hear something, I always remember it."	B. Interpersonal Intelligence
------ 3. "I prefer first to see something done and then to do it myself."	C. Visual/Spatial Intelligence
------ 4. "I understand the subject in a dramatic activity and role playing better.."	D. Intrapersonal Intelligence
------ 5. "I would like to experience the subject through an independent project or journal writing".	E. Musical Intelligence.
------ 6. "I can easily solve exercises in an active imagination."	F. Naturalist Intelligence

Part III (total: 6points). FILL IN THE BLANKS

6. (4 points) About ---------- question, Gurkan gave this example: “What would happen, if there were no gravity on the earth?” In general, it was ----------question. (Forum)

7. (2 points) Focusing the subject on one idea at a time and presenting it so that learners can master a point before the teacher introduces the next point is the key of the ---------- method. (Forum)

Part IV. (Total: 10 points) MULTIPLE CHOICES.
Choose the answer(s) that you deem most appropriate. Some questions may have more than one suitable answer.

8. (2 points) Which one of the following cannot be a strategy of the step ”presenting and structuring” in the direct instruction model?

A) Port - whole relationships
B) Comparative relationships
C) Constructive relationships
D) Combinatorial relationships

9. (2 points) Which one the following is NOT the primary limitations of the lecturing (a type of direct instruction)?

A) Audience is passive
B) Learning is difficult to gauge
C) Communication in one way
D) Time used for lecturing

10. (2 points) which one of the following sequences is true (common-general) in expository teaching for mastery learning?

A) Review – present content – practice – feedback
B) Present content – practice – further practice – feedback
C) Review – practice – present content – further practice
D) Present content – practice – feedback – more content

11. (2 points) Which of the following is NOT a primary characteristic of the Direct-Instruction Method?

A) Teachers set specific goals rather than general.

B) Teacher use structured learning materials.

C) Teacher provides facilitative learning environment.

D) Teachers provide students with corrective feedback.

12. (2 points) What would a teacher avoid doing during the independent practice in expository teaching?

A) Circulating around the classroom

B) Scanning written responses

C) Reminding student of necessary facts or rules

D) Prompting for the right answers

Part V (total: 54 points). SHORT ANSWER
Give a short answer for the following questions in the blanks provided below.

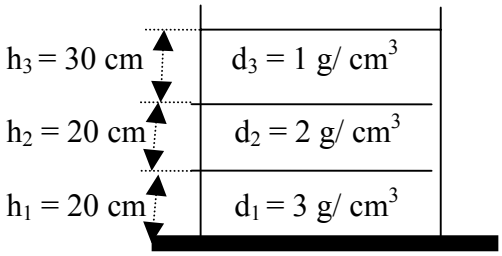
13. First "Express 3/ 8 as a decimal" then draw the distinctions in the solution related to the different types of mathematical competence (Fact, skill, concept, strategy) possessed by an individual. (8 points)

14. (15 points) Write three of the five key behaviors that could influence how we teach. Explain briefly by indicating in what way they can influence! (Write three types of influences for each behavior)

15. Solve ONE of the following problems by using the problem solving principles. Write all the stages and the strategies in the columns. Write the strategies that you used in "example" column. (15 points)

a. A ship is 20 miles to the west of another ship. The first ship is moving east at the rate of 10 miles per hour, the second ship is moving north at the rate of 15 miles per hour. Find the distance between the two ships five hours later.

b. What is the pressure at the bottom of the vessel? ($g = 10\ m/s^2$)



16. (16 points)

A. For each real number x, $Sin^2x + Cos^2x = 1$

B. $F_K = V_b \cdot d_s \cdot g$ (F_K :Kaldırma kuvveti, V_b: Batan kısmın hacmi)

Write an example teaching for ONE of the generalizations above by using inductive discovery. (Use each steps.)

APPENDIX B

SCORING OF THE MIDTERM EXAM

Part I (total: 6 points). TRUE/FALSE. You know the drill: It's either true or false. Circle the right one. If false, write the correct form.

1. (2 points) "Ali, do you think these triangles are congruent?" is a elliptical question.

True False

2 points

2. (2 points) "Who can tell me the cell division?" is a leading question. (Forum)

1 point

True **False**

1 point

Teacher-centered questions or factual questions

3. (2 points) For a "incorrect due to carelessness" response, teacher should provide reinforcing statement and quickly restate the fact, rules, or step needed for the right answer. (Forum)

1 point

True **False**

Teacher acknowledge that the answer is wrong and move immediately to the next for the correct response.

1 point

Part II (total: 24 points). MATCHING

4. (12 points) Directions: Match the description in column A with the correct method in column B. Write the matching letter in the blanks provided in column A. The items in column B may be used once, more than once, or not at all. (2 points each) Consider the primary characteristics of the method!

Column A	Column B
B or C 1. Teaching how to deal with new situation	A. Questioning
A 2. Helping students to evaluate their own progress	B. Problem Solving
E or D 3. Providing students a structured presentation.	C. Discovery
A or C 4. Helping students to organize and built.	D. Lecturing
B 5. Helping students to monitor and regulate their action.	E. Expository
C 6. Helping students to recognize their environment	

Each one is 2 points

5. (12 points) Directions: Match the statements in column A with the type of intelligence in Column B. Write the matching letter in the blanks provided in column A. The items in column B may be used once, more than once, or not at all. (2 points each)

Column A	Column B
Student can say that	Student who has
C 1. "After reading a text I picture the whole page in my mind."	A.Bodily/Kinesthetic Intelligence
E 2. "If I hear something, I always remember it."	B. Interpersonal Intelligence
A 3. "I prefer first to see something done and then to do it myself."	C.Visual/Spatial Intelligence
B 4. "I understand the subject in a dramatic activity and role playing better.."	D. Intrapersonal Intelligence
D 5. "I would like to experience the subject through an independent project or journal writing".	E. Musical Intelligence.
C 6. "I can easily solve exercises in an active imagination."	F. Naturalist Intelligence

Each one is 2 points

Part III (total: 6points). FILL IN THE BLANKS

1 point

6. (4 points) About ..**Hypothetical**.... question, Gurkan gave this example: "What would happen, if there were no gravity on the earth?". In general, it was..**divergent**...question . (Forum)

1 point

7. (2 points) Focusing the subject on one idea at a time and presenting it so that learners can master a point before the teacher introduces the next point is the key of the –**expository teaching (direct instruction**)--- method. (Forum)

2 points

Part IV. (Total: 10 points) MULTIPLE CHOICES.

Choose the answer(s) that you deem most appropriate. Some questions may have more than one suitable answer.

8. (2 points) Which one of the following cannot be a strategy of the step ”presenting and structuring” in the direct instruction model?

A) Port - whole relationships
B) Comparative relationships
C) Constructive relationships
D) Combinatorial relationships

2 points

9. (2 points) which one the following is NOT the primary limitations of the lecturing (a type of direct instruction)?

A) Audience is passive
B) Learning is difficult to gauge
C) Communication in one way
D) Time used for lecturing

2 points

10. (2 points) which one of the following sequences is true (common-general) in expository teaching for mastery learning?

A) Review – present content – practice – feedback
B) Present content – practice – further practice – feedback
C) Review – practice – present content – further practice
D) Present content – practice – feedback – more content

2 points

11. (2 points) Which of the following is NOT a primary characteristic of the Direct-Instruction Method?

A) Teachers set specific goals rather than general.
B) Teacher use structured learning materials.
C) Teacher provides facilitative learning environment.
D) Teachers provide students with corrective feedback.

2 points

12. (2 points) What would a teacher avoid doing during the independent practice in expository teaching?

A) Circulating around the classroom

B) Scanning written responses

C) Reminding student of necessary facts or rules

D) Prompting for the right answers

2 points

Part V (total: 54 points). SHORT ANSWER
Give a short answer for the following questions in the blanks provided below.
13. First "Express 3/ 8 as a decimal" then draw the distinctions in the solution related to the different types of mathematical competence (Fact, skill, concept, strategy) possessed by an individual. (8 points)

Fact: information, which is unconnected or arbitrary such that it cannot be supported by conceptual structure.
e.g. 3/8 = .375 is a fact.

Skill: knowledge and ability that enables you do something.
e.g. To be able to convert the rational numbers into decimal numbers easily.

Concept: definition of objects or events
e.g. rational numbers

Strategy: procedures which guide the choiche of which skills to use or what knowledge to draw upon at each stage.
e.g. use division rule to reach the aim.

Each definition is one point

Each example is one point

14. (15 points) Write three of the five key behaviors that could influence how we teach. Explain briefly by indicating in what way they can influence! (Write three types of influences for each behavior)

Three of them should be written: Lesson Clarity, Instructional Variety, Teacher Task Orientation, Engagement in the Learning Process, Student Success Rate.

Lesson Clarity: (1) informing learners of the lesson objective, (2) providing learners with an advance organizer, (3) checking for the task relevant prior learning at the beginning of the lesson, (4) giving directives slowly and distinctly, (4) knowing ability levels and teaches at or slightly above learners'

current level, (5) using examples, illustration.... (Writing thee behaviors sufficient)

Instructional Variety: (1) using attention gaining devices, (2) showing enthusiasm and animation, (3) varies mode of presentation, (4) incorporate students' ideas or participation in some aspects of instruction, (5) varies type of question.... (Writing three behaviors is sufficient)

Teacher Task Orientation: (1) develops unit and lesson plans reflect the most relevant features of the curriculum guide (2) handles administrative and clerical interruptions efficiently (3) stops or prevents misbehaviors with a minimum of class disruption (4) selects the most appropriate instructional model for the objectives being taught (5) build to unit outcomes with clearly definable events.... (Writing three behaviors is sufficient)

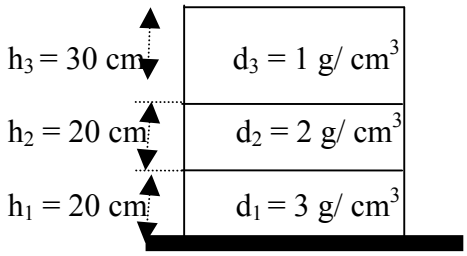
Engagement in the Learning Process: (1) elicit the desired behavior immediately after the instructional stimuli, (2) provides opportunities for feedback in a nonevaluative atmosphere, (3) uses individual and group activities, (4) uses meaningful verbal praises to get and keep students actively participating in the learning process, (5) monitors and checks progress doing independent practice.... (Writing three behaviors is sufficient)

Student Success Rate: (1) establish unit and lesson content that reflects prior learning, (2) administer correctives immediately after initial response, (3) divides instructional stimuli into small chunks, (4) plans transitions to new material in easy to grasp steps, (5) varies the pace at which stimuli are presented and continually builds toward a climax.

Each key behaviors (written by three influences of them) is 5 points.

15. Solve ONE of the following problems by using the problem solving principles. Write all the stages and the strategies in the columns. Write the strategies that you used in "example" column. (15 points)

A. A ship is 20 miles to the west of another ship. The first ship is moving east at the rate of 10 miles per hour, the second ship is moving north at the rate of 15 miles per hour. Find the distance between the two ships five hours later.
B. What is the pressure at the bottom of the vessel? ($g = 10\ m/s^2$)



Stages	Strategies	Examples
Understanding the problem **BEFORE PHASE**	▪ **Brainstorming** ▪ **Be sure task is understood** ▪ **Use of simple version** ▪ **Establish expectation** ▪ **Estimate or use mental computation**	**Give examples for these strategies according to the above problems**

1 point

2 points

1 point

Stages	Strategies	Examples
Plan-and-Carry-out Strategies **DURING PHASE** 1 point 2 points	▪ **Provide hints and suggestions** ▪ **Encourage testing of ideas** ▪ **Suggest extension or generalization** ▪ **Find a second method** ▪ **Draw a picture** ▪ **Look for a pattern** ▪ **Make a table or chart** ▪ **Try the simpler form of the problem** ▪ **Guess and check** ▪ **Make an orgaized list**	**Give examples for these strategies according to the above problems** 2 points
Looking Back Strategies **AFTER PHASE** 1 point	▪ **Justify answer** ▪ **Consider how the problem was solved** ▪ **Look for possible extensions or generalizations** 2 points	**Give examples for these strategies according to the above problems** 2 points

16. (16 points)

A. For each real number x, $Sin^2x + Cos^2x = 1$
B. $F_K = V_b \cdot d_s \cdot g$ (F_K :Kaldırma kuvveti, V_b: Batan kısmın hacmi)

Write an example teaching for ONE of the generalizations above by using inductive discovery. (Use each steps.)

1. Present Examples — 2 points

Who can tell me what you find for Sin^2 0 + Cos^2 0

2. Describe Examples — 2 points

Look at the circle and locate the trigonometric values for zero

3. Present additional examples — 1 point

Say the results of sin^2 7456 + Cos^2 7456

4. Describe second example and compare to first example — 2 points
Show the angle on the circle!
Is there any difference between them?

5. Present additional examples and non-examples — 2 points
Compare and contrast examples,

6. Prompt students to identify characteristics or relationship — 2 points

Can anyone describe the pattern we see in all these equations?

7. State definition or relationship — 3 points
For all real number x, sin^2 x + Cos^2 x = 1

8. Ask for additional examples — 2 points

Use these rules found for the sin^2 2x + Cos^2 2x

APPENDIX C

FINAL EXAM

PRED 356 Methods of Math and Science Teaching

Instructor: Abdullah TOPÇU
Final Examination
June 10, 2004; 09:00-12:00 am

Instructions: This exam consists of 20 questions presented in 5 sections. The total score is 100. The sections and related points are as follows:

Part I: Questions 1-4: True/False (8 Points)

Part II: Questions 5-6: Matching (18 Points)

Part III: Questions 7-9: Fill in the Blanks (6 Points):

Part IV: Questions 10-14: Multiple Choice (10 Points):

Part V: Questions 15-21: Essay (58 Points):

Part I (Total: 8 points). TRUE/FALSE. You know the drill: It's either true or false. Circle the right one. If false, write the CORRECT FORM WITH THEIR REASONS.

1. (2 points) Project-based learning is an instructional method that aims at student engagement in real world tasks to enhance learning.

True False

---

2. (2 points) Read the passage below!
"Ms.Ubuz wanted her students to induce how to add fractions with common denominators. So she presented such questions some of which were solved correctly, and some had incorrect solutions. Then she asked her students to figure out how to solve such problems correctly by looking at the examples she presented from the book."
It is an example for the introduction part of the project-based learning.

True False

---

3. (2 points) Teachers pool ideas and experiences through the discussion method and it is more effective after a presentation or a film that needs to be analyzed.

True False

---

4. (2 points) Read the passage below!

"Teacher: In what ways other than using from the periodic table might we predict the undiscovered elements?

Student1: We could go to the moon and see if there are some elements there we don't have.

Student2: We could dig a hole down to the center of the earth.

Teacher: These are too costly and time consuming. Can we use the elements we already have here on earth to find some discoveries?"

Both of the questions are closed clarification questions.

True False

Part II (total: 18 points). MATCHING

5. (6 points) Directions: In the following exercise, column A contains description of students' activities in team-oriented cooperative learning and column B names of three types of the team-oriented cooperative learning. Match each activity in column A with its corresponding type of team-oriented cooperative learning. Write the matching letter in the blanks provided in column A. Team-oriented cooperative learning types may be used one, or more than once (1 points each).

Column A Students' activities	Column B Types of team-oriented cooperative learning
------1. Students learn the content through the teacher presentation. ------2. Students read the unique section of the text at the beginning of the class. ------3. Students monitor teammate's level of understanding. ------4. Students study through the assigned unit given by the student's monitor. ------5. Students take worksheet and work on it with their team. ------6. Expert groups help the students by giving information about the content.	A.Students Teams - Achievement Division B. Jigsaw C. Team-Assisted Individualization

6. (12 points) Directions: In the following exercise, column A contains description of students' activities in the "discussion method" and column B names of three types of the discussion method. Match each activity in column A with its corresponding types of discussion in Column B. Write the matching letter in the blanks provided in column A. The type of the discussion may be used once, more than once (2 points each)

Column A Activities	Column B Types of the Discussion
------- 1. Students in class ask questions to the groups of the students having conversations.	A. Panel
------- 2. Students make very hard preparations about the topics such as the life in Mars, cell division, etc. and present the differing positions about the topic.	B. Debates
------- 3. A group of students make some preparations about the usage of nuclear energy and each student makes an opening statement about the topic and continues to talk under the control of the leader.	C. Symposium
------- 4. Two groups of students prepare and discuss about advantages and disadvantages of using "lens".	
------- 5. Quite hard discussion takes place between two groups who advocate two opposing views.	
-------- 6. After presenting the topics, the presenter student answers the questions of their friends in the classroom.	

Part III (total: 6 points). FILL IN THE BLANKS

7. (2 points) The question "How do single-celled animals reproduce themselves and divide up to create similar animal life that looks like themselves" is an ineffective question because it is ----------question. It should be stated as: ---------- ----------

8. (2 points) Cooperative learning has two important features, which distinguish it from other forms of small group instructions---------- and ----------.

9. (2 points) Teacher constructs a role-playing scenario about the working principles of eye. The teacher gives students their roles according to the structure of the eye. For example; two students may be "the iris", one of them may be "the lens", and so on….

In this case, the proper role of the teacher is –---------- to facilitate understanding and start the play.

Part IV. (Total: 10 points) MULTIPLE CHOICES.
Circle the answer(s) that you deem MOST appropriate.

10. (2 points) A pupil fails to answer the question: "why do astronauts weigh less on the moon than on earth?" Which of the following would be a good starting prompt to lead the pupil towards the idea of gravity?

A) How much do you weigh yourself?
B) How much less do the astronauts weigh on the moon?
C) Not only the astronauts weigh less but also they can jump higher. Why?
D) How can you compare the weight of the astronauts? Why?

11. (2 points) Which one of the following is NOT TRUE about **inductive discovery** method?

A) Children own the knowledge
B) Teacher ensures integrity of children's construction
C) Experimentation causes curiosities
D) Teacher tells children how to develop

12. (2 points) Which one of the following is NOT TRUE for the drama as a method?

A) Experiential approach is used for learning
B) Product is the major goal of the drama.
C) A variety of communication experiences are offered.
D) Teacher becomes a learner among the learners

13. (2 points) Which of the following techniques would be LEAST characteristic of Discovery Learning?

A) Permitting mistakes
B) Allowing students to ask questions
C) Introducing disturbing data
D) Stating behavioral objectives

14. (2 Points) Which of the followings is NOT TRUE about the drills?

A) They provide practice for predefined skills.

B) They give immediate feedback to the student

C) They attempt to teach new material by direct instruction.

D) They provide some forms of correction and remediation

Part V (total: 50 points). SHORT ANSWER

Give a short answer for the following questions in the blanks provided below.

15. (6 points) Define what teacher's task orientation is and write three most important questions that teacher must ask himself/herself to achieve high level of task orientation.

16. (6 points) Assume that you use expository teaching as a method.
Design your lesson plan on ……
Please consider only these levels of detail.

1. What is the subject area for your lesson?
2. What is the grade level for your lesson?
3. Use "combinatorial relationship" to structure and present the content of the subject.

17. (8 points) A typical algorithmic exercise is given below:

```
 503
_267
------
 236
```

a. What is the subject area for your lesson?

b. What is the grade level for your lesson?

c. Turn it into a problem or an investigation type of mathematical task and explain the reason.

18. (6 points) Assume that you use cooperative learning method;
Design your own lesson on…….
Please consider only these levels of detail.
a. What is the subject area for your lesson?
b. What is the grade level for your lesson?
c. How will you assess your students' performances? (What performance standards will you use? You can link to a separate rubric document from here, or you could briefly summarize your criteria on this page. Will you evaluate students individually, or evaluate the group as a whole?)

19. (12 points) Assume that you use computer assisted instruction;
Design your own lesson on "graph of the quadratic equation" or "cell division". Please consider only these levels of detail.
a. What is the grade level for your lesson?
b. What are your learning objectives?
c. How will you design your students' activities? (Questions to be answered, the learners' activities. List the steps your students will go through as they accomplish the task.)

20. (12 points) Assume that you use project-based learning; Design your own lesson on

Subject 1: Interest Problem
Subject 2: Poles of the Magnet

Please consider only these levels of detail

a. What is the grade level for your lesson?

b. How will you design your students' activities (Essential questions-Designing a plan). How will you assess your students' products? (You can link to a separate rubric document from here, or you could briefly summarize your criteria on this page

21. (8 Points) Read the case below!

Assume that the learning task is the organelles of an animal cell and the subject is explained by the drama. Each of the organelle is matched with a student.

Student N- Nucleus
Student M- Mitochondria
Student G: Golgi apparatus
..……

The students stand in the center of the class. Firstly, students introduce themselves. For instance; Student R says:" My name is ribosome. I'm the smallest cell and I'm responsible for the protein synthesis in the cell."

After students introduce themselves, they act the activities of the cell while it digests a harmful bacterium. The students show the relations between the organelles and display the functions ……

Exemplify the concepts below by using the drama example above.

Dramatic enactment:
Dramatic moments (At least two)
Communication forms (at least two)
Representation forms (at least two)

APPENDIX D

SCORING OF THE FINAL EXAM

Part I (total: 8 points). TRUE / FALSE. You know the drill: It's either true or false. Circle the right one. If false, **write the correct form with their reasons.**

1. (2 points) Project-based learning is an instructional method that aims at student engagement in real world tasks to enhance learning.

True False

2 points

2. (2 points) Read the passage below!

"Ms.Ubuz wanted her students to induce how to add fractions with common denominators. So she presented such questions some of which were solved correctly, and some had incorrect solutions. Then she asked her students to figure out how to solve such problems correctly by looking at the examples she presented from the book."

It is an example for the introduction part of the project-based learning.

True **False**

1 point

It is an example for the expository teaching.

1 point

3. (2 points) Teachers pool ideas and experiences through the discussion method and it is more effective after a presentation or a film that needs to be analyzed.

True False

2 points

4. (2 points) Read the passage below!

"Teacher: In what ways other than using from the periodic table might we predict the undiscovered elements?

Student1: We could go to the moon and see if there are some elements there we don't have.

Student2: We could dig a hole down to the center of the earth.

Teacher: These are too costly and time consuming. Can we use the elements we already have here on earth to find some discoveries?"

Both of the questions are closed clarification questions.

True **False**

1 point

Both of the questions are open-ended questions. (also acceptable: open-ended inventive, open-ended provocative, open-ended hypothetical)

1 point

Part II (total: 18 points). MATCHING

5. (6 points) Directions: In the following exercise, column A contains description of students' activities in team-oriented cooperative learning and column B names of three types of the team-oriented cooperative learning. Match each activity in column A with its corresponding type of team-oriented cooperative learning. Write the matching letter in the blanks provided in column A. Team-oriented cooperative learning types may be used one, or more than once. (One point each)

Column A Students' activities	Column B Types of team-oriented cooperative learning
--A---1. Students learn the content through the teacher presentation.	A.Students Teams-Achievement Division
--B---2. Students read the unique section of the text at the beginning of the class.	B. Jigsaw
--C---3. Students monitor teammate's level of understanding.	C.Team-Assisted Individualization
--C---4. Students study through the assigned unit given by the student's monitor.	
--A---5. Students take worksheet and work on it with their team.	
--B---6. Expert groups help the students by giving information about the content.	

Each one is 1 point.

6. (12 points) Directions: In the following exercise, column A contains description of students' activities in the "discussion method" and column B names of three types of the discussion method. Match each activity in column A with its corresponding types of discussion in Column B. Write the matching letter in the blanks provided in column A. The type of the discussion may be used once, more than once (2 points each)

Column A	Column B
Activities	Types of the Discussion
..A.. 1.Students in class ask questions to the groups of the students having conversations.	A. Panel
..C.. 2. Students make very hard preparations about the topics such as the life in Mars, cell division, etc. and present the differing positions about the topic..	B. Debates
..A.. 3. A group of students make some preparations about the usage of nuclear energy and each student makes an opening statement about the topic and continues to talk under the control of the leader.	C. Symposium
..D.. 4. Two groups of students prepare and discuss about advantages and disadvantages of using "lens".	
..D.. 5. Quite hard discussion takes place between two groups who advocate two opposing views.	
..C.. 6. After presenting the topics, the presenter student answers the questions of their friends in the classroom.	

Each one is 2 points

1 point

Part III (total: 6 points). FILL IN THE BLANKS

7. (2 points) The question "How do single-celled animals reproduce themselves and divide up to create similar animal life that looks like themselves" is an ineffective question because it is complex.... **(ambiguous) question**.... It should be stated as: **.....By what process do single-celled animals reproduce? Or how do single-celled animals reproduce themselves?**.....

1 point

8. (2 points) Cooperative learning has two important features, which distinguish it from other forms of small group instructions:.... **individual accountability**.... and .....**positive interdependence**.....

1 point

1 point

9. (2 points) Teacher constructs a role-playing scenario about the working principles of eye. The teacher gives students their roles according to the structure of the eye. For example; two students may be "the iris", one of them may be "the lens", and so on….

In this case, the proper role of the teacher is..... **a beautiful rose on the desk (how can you see me?) or playing the light**..... to facilitate understanding and start the play.

2 points

Part IV. (Total: 10 points) MULTIPLE CHOICES.
Circle the answer(s) that you deem MOST appropriate.

10. (2 points) A pupil fails to answer the question: "why do astronauts weigh less on the moon than on earth?" Which of the following would be a good starting prompt to lead the pupil towards the idea of gravity?

2 points

A) How much do you weigh yourself?
B) How much less do the astronauts weigh on the moon?
C) Not only the astronauts weigh less but also they can jump higher. Why?
D) How can you compare the weight of the astronauts? Why?

11. (2 points) Which one of the following is NOT TRUE about **inductive discovery** method?

A) Children own the knowledge
B) Teacher ensures integrity of children's construction
C) Experimentation causes curiosities
D) Teacher tells children how to develop

2 points

12. (2 points) Which one of the following is NOT TRUE for the drama as a method?

A) Experiential approach is used for learning
B) Product is the major goal of the drama.
C) A variety of communication experiences are offered.
D) Teacher becomes a learner among the learners

2 points

13. (2 points) Which of the following techniques would be LEAST characteristic of Discovery Learning?

A) Permitting mistakes
B) Allowing students to ask questions
C) Introducing disturbing data
D) Stating behavioral objectives

2 points

14. (2 Points) Which of the followings is NOT TRUE about the drills?

A) They provide practice for predefined skills.

B) They give immediate feedback to the student

C) **They attempt to teach new material by direct instruction**.

D) They provide some forms of correction and remediation

2 points

Part V (total: 50 points). SHORT ANSWER

Give a short answer for the following questions in the blanks provided below.

15. (6 points) Define what teacher's task orientation is and write three most important questions that teacher must ask himself/herself to achieve high level of task orientation.

Teacher task orientation refers to how much classroom time the teacher devotes to the task of teaching an academic subject.

3 points for definition

Task related questions a teacher must answer are:

1. **How much time do I spend lecturing, asking questions, and encouraging students to inquire or think independently?**
2. **How much time do I spend organizing for teaching and getting my students ready to learn?**
3. **How much time do I spend assessing my learners' performance?**

1 point for each question

16. (6 points) Assume that you use expository teaching as a method.

Design your lesson plan on …… **Please consider only these levels of detail.**

1. What is the subject area for your lesson?
2. What is the grade level for your lesson?
3. Use "combinatorial relationship" to structure and present the content of the subject.

1 point

Subject: The effects of electric current

Grade: 7 th grade

1 point

4 points for table with content

Apparatus	**Door Bell**	**X**			
	Automatic Fuse		**X**		
	Accumulator				**X**
	Flora suns Lamb			**X**	
The effects of electric current		**Magnetic**	**Heat**	**Light**	**Chemical**

17. (8 points) A typical algorithmic exercise is given below:

503
_267

236

a. What is the subject area for your lesson?

b. What is the grade level for your lesson?

c. Turn it into a problem or an investigation type of mathematical task and explain the reason.

1 point

Subject Area: Subtraction

1 point

Grade Level: 4th

3 points

Problem:

Mustafa says 503 km to the beach. When we stopped for gas, we had gone 267 km. How much farther do we have to drive?

3 points

Reasons:

This problem is designed to help students to develop an add-on of subtraction. Before presenting this problem, students are required the missing part of 100 after supply one part. For example; try numbers like 80 or 30 at first; then try 47 or 62. After presenting this actual task above, teacher might ask students whether the answer to the problem is more or less than 300.

18. (6 points) Assume that you use cooperative learning method.;
Design your own lesson on……. **please consider only these levels of detail.**
a. What is the subject area for your lesson?
b. What is the grade level for your lesson?
c. How will you assess your students' performances? (What performance standards will you use? You can link to a separate rubric document from here, or you could briefly summarize your criteria on this page. Will you evaluate students individually, or evaluate the group as a whole?)

Subject: The benefits of the nuclear energy

0.5 point

Grade Level: 7th

0.5 point

Teacher should stress the importance of individual effort in achieving group goals. Therefore he/she incorporates both individual performance and, thoroughness and accuracy of the group product. Each individual 's grade can be in two separate parts or can be composite grade that combine his or her own plus groups effort. I prefer first one.

2 point

One of the below rubric with at least **four criterias** was sufficient. Each criteria is 0.75 point**. 3 points in total for the rubric.**

Rubric for individual performance	**Limited**	**Developing**	**Accomplished**	**Exemplary**
Collecting information				
Fulfill Team Role's Duties				
Share Equally				
Cooperate with Teammates				
Participation of group members				
Relationship among other groups				
Listen to Other Teammates				
Making Fair Decisions				

Rubric for group performance.	Limited	Developing	Proficient	Advanced	Exemplary
Group members facilitate each other's participation.					
All group members participate in project works					
Work is distributed and completed.					
Completion of learning activity to be shared with other teams					
Group uses members' strengths effectively.					
Group members solve conflicts effectively.					
Group presents the complete result.					

19. (12 points) Assume that you use computer assisted instruction;
Design your own lesson on "graph of the quadratic equation" or "cell division". **Please consider only these levels of detail**.
a. What is the grade level for your lesson?
b. What are your learning objectives?
c. How will you design your students' activities? (questions to be answered, the learners' activities. List the steps your students will go through as they accomplish the task.)

1 point

At least three objectives should be written. 3 points

a. Grade Level: 10th

b. Students will be able to

Enter the coefficients of the equations into the drill or simulation program
Analyze the change on the graph with relation to the coefficients "a" (action)
Analyze the change on the graph with relation to the coefficients "b" (action)
Analyze the change on the graph with relation to the coefficients "c" (action)

Synthesize the equation of the graph given by the program (action and feedback)
To evaluate the reason of the mistakes presented by the program (Feedback)

c.
Introductory section: 1 point
Main rules of the drawing quadratic equations' graph are given. (repeated: by the teacher and by the program)
Present senario/Select items 2 points
Students solve these equations and evaluate their results
$Y= 3x^2$
$Y= 3x^2+ 4x$
$Y= 3x^2+ 4x + 5$
Actions required/Question response 2 points
Students are required to enter a, b, c into the program for each of the above equations.
Students are required to show the graphs of the equations. 1 point
Student acts/Judge response
Students are required to change the value of a (or b, or c) and analyze the change on the graph.

System Updates/Feedback 1 point
Students are required to find the equation of the graph on the screen.
Students are required to evaluate the feedback presented by the program and find the new strategy. 1 point
According to the success of the students, teacher decides to return to the start of the program and the cycle continues until the mastery level.

20. (12 points) Assume that you use project-based learning; Design your own lesson on

Subject 1: Interest Problem
Subject 2: Poles of the Magnet

Please consider only these levels of detail.
a. What is the grade level for your lesson?
b. How will you design your students' activities (Essential questions-Designing a plan). How will you assess your students' products? (You can link to a separate rubric document from here, or you could briefly summarize your criteria on this page

Grade Level: 8th 1 point

Essential questions: 3 point
Teacher says: Your fathers give your group 100 million. You want to buy a bycyle for your group's work. School administration gives your group 1% of the income of the canteen if you give some money as a capital for the canteen. How can you develop a strategy to buy the bicycle that you want?

Plan: 1. Group consists of the 5 members. (1 point) 5 points

2. Distribution of the duties (1 point)

Leader: As a decision maker

1st member: gathers information about the interest rate of the banks

2nd member: Tasks related to canteen

3rd member: holds account……..

3. Student prepare a portfolio that contains three different strategy having different time table and monetary funding (1 point)

4. Students prepare a task plan covering four-class period. (2 points)

First hour: distribution of duties to the proper person in the group

Second hour: member gathers information

Third hour: Meeting of the group and make the calculation and preparing the output

Fourth hour: Presentation of the output.

Assessment of the output: 3 points. **At least two** criterias should be listed.

Group Name: **Capital Marmara**	**Limited**	**Developing**	**Proficient**	**Advanced**	**Exemplary**
Effective using of the information about interest					
Sufficiency and consistency of information (Is there any lack parts)					
Thoroughness of the information and accuracy of calculations.					
Presentation of the portfolio					

21. (8 Points) Read the case below!

Assume that the learning task is the organelles of an animal cell and the subject is explained by the drama. Each of the organelle is matched with a student.

Student N- Nucleus

Student M- Mitochondria

Student G: Golgi apparatus

……

The students stand in the center of the class. Firstly, students introduce themselves. For instance; Student R says:" My name is ribosome. I'm the smallest cell and I'm responsible for the protein synthesis in the cell."

After students introduce themselves, they act the activities of the cell while it digests a harmful bacterium. The students show the relations between the organelles and display the functions ……

Analyze the concepts below by using the drama example above.

1 point

Dramatic enactment: Animation of animal cell organelles

3 points

Dramatic moments (At least two)

a. **While the presentation of the responsibility of the organelles, the others consider their duties related to these responsibilities**
b. **Digestion of a harmful bacteria**

2 points

Communication forms (at least two)

a. **Presentation of the responsibilities**
b. **Drawing of their functions**

2 points

Representation forms (at least two)

a. **Body movement which shows digestion of a harmful bacteria**
b. **Charts showing organelles' structure**

APPENDIX E

ATTITUDE TOWARDS COMPUTER

The purpose of this survey is to gather information concerning people's attitudes toward learning about and working with computers. All responses are kept confidential. Completion of this survey is compulsive. Make (X) on your choice of response. Please return the survey as an attachment file to your instructor when you are finished.

Surname/ Name :
Id Number/ Department:

Have you taken any course related to computers? Yes ( ) No ( )
(If yes) Write the name of courses, please.....

Which of the following programming languages do you know?

( ) NONE ( ) HTML ( ) JAVA ( ) PASCAL ( ) C Other.....

Have you had an experience with computers?

( ) No experience ( ) 1 Week or less
( ) 1 week to 1 month ( ) 2 month to 6 month
( ) 7 months to 1 year ( ) 1 year or more

Briefly state the type of computer experience:.....

Have you ever used a computer in the following situations?	YES	NO
At school in class (before university)		
At university		
At a computer center		
At home using your own micro		
At a friend or relative's house		
Any other place		
Have you ever used a computer for:		
Video games		
Using software packages, e.g. for data analysis		
Writing your own programs		
Using a word processor		
In a lesson/tutorial/lab		
In a work situation		

Below are a series of statements. There are no correct answers to these statements. They are designed to permit you to indicate the extent to which you agree or disagree with the ideas expressed. Place a "X" mark in the box under the label which is closest to your agreement or disagreement with the statements.

		Strongly Agree	Slightly Agree	Slightly Disagree	Strongly Disagree
1	Computers do not scare me at all.				
2	I'm no good with computers.				
3	I would like working with computers.				
4	I will use computers many ways in my life.				
5	Working with a computer would make me very nervous.				
6	Generally, I would feel OK about trying a new problem on the computer.				
7	The challenge of solving problems with computers doesn't appeal to me.				
8	Learning about computers is a waste of time.				
9	I do not feel threatened when others talk about computers.				
10	I don't think I would do advanced computer work.				
11	I think working with computers would be enjoyable and stimulating.				
12	Learning about computers is worthwhile.				
13	I feel aggressive and hostile toward computers.				
14	I am sure I could do work with computers.				
15	Figuring out computer problems does not appeal to me.				
16	I'll need a firm mastery of computers for my future work.				
17	I wouldn't bother me at all to take computer courses.				
18	I'm not the type to do well with computers.				
19	When there is a problem with a computer run that I can't immediately solve, I would stick with it until I have the answer.				
20	I expect to have little use for computers in my daily life.				
21	Computers make me feel uncomfortable.				
22	I'm sure I could learn a computer language.				
23	I don't understand how some people can spend so much time working with computers and seem to enjoy it.				
24	I can't think of any way that I will use computers in my career.				

		Strongly Agree	Slightly Agree	Slightly Disagree	Strongly Disagree
25	I would feel at ease in a computer class.				
26	I think using a computer would be very hard for me.				
27	Once start to work with the computer, I would find it hard to stop.				
28	Knowing how to work with computers will increase my job possibilities.				
29	I get a sinking feeling when I think of trying to use a computer.				
30	I could get good grades in computer courses.				
31	I will do as little work with computers as possible.				
32	Anything that a computer can be used for, I can do just as well some other way.				
33	I would feel comfortable working with a computer.				
34	I do not think I could handle a computer course.				
35	If a problem is left unsolved in a computer class, I would continue to think about it afterward.				
36	It is important for me to do well in computer classes.				
37	Computers make me feel uneasy and confused.				
38	I have a lot of self-confidence when it comes to working with computers.				
39	I do not enjoy talking with others about computers.				
40	Working with computers will not be important to me in my life's work.				

APPENDIX F

GENERAL ATTITUDE TOWARDS WEB BASED COURSE SCALE

Important Note: The purpose of the survey is rather information about students' perception, success and participation in web-based distance learning courses. Completion of this survey is compulsive and will constitute informed consent in this study.

Instruction: Make (X) on your choice of response. After completing the form, submit it as an attachment to the e-mail address:

Surname Name :

Id Number/ Department :

Experience with the World Wide Web (Web)

Q01. Which of the following best describes your experience with the Web?

O	I am novice: seldom if ever surf the Web
O	I occasionally surf the Web.
O	I frequently surf the Web.
O	Use of the Web is central to my professional work.
O	Use of the Web is central to my studies.

Current Feelings about World Wide Web

For each of the following pairs of words, on a scale of 1 to 5 please indicate the response that is closest to your CURRENT FEELINGS ABOUT WEB. For instance, for the first pair of words, if you feel the Web in general is “completely stimulating” to use and not all “dull”, check “1”, “3” means that you are undecided or think that they e equally likely to be stimulating or dull, “2” means you feel that they are more stimulating than dull.

		1	2	3	4	5	
Q02	Stimulating (Uyarıcı)	○	○	○	○	○	Dull (Tekdüze)
Q03	Fun (Eğlenceli)	○	○	○	○	○	Dreary (Sıkıcı)
Q04	Easy (Kolay)	○	○	○	○	○	Difficult (Zor)
Q05	Personal (Kişisel)	○	○	○	○	○	Impersonal (Kişisel olmayan)
Q06	Helpful (Yardımcı)	○	○	○	○	○	Hindering (Engelleyici)
Q07	Unthreatening (Korkutucu değil)	○	○	○	○	○	Threatening (Korkutucu)
Q08	Efficient (Verimli)	○	○	○	○	○	Inefficient (Verimsiz)
Q09	Reliable (Güvenilir)	○	○	○	○	○	Unreliable (Güvenilmez)

Online course support

1. [Q10] When I asked my instructor a question by emails, I typically received an answer within;
- ○ Four hours
- ○ Less than a day (5-24 hours)
- ○ Two days
- ○ Three or more days, but less than a week
- ○ A week or more
- ○ Never
- ○ I did not ask questions by email.

2. [Q11] I received individual assistance from my instructor when I needed it.
○ Yes ○ No

3. [Q12] Which of the following most accurately describes where you sought technical assistance with your web-based course? Check all that apply.
- ○ Internet Service Provider (ISP)
- ○ Another student
- ○ Course instructor
- ○ Did not need help.
- ○ Other_____

Using the scale below, please indicate how strongly you agree or disagree. (1=Strongly Disagree; 2=Disagree; 3=Neutral; 4=Agree; 5=Strongly Agree)					
	1	2	3	4	5
Q13. I needed a lot of help to access course materials on the web.	○	○	○	○	○
Q14. Accessing course information using a web browser such as Netscape or Internet Explorer was easy to do.	○	○	○	○	○
Q15. My instructor gave me thorough information so that I could successfully access course materials.	○	○	○	○	○
Q16. Online course support from the instructor through telephone line was available whenever I needed it.	○	○	○	○	○
Q17. I was able to access the course website whenever I needed.	○	○	○	○	○
Q18. Technical support from the student help line was available whenever I needed it.	○	○	○	○	○
Q19. Teaching assistants provided helpful information when I requested it.	○	○	○	○	○

Level of Communication

Using the scale below, please indicate how strongly you agree or disagree. (1=Strongly Disagree; 2=Disagree; 3=Neutral; 4=Agree; 5=Strongly Agree)					
	1	2	3	4	5
Q20. Using online discussion made me communicate more with my fellow students.	○	○	○	○	○
Q21. I felt inhibited in taking part in online discussion session.	○	○	○	○	○
Q22. The web discussions made a positive contribution to my learning.	○	○	○	○	○
Q23. The use of chat room helped me to learn the course materials	○	○	○	○	○
Q24. There were sufficient opportunities to interact online with classmates.	○	○	○	○	○
Q25. I like having email connection with my instructor.	○	○	○	○	○
Q26. Having e-mail provided timely contact with my instructor.	○	○	○	○	○
Q27. Collaborative online group activities helped me to succeed in the course.	○	○	○	○	○
Q28. Online Collaborative activities took too much of my time.	○	○	○	○	○
Q29. Identifying additional web sites to supplement course materials positively contributed to my learning.	○	○	○	○	○
Q30. Access to online lecture notes made a positive contribution to my learning.	○	○	○	○	○
Q31. The web-streamed lectures made a positive contribution to my learning.	○	○	○	○	○
Q32. I received responses to my email questions within 24 hours from my instructor.	○	○	○	○	○
Q33. I waited for an email response to my question from my instructor before continuing my online participation.	○	○	○	○	○
Q34. I waited for an email response to my question from my friends before continuing my online participation	○	○	○	○	○

Using the scale below, please indicate how strongly you agree or disagree. (1=Strongly Disagree; 2=Disagree; 3=Neutral; 4=Agree; 5=Strongly Agree)					
	1	2	3	4	5
Q35. Receiving responses to my email questions in a timely manner motivated me to complete assignments.	○	○	○	○	○
Q36. The posting of Frequently-Asked-Questions (FAQ's) on the website helped me to move forward with my online studies.	○	○	○	○	○
Q37. In general, my instructor returned graded assignments in a timely manner.	○	○	○	○	○

Perceptions of Satisfaction and Success

Using the scale below, please indicate how strongly you agree or disagree. (1=Strongly Disagree; 2=Disagree; 3=Neutral; 4=Agree; 5=Strongly Agree)					
	1	2	3	4	5
Q38. Taking a web-based course is more convenient.	○	○	○	○	○
Q39. Taking a web-based course is boring.	○	○	○	○	○
Q40. When I became very busy with other things, I was more likely to stop.	○	○	○	○	○
Q41. I would not take another Web-based course.	○	○	○	○	○
Q42. I found the online course a better learning experience than face-to face.	○	○	○	○	○
Q43. I gained skills that are useful in my actual or chosen profession.	○	○	○	○	○
Q44. I spent too much time trying to log onto the course web site.	○	○	○	○	○
Q45. I spent too much time surfing on the Web instead of studying.	○	○	○	○	○
Q46. I would recommend taking web-based courses to friends or associates.	○	○	○	○	○
Q47. I found learning online to be frustrating.	○	○	○	○	○

Using the scale below, please indicate how strongly you agree or disagree. (1=Strongly Disagree; 2=Disagree; 3=Neutral; 4=Agree; 5=Strongly Agree)					
	1	2	3	4	5
Q48. This course contributed to my educational or personal development.	○	○	○	○	○
Q49. This was one of the best courses I have taken.	○	○	○	○	○
Q50. The pace of the course was just about right for me.	○	○	○	○	○
Q51. Overall I was very satisfied with this web-based learning experience.	○	○	○	○	○

[Q52] What one or two things did you like BEST about your online course?

1._____
2._____
3._____

[Q53] What one or two things did you like LEAST about your online course?

1._____
2._____
3._____

[Q54] At the beginning of the course, what grade did you expect to earn?

☐A
☐B
☐C
☐D
☐Incomplete

[Q55] How do you define successful completion of your web-based course?

☐Earn an A
☐Earn a B or better
☐Earn a C or better
☐Other

_____

Additional Statements

APPENDIX G

METACOGNITION QUESTIONNAIRE

Department
Bölüm:
Name and Surname
Ad ve Soyadı:
University Entrance Exam
ÖSYM Puanı ve Türü:

Mark one of the best-fit choices for your condition after reading the statement. Please mark it honestly for the sake of the evaluations. The purpose of this questionnaire is to get information about pupils' awareness and monitoring of the comprehension process. All the information given here will be anonymous. Please write all the information related to yourself in case I would need to come back to you. After marking, please answer "why" and "how" questions. İfadeyi okuduktan sonra sizin için en uygun olanını ölçeğin güvenirliliği için samimiyetle işaretleyiniz. Ölçeğin amacı kişinin anlama sürecini göstermesi ve zihinsel faaliyetlerinin farkında olması bilgisini öğrenebilmektir. Verilen tüm bilgiler gizli tutulacaktır. Lütfen size bir daha ihtiyaç duymayacak şekilde kendinizle ilgili tüm bilgileri veriniz. İşaretlemeden sonra "niçin" ve "nasıl" sorularına cevap veriniz.	A NOT TRUE FOR ME DOĞRU DEĞİL B HARDLY TRUE FOR ME PEK DOĞRU DEĞİL C I DON'T KNOW BİLMİYORUM D RATHER TRUE FOR ME OLDUKÇA DOĞRU E VERY TRUE FOR ME TAMAMEN DOĞRU				
	A	B	C	D	E
1.I check over my work to make sure I did it right. Why? How? Yaptığım işin veya çalışmanın doğru olduğundan emin olmak için kontrol ederim. Niçin? Nasıl?	○	○	○	○	○

A NOT TRUE FOR ME (DOĞRU DEĞİL) B HARDLY TRUE FOR ME (PEK DOĞRU DEĞİL) C I DON'T KNOW (BİLMİYORUM) D RATHER TRUE FOR ME (OLDUKÇA DOĞRU) E VERY TRUE FOR ME (TAMAMEN DOĞRU)	A	B	C	D	E
2. When I study, I practice saying to myself the important facts, principles and concepts in my cognition. Why? How? Çalışırken zihnimdeki önemli gerçekleri, kuralları ve kavramları kendi kendime söyleyerek alıştırma yaparım. Niçin? Nasıl?	○	○	○	○	○
3. When I read a text, I expose the inconsistent meaning in it. Why? How? Bir parçayı okurken anlam tutarsızlıklarını ortaya çıkarırım. Niçin? Nasıl?	○	○	○	○	○
4. When I study, I put important ideas in to my own words. Why? How? Çalışırken önemli fikirleri kendi kelimelerime dökerim. Niçin? Nasıl?	○	○	○	○	○
5. While I study, I isolate myself from things that distract me. Why? How? Çalışırken dikkatimi dağıtan her şeyden kendimi soyutlarım. Niçin? Nasıl?	○	○	○	○	○
6. While I study a material, I ask questions to myself to make sure that I understand it. Why? How? Bir konuya çalışırken anlayıp anlamadığıma emin olmak kendi kendime için soru sorarım. Niçin? Nasıl?	○	○	○	○	○
7. I begin to study a material by asking myself what I know and what I don't know. Why? How? Bir konuya çalışmaya başlarken kendi kendime her zaman neyi bilip bilmediğimi sorarım. Niçin? Nasıl?	○	○	○	○	○
8. If I do not comprehend one point in a subject, I return to the related section or words. Why? How? Bir konuda anlamadığım bir nokta olursa, o konu ile ilgili kısma ve kelimelere dönerim. Niçin? Nasıl?	○	○	○	○	○

A NOT TRUE FOR ME (DOĞRU DEĞİL) B HARDLY TRUE FOR ME (PEK DOĞRU DEĞİL) C I DON'T KNOW (BİLMİYORUM) D RATHER TRUE FOR ME (OLDUKÇA DOĞRU) E VERY TRUE FOR ME (TAMAMEN DOĞRU)	A	B	C	D	E
9. I can easily distinguish the parts, which helps me to understand the subject clearly. Why? How? Konuyu net olarak anlamama yardım eden yerleri çalışma esnasında kolaylıkla ayırt edebiliyorum. Niçin? Nasıl?	○	○	○	○	○
10. When I read a text, I differentiate what I need and what is important for me. Why? How? Bir parçayı okurken benim için önemli olan ve ihtiyaç duyacağım şeyleri ayırt ederim. Niçin? Nasıl?	○	○	○	○	○
11. If I have to learn a subject, I first go over the material to make a plan to study it. Why? How? Eğer bir konuyu öğrenmek zorunda isem, çalışma planı yapmak için öncelikle konunun üzerinden şöyle bir geçerim. Niçin? Nasıl?	○	○	○	○	○
12. I become to be quite motivated to study more when I comprehend the study material. Why? How? Konuyu anladığım zaman daha fazla çalışmak üzere oldukça motive oluyorum. Niçin? Nasıl?	○	○	○	○	○
13. I give much attention to the definition of a concept. Why? How? Kavramların tanımına daha çok dikkat ederim. Niçin? Nasıl?	○	○	○	○	○
14. I categorize the learning material as easy or difficult. Why? How? Öğrenilecek konuyu kolay veya zor diye sınıflara ayırırım. Niçin? Nasıl?	○	○	○	○	○
15 While I read a text, I seek to find out the synonymous meaning in it. Why? How? Parçayı okurken içindeki benzer anlamlıları bulmaya çalışırım (ararım). Niçin? Nasıl?	○	○	○	○	○

A NOT TRUE FOR ME (DOĞRU DEĞİL) B HARDLY TRUE FOR ME (PEK DOĞRU DEĞİL) C I DON'T KNOW (BİLMİYORUM) D RATHER TRUE FOR ME (OLDUKÇA DOĞRU) E VERY TRUE FOR ME (TAMAMEN DOĞRU)	A	B	C	D	E
16. Before I begin to study a material, I decide on my purpose for studying it. Why? How? Konuyu çalışmaya başlamadan önce onu çalışmadaki amacımı düşünürüm. Niçin? Nasıl?	○	○	○	○	○
17. I am able to grasp abstract ideas and focus my attention on those at the time of studying. Why? How? Çalışırken soyut fikirleri kavrayabilir ve dikkatimi o hususlara verebilirim. Niçin? Nasıl?	○	○	○	○	○
18. Before I study a new material thoroughly I often pass lightly over it to see how it is organized. Why? How? Yeni bir konuya çalışmaya başlamadan önce genelde nasıl organize olduğunu görmek için şöyle bir üzerinden geçerim. Niçin? Nasıl?	○	○	○	○	○
19. When a different idea comes into my mind instantaneously, while I am studying, I check it in a different condition. Why? How? Çalışırken farklı bir düşünce aniden aklıma geldiğinde onu farklı bir durumda kontrol ederim. Niçin? Nasıl?	○	○	○	○	○
20. I talk to myself about my thinking process after I studied. Why? How? Çalıştıktan sonra düşünme sürecim üzerine kendi kendime konuşurum. Niçin? Nasıl?	○	○	○	○	○
21. Before I begin to read a text, I think about the inquiry questions exposed by the title of it. Why? How? Parçayı okumaya başlamadan önce, başlığın ilham ettiği soruları düşünürüm. Niçin? Nasıl?	○	○	○	○	○
22. While I study a subject, I ask myself if I am on the right track. Why? How? Bir konuya çalışırken doğru yolda olup olmadığımı kendi kendime sorarım. Niçin? Nasıl?	○	○	○	○	○

A NOT TRUE FOR ME (DOĞRU DEĞİL) B HARDLY TRUE FOR ME (PEK DOĞRU DEĞİL) C I DON'T KNOW (BİLMİYORUM) D RATHER TRUE FOR ME (OLDUKÇA DOĞRU) E VERY TRUE FOR ME (TAMAMEN DOĞRU)	A	B	C	D	E
23. While I study a subject, I determine what I should remember later. Why? How? Bir konuya çalışırken daha sonra hatırlamam gerekenlere karar veririm. Niçin? Nasıl?	○	○	○	○	○
24. While I study a subject, I am in an effort to integrate the new knowledge to the existed schema in my brain. Why? How? Bir konuya çalışırken yeni öğrendiğim bilgileri kafamda var olan bilgi dağarcığıma entegre etme çabası içinde olurum. Niçin? Nasıl?	○	○	○	○	○
25. I determine a different strategy to acquire knowledge according to its type. (Task related, theoretical, etc.) Why? How? Bilginin türüne göre (teorik, aktivite ile ilgili, vs.) onu edinmek için farklı stratejiler belirlerim. Niçin? Nasıl?	○	○	○	○	○
26. After I finish studying a subject, I easily go back any section, any words and/or any definitions that I need. Why? How? Bir konuyu çalışmayı bitirdikten sonra ihtiyaç duyduğum bölüm, kelime ve/veya tanıma kolaylıkla geri dönerim. Niçin? Nasıl?	○	○	○	○	○
27. When I think about what I did yesterday, I am most probably to get a whole picture. Why? How? Dün ne yaptığımı düşündüğüm zaman büyük bir olasılıkla olayları bir bütün olarak düşünebilirim. Niçin? Nasıl?	○	○	○	○	○
28. I make up a map for the concepts of the subject. Why? How? Konunun kavramları için bir ilişkiler şeması yaparım Niçin? Nasıl?	○	○	○	○	○

A NOT TRUE FOR ME (DOĞRU DEĞİL) B HARDLY TRUE FOR ME (PEK DOĞRU DEĞİL) C I DON'T KNOW (BİLMİYORUM) D RATHER TRUE FOR ME (OLDUKÇA DOĞRU) E VERY TRUE FOR ME (TAMAMEN DOĞRU)	A	B	C	D	E
29. I have little doubt about decision of which methods should I apply to learn a subject. Why? How? Bir konuyu öğrenirken hangi metodu uygulayacağımın kararı hakkında çok az şüphem olur. Niçin? Nasıl?	○	○	○	○	○
30. I feel more comfortable to use my own approach rather than outline given by others to comprehend a material. Why? How? Bir parçayı anlamak için başkalarının verdiği yaklaşımı kullanma yerine, kendi yaklaşımımı kullanırken kendimi daha rahat hissederim. Niçin? Nasıl?	○	○	○	○	○

APPENDIX H

OBSERVATION CHECKLIST

"S.D" stands for Strongly Disagree, "D" stands for Disagree, "U" stands for Uncertain, "A" stands for Agree, "S.A" stands for Strongly Agree	S.D	D	U	A	S.A
1. Students plan investigations, and assign subtopics and tasks.	○	○	○	○	○
2. Instructor acts as a coach, not a content provider.	○	○	○	○	○
3. Instructor's comments are often as giving clear explanation.	○	○	○	○	○
4. Students experience the complexity of inquiry as it would be conducted by a scientist.	○	○	○	○	○
5. Course site provides links related to the course content to stimulate recall for the prior learning.	○	○	○	○	○
6. Course site provides guidance with spontaneous announcements, messages and tips.	○	○	○	○	○
7. Course site provides regular feedback via e-mail and messages in the forum.	○	○	○	○	○
8. Students focus on knowledge building rather than knowledge reproduction.	○	○	○	○	○
9. Students respond each other's work, share findings and make comments and suggestions through the forum and e-mail tools.	○	○	○	○	○
10. Problem or ill-structured cases foster the knowledge through students' participating in questioning and correcting on each other's work.	○	○	○	○	○
11. Students participate in a form of exploratory learning.	○	○	○	○	○
12. Students can see the interrelatedness of concepts through reading and commenting on each other's notes.	○	○	○	○	○
13. Students can ask questions to the expert in order to conduct their inquiry.	○	○	○	○	○
14. Students access, participate and use the course interface and interior linked sites with no time, location or any other limitations.	○	○	○	○	○
15. The method in this course has the characteristics of the expository teaching or in other words direct instruction.(review of the previous lesson, lecturing, practice, feedback, independent practice/homework)	○	○	○	○	○

CURRICULUM VITAE

PERSONAL INFORMATION

Surname, Name: Topçu, Abdullah
Nationality: Turkish (TC)
Date and Place of Birth: 26 September 1969 , Ankara
Marital Status: Married
Phone: +90 216 518 96 81
Fax: +90 216 417 57 70
email: abdullah.topcu@boun.edu.tr

EDUCATION

Degree	Institution	Year of Graduation
MS	İTU Mathematical Engineering	1997
BS	BU Math Education	1992
High School	Işıklar Military High School, Bursa	1987

WORK EXPERIENCE

Year	Place	Enrollment
2003- Present	K.K. Lisan Okulu Komutanlığı	Measurement and Evaluation Officer
2000-2003	K.K.9. Zh. Tugay Komutanlığı	Curriculum Planner
1992-2000	Kuleli Askeri Lisesi Komutanlığı	Math Teacher

FOREIGN LANGUAGES

Advanced English, Intermediate German

PUBLICATIONS

1. Topçu, A. & Ubuz, B. (2005). The effect of the metacognitive abilities on the discussion performance in a direct instructional asynchronous "Science and Math Teaching Method" online course. 16th Society for Information Technology & Teacher Education Proceedings (Vol. II), 2351-2360.

2. Topçu, A. & Ubuz, B. (2004). The effect of the metacognitive abilities on the discussion performance in a constructivist "Science and Math Teaching Method" online course. IV. International Educational Technology Symposium Proceedings (Vol. II), 1096-1101.

HOBBIES

Computer Technologies, Motor Sports, Basketball, Gourmet, Movies,