EFFECTIVENESS OF HYBRID INSTRUCTION ON CERTAIN COGNITIVE AND AFFECTIVE LEARNING OUTCOMES IN A COMPUTER NETWORKS COURSE

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Approval of the 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. M. Yaşar ÖZDEN
Chair of Computer Education and Instructional Technology 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.

Asst. Prof. Dr. Zahide YILDIRIM
Supervisor

Examining Committee Members

Prof. Dr. Meral AKSU (METU/EDS)

Asst. Prof. Dr. Zahide YILDIRIM (METU/CEIT)

Prof. Dr. Ömer GEBAN (METU/SSME)

Assoc. Prof. Dr. Safure BULUT (METU/SSME)

Asst. Prof. Dr. Nergiz ÇAĞILTAY (ATILIM U./CENG)

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Name, Last name : Ömer DELİALİOĞLU

Signature :

ABSTRACT

EFFECTIVENESS OF HYBRID INSTRUCTION ON CERTAIN COGNITIVE AND AFFECTIVE LEARNING OUTCOMES IN A COMPUTER NETWORKS COURSE

Delialioğlu, Ömer
Ph. D., Department of Computer Education and Instructional Technology
Supervisor: Asst. Prof. Dr. Zahide Yıldırım

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This study examined the effectiveness of a hybrid instruction in terms of students' achievement, knowledge retention, and attitudes towards course content and course satisfaction. An in-depth analysis was done to understand students' perceptions about the effective domains of interactive learning, which included pedagogical philosophy, learning theory, goal orientation, task orientation, source of motivation, teacher role, metacognitive support, collaborative learning, and structural flexibility of a hybrid course.

In this study quantitative and qualitative research methodologies were used in conjunction. Experimental study was carried out to understand if there is a significant difference between the hybrid course and the traditional course in terms of students' achievement, retention, satisfaction, and attitude. Qualitative analysis was done to understand students' perceptions about the effective dimensions of interactive learning.

The subjects of this study were 50 students in a "Computer Networks and Communication" course, offered by the Computer Education and Instructional Technologies Department of METU. The control and experimental groups consisted of 24 and 26 students respectively. The students in the experimental group were interviewed one on one at the end of the treatment.

The quantitative findings of the study indicated no significant difference between the hybrid course and the traditional course in terms of students' achievement, retention, satisfaction, and attitude.

The qualitative findings of this study showed that the amount of information supplied in the course web-site, need for metacognitive support, authentic learning activities and collaboration, type and source of motivation, individualized learning and access to internet played important roles in students' learning in the hybrid course.

Keywords: web-assisted instruction, hybrid course, instructional technology, effective dimensions of interactive learning

ÖZ

MELEZ (HİBRİT) ÖĞRETİMİN BİR BİLGİSAYAR AĞLARI DERSİNDEKİ BELİRLİ BİLİŞSEL VE DUYUŞSAL ÖĞRENME ÇIKTILARI ÜZERİNDEKİ ETKİNLİĞİ

Delialioğlu, Ömer
Doktora, Bilgisayar ve Öğretim Teknolojileri Eğitimi Bölümü
Tez Yöneticisi: Yrd. Doç. Dr. Zahide Yıldırım

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Bu çalışmada bir web-destekli öğretimin etkinliği, öğrencilerin başarı, bilgiyi hatırda tutma, ders içeriğine karşı tutum ve ders doyumları yönünden incelenmiştir. Öğrencilerin, bir melez (hibrit) dersin eğitim felsefesi, öğrenme teorisi, amaca yönlendirme, işleme yönlendirme, güdü kaynağı, öğretmen rolü, biliş-üstü destek, işbirlikçi öğrenme ve yapısal esnekliğini içeren etkileşimli öğrenmenin etkin alanları ile ilgili algılarını anlamak ve açıklayabilmek için kapsamlı bir analiz yapılmıştır.

Bu çalışmada nicel ve nitel araştırma yöntemleri birlikte kullanılmıştır. Melez (hibrit) ders ile geleneksel ders arasında öğrencilerin başarısı, bilgiyi hatırda tutma, ders içeriğine karşı tutum ve ders doyumları yönünden anlamlı bir fark olup

olmadığını anlamak için deneysel bir çalışma yapılmıştır. Öğrencilerin etkileşimli öğrenmenin etkin alanları ile ilgili algılarını anlamak için içerik çözümlemesi yapılmıştır.

Bu çalışmanın örneklemi, ODTÜ – Bilgisayar ve Öğretim Teknolojileri Eğitimi Bölümü bünyesinde verilen "Bilgisayar Ağları ve İletişim" dersindeki 50 öğrencidir. Kontrol ve deney grupları sırasıyla 24 ve 26 öğrenciden oluşmuştur. Deney grubundaki öğrencilerle deneysel uygulama sonunda bire bir görüşmeler yapılmıştır.

Çalışmanın nicel bulguları melez (hibrit) ders ile geleneksel ders arasında öğrencilerin başarısı, bilgiyi hatırda tutma, ders içeriğine karşı tutum ve ders doyumları yönünden anlamlı bir fark olmadığını göstermiştir.

Çalışmanın nitel bulguları, dersin web-sitesinde verilen içerikte sağlanan bilgi miktarının, biliş-üstü destek gereksiniminin, özgün öğrenme etkinlikleri, işbirlikçi öğrenmenin, güdü kaynağı ve türünün, bireysel öğrenme ve Internet erişiminin, öğrencilerin melez (hibrit) dersteki öğrenmelerinde önemli rol oynadığını göstermiştir.

Anahtar Kelimeler: web-destekli öğrenme, melez (hibrit) ders, öğretim teknolojisi, etkileşimli öğrenmenin etkin alanları

To my wife Fatma and my son Kerem,

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INTRODUCTION

Today's educational systems are affected by the rapid developments in technology especially in the Internet. How to integrate Internet into the educational system is considered to be a main issue in the field. To be able to integrate Internet into the education effectively, many educational approaches have been evolved and implemented. One of these approaches is online instruction.

With the emerging of the Internet and World Wide Web in early 1990's the way educators understood and treated computer assisted instruction (CAI) or computer based instruction (CBI) changed. Number of faculty members and the effort of those to develop their own online courses increased. Many of the early instructors were working by themselves as Web Based Instruction (WBI) designers to put their lectures and tutorials on the Web. This enthusiastic and willing attitude was the spirit that led to WBI programs at the universities (Ellis and Phelps, 2000).

Online instruction is delivered either synchronous, asynchronous, or both. In all cases the students are able to study on their own time and have the flexibility to take courses without physically being in the classroom. This nature allows for self-paced learning and reflection (Vrasidas and McIsaac, 1999). From the late 1990's to the millennium there have been researches towards online instruction (Brown, 1997; Carswell, 1997; MacManus, 1996; Oliver, Herrington & Omari, 1996). These research studies mostly discussed the interactivity issue while converting traditional courses to

online courses. The main criticisms were that the online courses were the electronic repackaging of lecture notes which could be referred as "electronic page turners" (Jones & Jo, 1998).

At the same time there are many research studies that compare traditional instruction and online instruction in terms of their effectiveness. The report prepared by Phipps and Morisotes (1999) for the Institute for Higher Education Policy investigated the recent research studies on the effectiveness of distance learning and found that many of the studies indicated the performance level of students in online course was similar to that of students in traditional classroom. Some of the findings however, were doubtful since the overall qualities of the research were meant to be questionable. The findings were mainly based on three measures:

- Student outcomes, such as grades and test scores.
- Student attitudes about learning through distance education.
- Overall student satisfaction toward distance learning. (p.2)

The summary of the findings of their research were:

- Student achievement in distance learning courses compare favorably with classroom-based instruction,
- Student satisfaction is higher in distance learning courses,
- Students and faculty members have a positive view towards distance learning.

Traditional instruction has been used in educational systems for centuries. The medium of teaching or the delivery method for this type of instruction has been face to face lecture. Traditional instruction puts the teacher at the center of the activities. The teacher is the one who is active, and who decides on the content, lectures, makes exams, gives assignments and home works and is responsible of knowledge delivery. Students on the other hand, are passive in the classroom, are expected to listen silently, take notes and save questions for later time.

Traditional instruction expects student to be lectured in a classroom, at a determined time and duration. Limited number of students according to the seat number in the classroom needs to be there at the class start time. This is why one of the main problems of traditional instruction is logistic support. Time, place and materials are needed and have to be planed for instruction. As the student numbers increase the planning process becomes more and more difficult and the resources are becoming less and lesser. Adding these logistic problems with the current situation of the Turkish higher education, the high demand for University entrance, we have a big problem to deal with.

According to the statistics obtained from the Turkish Council of Higher Education the student population in Universities has increased from 329.000 to approximately 660,000 between the years 1990 and 2000. This is an increase of roughly 330,000 students, all of whom expect higher education. For such a big growth in student number in just 10 years, it is not possible to build and staff enough universities to keep up with the demand. One solution to the problem of increased enrollment has been a reevaluation of the way classes are offered. Parallel to this growth, Online Education (OE), Web Based Instruction (WBI) and Distance Education (DE) have increased dramatically throughout the 1990's and are expected to continue to grow well in future. Currently, 35,6 percent of the Turkish higher education is delivered trough Distance Education. However, distance education programs in the Turkish higher education system are in the form of lecture broadcast on TV and direct contact hours. The Faculty of Open Education of Anadolu University in Eskişehir is given the responsibility of implementing these programs. Some universities, like Middle East Technical University are offering complete certificate and Master programs online and every day new online courses are added to the curriculum.

Distance Education and specifically online learning reach students who otherwise would not have access to a higher education. This population includes students who could not get access to a higher education program in one of the universities, and in terms of continuing education, people with work schedules that

preclude them from participating in a traditional class environment. Given a computer and an Internet connection, it is then assumed that this portion of the population would be able to complete a degree or take classes for professional development at their leisure time. Another option might be to change the structure of the educational environment to fit student needs by offering courses during non-traditional hours. Universities began offering night classes. Evening degree programs allowed a subset of students otherwise excluded from the educational process to attend classes and work toward a degree or diploma. These evening course offerings have grown and spawned newer programs. While these programs were solving some of the problems related with resources, in the long run they still required logistic support, brought new cost to the institutes, and could not cover all demands like decrease in classroom seat time. Not to mention the pedagogical problems of traditional instruction, the idea of using the new technologies as media to overcome those and the question if technology would increase teaching/learning brought the need for online programs. However, technology early studies showed that technology can be a "double-edged sword" if not properly planned and implemented. Research and discussions on online courses lasted throughout the 90's and educators came to a conclusion: Learning process do not change just because technology is integrated into the classroom (Achacoso; 2003). A carefully designed and good implemented online course, distance learning and/or web based instruction could help to access faster and more information, give opportunity to use multimedia environments that can affect more than one sense and support help in understanding.

Assessing the effectiveness of online courses is not an easy issue since evaluating technology and learning is not based on solid ground. The learning environment, context, students and instructors are variable and in great spectrum. Assessing purely student achievement trough exam grades or point grade averages can only give limited information on how successful the course was. Another model is needed that covers several classes of variable affecting the learning in those courses. Such a model was developed by Reeves and Reeves (1997) to define the effective domains of interactive learning in World Wide Web (WWW). This model can be used to understand where the online courses dimensions are located on the continua with contrasting values at two ends. The dimensions are (1) pedagogical

philosophy, (2) learning theory, (3) goal orientation, (4) task orientation, (5) source of motivation, (6) teacher role, (7) metacognitive support, (8) collaborative learning, (9) cultural sensitivity, and (10) structural flexibility. The model is described in more detailed in literature review chapter.

The inherent problems of online instruction and the pressure of resources like time, money, hardware, software have lead to a new idea, mixing the good parts of online courses with the good parts of face to face courses. This new structure was given different names; some of them are listed below:

- Hybrid Instruction
- Mediated Learning
- Blended Learning
- Web Enhanced Instruction
- Web Assisted Instruction

A hybrid model of Instruction that will be called Web-assisted Instruction for this study was designed and developed to deliver content of a course by technological means. This type of instruction was meant to maintain and increase the quality of the instruction by streamlining and rethinking the delivery of course content.

In general, these types of courses are referred as hybrid courses. The hybrid approach to instruction was basically composed of face to face components like in-class discussion, group work, lecture together with web components like contents, assignments, announcements, chat room and other online materials.

1.1 Statement of the Problem

Web-assisted Instruction (WAI) may be seen as the middle ground between Distance Learning and Classroom Learning. There are many pieces of classroom learning that cannot be replicated on-line like true discussions, hands-on projects, and live debates. However, there are also many strengths of online learning and the internet needs to become not only a place to store information and material, but a place where students and teachers can do meaningful work.

Parallel to world wide applications, in Turkey, Web-assisted instruction/learning practices have been increased with the rapid developments in the Internet Technology. Even though there is an increase in the number of applications, there are not enough research studies that will guide the Web-assisted instruction/learning practices in the field. Therefore, there is a need to examine WAI applications from different dimensions and contribute to related literature in this respect. Hence, the aim of this study is to investigate the positive elements of online environment into traditional face to face instruction, and investigate its effectiveness from different dimensions.

1.2 Purpose of the Study

The current study has two main purposes. The first purpose is to investigate the effectiveness of a hybrid course in terms of students' achievement, satisfaction, attitude and retention. The second purpose of the study is to investigate the effective dimensions of interactive learning for a hybrid course relative to students' perceptions. As stated before, a hybrid course is a combination of web based course and face to face course. It is possible to assess the effectiveness of such a course by traditional model of assessment using exam scores and other measurement tools. This is valid to understand if the course is successful in improving the student learning. However, in order to see the whole picture, there is also a need to

understand from the students' perspective if hybrid course is effective in terms of dimensions of interactive learning. To investigate this, Reeves and Reeves effective dimensions of interactive learning (1997), which include ten dimensions of interactive learning, will be used as a conceptual framework. By investigating the findings the study also aims to propose a model to build hybrid courses.

The research questions that guide this study are;

Question 1. Is there a significant difference between experimental (exposed to hybrid course) and control (exposed to traditional instruction) groups in the achievement tests at the end of the experiment?

Question 2. Is there a significant difference between experimental and control groups in knowledge retention one month after the experiment?

Question 3. Is there a significant difference between experimental and control groups in attitudes toward computer networks subject at the end of the experiment?

Question 4. Is there a significant difference between experimental and control groups in course satisfaction at the end of the experiment?

Question 5. What are students' (experimental group) perceptions about the hybrid course in terms of effective dimensions of interactive learning at the end of the experiment?

Sub Questions:

5.1. What are students' perceptions about the pedagogical philosophy employed in the hybrid course?

5.2. What are students' perceptions about the learning theories that formed a base for the hybrid course?

5.3. What are students' perceptions of goal orientation of the hybrid course?

5.4. What are students' perceptions of task orientation of the hybrid course?

5.5. What are students' motivation types in the hybrid course?

5.6. What are students' perceptions in terms of teacher role in the hybrid course?

5.7. What are students' perceptions of metacognitive support in the hybrid course?

5.8. What are students' perceptions of collaborative learning strategies employed in the hybrid course?

5.9. What are students' perceptions of structural flexibility of the hybrid course?

1.3 Significance of the Study

In our country we have educational problems. These problems are routed on inefficient resources and pedagogical applications. As a nation with a high amount of young population, it is difficult to allocate resources for all. There is a rough ratio

of 1/20 between university applicants and accepted students. The classrooms in our elementary to high schools are crowded. The curriculum is "overloaded" and hard to cover in the school year time. It is not possible to apply constructivist learning methodologies like problem based learning, discovery learning, project based learning and so on. In this picture, it is obvious that we need new ways of allocating resources for education and designing and implementing courses. This is true for elementary school to university level of education. The findings of this research can shed light to the important considerations when designing and implementing new courses with a different structure, integrating technology to improve effectiveness.

Effectiveness of instruction whether online or traditional have been a great issue for researchers in the instructional technology field. The implementation of new technologies into the educational system is encouraged. It is expected that the resulting mixture will improve the quality of teaching-learning process, while decreasing the physical and mental resources. Although the use of solid technology is encouraged, the shift from the traditional classrooms and face to face teaching seems to be still the dominant way of teaching and learning. It can be foreseen that the change will take some time, and human learning will not fit how technology will work but technology will fit human learning preferences. To be able to facilitate human learning with technology there is a need for the instructional/learning theories guiding effective integration of web based technologies with learning habits of humans. This research study will yield valuable information on effectiveness issues that have to be taken into consideration while integrating web based technologies to courses with face to face classroom meetings. This study will also shed light on student perceptions in terms of effective dimensions of online learning. The results on student perceptions can help instructional technologists and course designers in understanding student preferences and contextual difficulties in such mixed courses that are called Web-assisted instruction and/or hybrid courses throughout this study, and guide them in designing and developing such courses.

CHAPTER 2

REVIEW OF LITERATURE

The impact of technology to education brought enhancements such as online syllabi and lecture notes, electronic grade submission, and virtual office hours. These administrative functions had no value in terms of pedagogical goals. On the other hand there have been individual efforts to use technology to improve teaching and learning. Many instructors supplemented their courses with simulations, online exercises, immediate online feedback and richer learning environment by using multimedia and hypermedia. The systematic and strategic integration of these tools to courses to meet pedagogical goals brought a new way of instruction. This new strategy existed for few years before it was given the name "hybrid instruction". Hybrid instruction can be understood as the combination of the efficiency and accessibility of online learning with the value of the practice and peer interaction (Barkley and Bianco, 2002). This type of instruction has been used for several educational purposes like pre-service and in-service teacher training, and courses in higher education. Hybrid, which is sometimes called blended, is used to label courses that combine face to face classroom instruction with web based instruction so that an important portion of the course material is online. This structure alters the way classroom seat time is used (Murphy, 2003).

2.1 Technology, Instruction and Learning

There is no one common definition of technology. That's why the impact of technology into education can not be measured from a common pre-set context. When we look at previous research on integrating technology into education as one whole picture, we can see that in someway, they deal with the integration of computers into the learning process. Different terminologies are used while talking on technology integration. Achacoso (2003, p.8) has listed some of the descriptors for technology used in the class as: technology-mediated learning, computer-aided instruction, distance education, distance learning, educational technology, home learning technologies, computer-based education, instructional technology, multimedia, communications systems, Web-based learning, educational multimedia applications, and computer-mediated communication. The list could be carried on with some other popular terminologies like online teaching/learning, blended learning, e-learning, hybrid instruction and so on. This terminology difference is not a major problem for researchers since everyone understood that all of them aid the integration of technology to education.

There are different opinions on technology-education relation. One of the earliest arguments against putting technology as a factor of learning came from Clark (1983). He argues that media (technology) is nothing but a vehicle that delivers instruction. In his argument he made the analogy that technology is like the truck that delivers our groceries and does not affect our nutrition. Clark (1994) believed that technology will not affect student learning. He pointed on the method of instruction as the most important thing to be considered for this aim. After Clark there were some other researchers like Kozma (1994), Russel (1999), Jonassen, Campell, and Davidson (1994), Ehrmann (1999) who believed that focusing purely on the technology would be wrong and that learning should be the center of the interest.

Previous research shows that integrating technology into instruction can definitely improve access to information. However, if the question in mind is: "Does technology improve learning", looking to previous research, the answer seems to be "No" (Ehrmann; 1999). This can be also seen in Russell's (1999) work "The No Significant Difference Phenomenon" which includes above 300 distance education studies that found learning outcomes from distance education courses not to be significantly different than traditional courses.

The integration of technology to instruction and learning can definitely help in accessing information. The access to information will be much faster and easier. Even if technology is only media, or just a vehicle, a better media, a faster vehicle will deliver information in much less time and more in amount. Technology has to be used in the right way with the appropriate method. On the other hand technology could also harm the teaching learning process if not properly used parallel to pedagogical findings. To put things in their correct order it is wise to repeat that technology has to support learning, not the other way round. Related with the use of technology Saba (1997) states that "technologies of the information age have the potential to bring education to each person by allowing individuals to take more responsibility for their learning and achieve independence of thought and action" (p.6). He states the pedagogical benefits of technology based education to the teaching learning process, to be more;

- learner-centered, rather than teacher-centered;
- case-based, rather than content-based;
- contextualized, rather than abstract; and
- democratic rather than elitist" (p. 6).

The initial question was: How can technology help learners in their learning? The answer could be: With the integration of technology to education learners can acquire knowledge faster, cheaper and better online (Draves, 1999). The benefits of technology to learners, especially in web based or distance education was listed by Draves (1999, p. 161):

- A learner can learn during his or her peak learning time.
- A learner can learn at his or her own speed.
- A learner can focus on specific content areas.
- A learner can test herself or himself daily.
- A learner can interact more with the teacher because he or she has the ability to post unlimited questions where in the traditional classroom setting, one is limited by time and number of participants wishing to ask questions/make comments.

With the development and widely use of Internet, new opportunities to use environments with information sources enough for individualized learning have raised. The new paradigm of learning, constructivism, that belief "individuals construct their own understanding of the world as they acquire knowledge and reflect on experience" (Kerka, 1996, p. 3) which was difficult to implement in traditional inefficient information source environments, could be used with technology implications.

2.2 Distance Education

In the literature and in the current study, the terms "distance education" and "distance learning" are used interchangeably. In its most basic form distance education can be understand as an educational setting in which the learner is away from the instructor. It has many types using different means and media for communicating them. The basic idea behind distance education is letting learners free to learn anytime, anyplace and at any pace. In its most basic definition the distance education is (Willis, 1993) (p. 4), "at its most basic level, distance education takes place when a teacher and student(s) are separated by physical distance, and technology (i.e., voice, video, data and print) is used to bridge the instructional gap." The definition was too general with this structure, and Cantelon (1995) expanded it further as "not merely meaning a geographic separation between learner and instructor, but also including cultural, emotional and pedagogical distance" (p. 4). He

also outlined that "what is truly unique about distance education is that the site of learning is transformed from a place to a process" (p. 9).

A more formal definition of distance education is made by Moore and Kearsley (1996):

> Distance education is planned learning that normally occurs in a different place from teaching and as a result requires special techniques of course design, special instructional techniques, special methods of communication by electronic and other technology, as well as special organizational and administrative arrangements. (p. 2)

An addition to the definition of distance education is made by Keegan (n.d.). His definition consists of five concepts; the first four elements are included in Moore and Kearsley's definition. He adds "the absence or 'quasi-permanent absence' of a peer group" (in Saba, 1997, p. 5).

Another formal definition of distance education made by American Council on Education (1996) is:

> Distance Education is a system and a process that connects learners with distributed learning resources. While distance education takes a wide variety of forms, all distance education is characterized by: (1) separation of place and /or time between instructor and learner, among learners, and/or between learners and learning resources, and (2) interaction between the learner and the instructor, among learners, and/or between learners and learning resources conducted through one or more media; use of electronic media is not necessarily required." (p.10)

Moore and Kearsley (1996) suggested a systems model to assist comprehension of distance education and learning. Accordingly, a distance education

system consists of learning, teaching, communication, design, and management (p. 5), which are the component processes that make up distance education. Moore (1996, cited in Saba; 1999), outlined "what all distance learners want and deserve":

- content that they feel is relevant to their needs;
- clear directions for what they should do at every stage of the course;
- as much control of the pace of learning as possible;
- a means of drawing attention to individual concerns;
- a way of testing their progress and getting feedback from their instructors;
- materials that are useful, active, and interesting. (p. 1)

As it was discussed above distance education should also be designed support and aid to student learning. To be able for that, teachers/instructors must have the required resources related with time, tools, and training. Designing and implementing distance education courses puts new responsibilities on the instructors shoulders, gives new roles as distance educators (Inman et al., 1999, p. 590). To be able to act in this new role, instructors need new information and new skills in using the technologies. Research shows that interaction is needed between experienced instructors and those who are new to new mode of teaching (Inman et al., 1999, p.590).

Interaction is the most important factor that contributes to the effectiveness of Distance Education applications. Interaction were defined by Moore & Kaersley (1996) under three categories as; learner-learner, learner-instructor, and learner-content. A fourth interaction type was a defined by Hillman, Wills and Gunewardena (1994) and added to Moore's interaction types with the development of new communication technologies by Chen (2001). The tools that can lead to these interactions can be listed as but are not limited to: e-mail, chat, teleconferencing, and forum. Using a variety of tools in the web based instruction can address certain technological problems as well as differing student needs. Using different delivery methods can enhance the number and quality of learning exercises. Moreover, if students see multiple means of communication, they can interact with each other and

the instructor with reduced anxiety which could enhance learning. With the help of the new technologies these interaction types can be facilitated more effectively.

There are numerous researches to show Distance Education has been a truly effective way to achieve learning. Instructors are willing to participate in Distance Education courses but are in the same time skeptical about the quality of learning. There are many studies showing that Distance Education students perform as good as those students in conventional classroom environments (Russell, 1999; Parrot, 1995; Barry 1995). But there are those who suggest that these researches are flawed (Phipps, 1999). There are numerous factors like demographic factors, and sampling techniques which could all have contributed to the findings in those researches.

Besides many other valuable researches on distance education, there are two researches that have to be mentioned. One of them is Russell's (1999) ""No Significant Difference Phenomenon" compendium. The other one is American Federation of Teachers (AFT) - and National Education Association (NEA) - commissioned "A Review of Contemporary Research on the Effectiveness of Distance Learning in Higher Education" by Phipps and Merisotis (1999). The former one, the study by Russel, included over 300 studies which were comparing the effectiveness of distance learning to traditional learning. The study was covering the studies starting from 1928 and going up to 1998. It covers studies on variety of distance education media including mail, radio, audio and video tapes, television and telephone. It also includes more recent studies on two way online communication and student-student, student –teacher interaction related to Computer Mediated Communication. The study does not report any evaluation criteria on how those researches were evaluated but it gives brief descriptions of each. The important point of the study was that all studies examined were reporting that the students' performance in distance courses was not significantly difference than those in traditional courses. This result included online and distance course in old fashion with mail, radio and television. This finding was criticized in that it was lowering the technology requirement to cheaper and old technologies like mail correspondence,

radio and television broadcast because they were as "no significant" as high cost computers and new edge technology (Farber, 1998). Moreover, the finding was found to general to state and easy to conclude by only observing the educational history.

The other report by Phipps and Merisotis (1999) were related more with studies on computer based learning in the 90's. They stated the purpose of the study as "to examine the research on distance learning more closely so that public policy may be better informed" (p.1). The report outlines that "there is a relative paucity of true, original research dedicated to explaining or predicting phenomena related to distance learning" (p.2). They also wrote in bold that "the overall quality of the original research is questionable and thereby renders many of the findings inconclusive" (p.3). The shortcomings and gaps of the researches under scope are listed as: (i) non-random subject selection, (ii) questionable validity of the instruments used to measure student outcomes and (iii) lack of controls for "reactive effects" of students and faculty such as increased motivation and interest stemming from a project's novelty. The gaps in the investigated studies are listed as (i) no account for differences in students and learning styles, (ii) no explanation for higher drop-out rates of distance learners, and (iii) no inclusion of a theoretical or conceptual framework. The report ends with implications which are: 1) the issue of nondiscriminatory access remains unclear, 2) technology cannot replace the human factor in higher education, and 3) the technology employed is secondary to pedagogical factors such as learning tasks, student motivation, and the instructor. As it was in the case of Russel's (1999) report the report of Phipps and Merisotis was criticized by other researchers. Brown and Mack (1999), found the evaluation of the studies in the report convoluted, naive, and contradictory, and their expectations of the research as unrealistic.

Phipps & Mertisotis (1999) suggests that the completion rate for Distance Education courses could be lower. The lack of support and direction could be one cause of the high attrition rate among Distance Education students. Without consistent contact with instructors and other students, many learners are not able to

navigate the course material. Even in the most sophisticated online environment, communication is totally different from in class discussion, question and answer. Those differences are not all negative, but the infrequent or non-existent contact can cause students to feel unsupported and self-taught. The relationship between the teacher and the student in distance learning is far different from what students are used to, and this may change the learning curve and affect the learning outcomes.

Rapid developments in technology such as the WWW and CMC have affected implementation of Distance Education applications, and how these technologies can be integrated into Distance Education effectively. The problem with research that compare distance education with other media are that these studies description of individual programs in the form of program evaluation (McIsaac & Gunawerdena, 1996). This type of research, that find no significant difference between distance education and other media is criticized to aim approving that learners in distance education courses are receiving the same quality of instruction as the learners on-campus so confirming the investment on distance education. (Burton & Cross, 1999).

2.3 Web Based Instruction (WBI)

There are many definitions of Web Based Instruction but the definition made by Khan (1997) in his book "Web Based Instruction" is clear and applicable for years on. WBI is defined as:

> … a hypermedia-based instructional program which utilizes the attributes and resources of the World Wide Web to create a meaningful learning environment where learning is fostered and supported. (p.6)

In another definition WBI was defined as (Relan & Gilliani, 1997),

> … is the application of repertoire of cognitively oriented instructional strategies implemented within a constructivist and

> collaborative learning environment, utilizing the attributes and resources of the World Wide Web.(p.43)

WBI has several advantages. These advantages can be grouped as logistical, instructional and economic. The idea behind WBI is to give the freedom to user for selecting the time, place, computer platform and operating system for learning (Hannum, 2001). Crossman (1997) states the advantages of web-based environments as "the ability to carry a vast amount of information and a variety of media from anywhere to anywhere" (p.19). This ability makes it possible for person to communicate with a single person or with the entire world. This structure, being able to communicate with any other person and to access many resources independent form time and distance, has been related to constructivism because it is based on collaboration and social interactions from which a person builds his own knowledge (Miller & Miller,1997). Hill (1997) points on the non-time dependency feature of the asynchronous WBI. This feature makes it possible for both the instructor and the learner to choose where and when to access learning materials.

There are many research studies investigating the effectiveness of Web-based instruction/learning in academic and business contexts (Lewis, Snow, Farris, & Westat, 1999; Comunale, Sexton, & Voss, 2002; King & Hildreth, 2001;). In 1999 the Institute for Higher Education Policy (IHEP) prepared a report on the research done on effectiveness of distance learning. They examined the existing research and identified shortcomings and omissions in those. As it was supplied in "2.2 Distance Education" section in detailed, the report was titled "What's the Difference?" (Phipps & Merisotis, 1999) and pointed on the fact that most of the existing research on WBI and distance learning focused on effectiveness in terms of student outcomes, attitudes and satisfaction. The problem with those researches was stated as the quality of the research, which varied tremendously between those.

The effect of learning strategies and motivation on performance in WBI was investigated in a research by Sankaran & Bui (2001). The study searched for a

possible relation between learning strategies and motivation of the students and their performance in a business computer course. Besides other results, one interesting finding related with the current study was that motivation was significantly correlated to performance in both WBI and Lecture courses. The relationship came out stronger for WBI.

Web-based instruction effected the implementation of constructivist learning. The new technologies brought many new opportunities for achieving information. Mayer (1999) reported constructivist learning as creation of knowledge of the learners by trying to make sense out of materials presented to them. He also argued that WBI designer must implement activities that would promote cognitive activities.

WBI is an ever developing educational approach parallel to the development of hardware, software and internet technologies. There are several research on WBI, some of them utilizing the interaction and informative qualities of the Internet (Pilgrim & Creek, 1997). The logistic support benefit brings flexibility for students to access to information from any place at any time while still getting assistance and teacher contact when needed. This structure makes WBI a viable option for today's educational institutes, especially universities. However, one of the limitations of WBI is that, with the widely applied structure, it is not flexible enough to cover all students. It should not be forgotten that to apply the proper instructional strategies in WBI is as important as it is in a traditional classroom setting. The instructional strategies for the WBI used should be derived from research, and should be hybridized with the current educational theories of teaching and learning. Currently there are many universities investigating and implementing WBI (Eaton, 1996). In the literature there were also many research carried out about how WBI should be applied correctly (Bell & Lefoe, 1998; Wild & Omari, 1996; Updegrove, 1995) using the WBI related elements of teaching and learning like flexible learning, collaboration, online education and virtual campuses. There are several researches investigating the inclusion of interaction, flexibility and student involvement to WBI courses as strategies to improve the quality of course delivery. However, as it is

implied in the current study the derivation of strategies from current educational theories as a mixture is another possible approach. There are researchers working on integration of Internet technologies with educational and instructional theories such as Carswell (1997), Dalgarno (1998), McMahon (1997) and Montgomery (1995).

2.3.1 Components of WBI

The components and features of WBI were specified by Khan (1997) which he referred as "components-and features specifications". Before the components were specifically deployed, it was known that the components of WBI systems were integral to them. The "components" of WBI were listed by Kahn (1997) as;

- Content development
- Multimedia
- Internet tools
- Computer storage devices
- Connections and service providers
- Authoring programs
- Servers
- Browsers and other applications (p.8)

The above listed items were referred as "components" by Khan (1997) and are integral to WBI systems. In addition to these, the processes and the products of the WBI systems consisting of these components were called "features" by Khan (1997). There is a mutually inclusive relationship between the components and the features of WBI. Examples of components of WBI are e-mail, forum, browsers, dial-up, and conferencing tools and so on. Components produce the features of a WBI system like, asynchronous or synchronous communication, print, streaming video, on-line search and so on. Khan (1997) divides the features of WBI into two categories; key features and additional features. Key features are more inherent to the Web and integral to WBI systems than additional features. These are features of WBI like interactivity, online search, independency in time, device and distance etc.

Additional WBI feature examples are user friendliness, authentic structure, cost-effectiveness, collaborative learning, etc.

2.3.2 Instructional Models for WBI

Researchers and academics who worked on on-line environments have developed many instructional models which could serve as a plan for others in creating on-line learning environments. Some of these instructional models are reviewed below.

Reeves and Reeves (1997) developed a model to understand the effectiveness of WBI instructions. The model included ten dimensions of interactive learning on the WWW which are listed as, (1) pedagogical philosophy, (2) learning theory, (3) goal orientation, (4) task orientation, (5) source of motivation, (6) teacher role, (7) metacognitive support, (8) collaborative learning, (9) cultural sensitivity, and (10) structural flexibility. The ten dimensions are summarized in Table 2.1.

Table 2.1 Effective Dimensions of Interactive Learning on the WWW

Pedagogical Philosophy	
Instructivism	Constructivism
Knowledge flows from instructor to the student	Knowledge as a construct in the mind of the learner
Learning Theory	
Behavioral	Cognitive
Learning can be seen in observable behavior	Learning relies on internal mental states
Goal Orientation	
Sharply Focused	General
Direct instruction with focus on a terminal behavior	Simulation with more than one solution to a problem
Task Orientation	
Academic	Authentic
Traditional academic exercises have to be done	Out of reach exercises in authentic settings have to be done
Source of Motivation	
Extrinsic	Intrinsic
Motivation from outside the learner/learning environment	Motivation from inside the learner/learning environment
Teacher Role	
Didactic	Facilitative
Teacher is the source of knowledge	Teacher is facilitator of instruction, guiding students
Metacognitive Support	
Unsupported	Integrated
No support for monitoring progress and adjusting to individual learner's needs	Supporting learners for the process of learning trough helping to monitor and regulate their own learning process.
Collaborative Learning Strategies	
Unsupported	Integral
Learners work individually to accomplish goals	Learners work in pairs/small groups to accomplish goals

Table 2.1 (*Continued*) Effective Dimensions of Interactive Learning on the WWW

Cultural Sensitivity	
Insensitive	Respectful
Cultural sensitivities are not taken into consideration while designed the course	Course is designed to respect and adapt to cultural norms
Structural Flexibility	
Fixed	Open
Site limited to specific times and/or places	Site not limited to specific times and/or places

Caladine (1999) has developed a model that he called "A Model for Learning and Teaching Activities" (MOLTA) (Figure 2.1). This model is not restricted to web based instructions but was more a model to help educators in using teaching learning material through different means. In MOLTA, Caladine (1999) classifies teaching and learning activities into five elements:

- Delivery of material
- Interaction with materials
- Interaction with the teacher
- Interaction between students
- Intra-action (p.24)

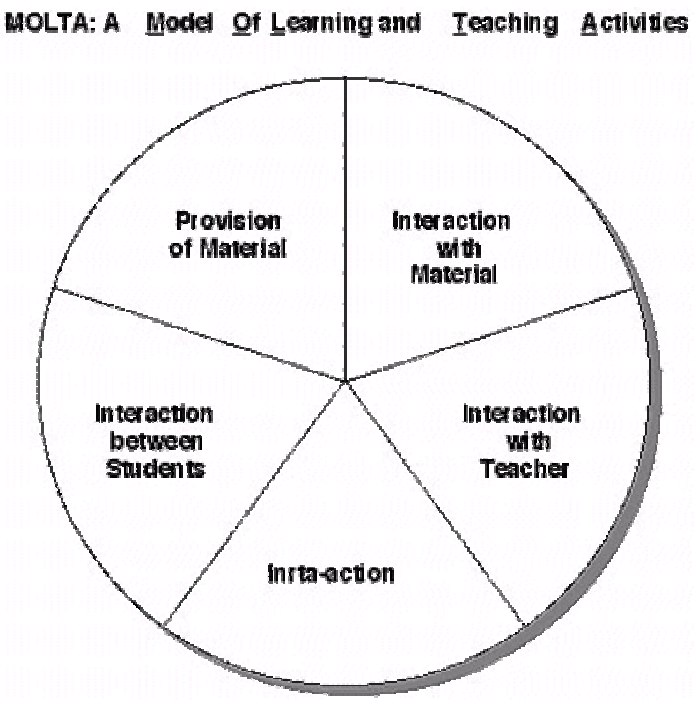

Figure 2.1 A Model for Learning and Teaching Activities (Caladine; 1999, cited in Matejka & Maguire, 2001)

Another model for understanding and designing online learning environments was developed by Welsh (1997, cited in Matejka & Maguire, 2001). The model was named "Event-Oriented Design" (EOD) and acknowledges the issues of current and future capabilities of the Web, as well as its evolving limitations. Asynchronous vs. synchronous learning, performance objectives and the selection of instructional strategies and specification of information and communication technologies are the elements from instructional design and distance education on which the model is build on. The EOD model lists the fallowing steps in designing for WBI:

1. Specify instructional goal and performance objectives of the course using traditional instructional design methods.
2. Sequence performance objectives and chunk them into a series of instructional modules, each of which results in students meeting objectives.
3. Divide each module into a series of instructional events.

4. For each event, specify event type; full synchronous, limited synchronous, or asynchronous.
5. For each event, specify appropriate Web-based technology(ies) to enable the event.

Some other important work on modeling for WBI that should be mentioned are "Learner-Centered Web Instruction for Higher-Order Thinking, Teamwork, and Apprenticeship" (Bonk and Reynolds, 1997, cited in Matejka & Maguire, 2001), "motivation" (Duchastel, 1997, cited in Matejka & Maguire, 2001), "active-learning" (Bostock, 1997, cited in Matejka & Maguire, 2001), "systematic approach to design and development" (Pernici and Casati, 1997, cited in Matejka & Maguire, 2001). In developing effective and efficient WBI these modles mentioned above provide important guidelines for the designers.

2.3 Advantages and Disadvantages of WBI

The advantages to using especially the internet for delivering distance learning were listed as (Bates, 1995; Eastmond; 1995; Wulff, 1996; all cited in Kerka, 1996):

- flexibility of time and place for learners and instructors;
- potential to reach a global audience;
- unlike a classroom setting, computer equipment and operating systems do not necessarily need to be compatible; and,
- relatively easy update of content by instructor (p. 2)

The advantages of WBI are related with meeting the needs of the broad range of students who attend tertiary institutions. The integration of WBI in to their course delivery system has provided the educational institutes with the opportunity to fulfill the needs of those students. Among others some of the benefits of using WBI in course delivery include (Jones & Jo, 1999):

- Self-paced progress - students working at their own pace
- Choice of location - students working in their choice of location
- Choice of session time - students working at a time of their choice
- Electronic communication with lecturers and other students. (p.2)

The most important limitation of WBI is that the development, design and delivery of a web-based course is not a simple task. The process requires dedicated work hours from instructors. The researches done on the development and implementation of WBI have shown that for every hour of web instruction, the development time can reach up to 18 hours (Boettcher, 1999, p.30). Moreover, there is a need for teamwork of educators and programmers for the production of high quality web-based courses. Because many times instructors are alone in developing and publishing their courses on the web, the course's production do not fallow Instructional System Design principles. General the quality of the web course is limited to the instructors' competencies in subject knowledge and coding skills.

One of the motives in developing web-based instruction is to reduce expenses of the educational institute. However, while developing their first WBI course they found out that the implementation of a web-based course is very expensive. In literature it was shown that the cost of a three-credit course can rise up around one million dollars (Boettcher, 1999). The administrators of the educational institutes tried to reduce the expenses, resulting with low cost, instructor alone web-based courses. As a result, the quality of these courses was not as high as expected and the students' course satisfaction were low too.

The lack of interactivity is another important factor that can be a limitation for the WBI. In the design and development process of a course of WBI besides providing all the required content, special attention should be given to include interactivity which is needed to motivate students into individualized learning. Without inherent support of metacognition and structural flexibility for students learning structures, the WBI product becomes an electronic page turner. WBI is not

replicating the paper-based teaching material on a web page, resulting in what appears to be an electronic book. Interaction does for sure not mean that the student reads the web page then clicks a button or arrow to move to the next.

It is important to mention that not all the types of courses are suitable for web-based instruction. There might be courses with content not suitable for delivering through the web. If such a course is tried to be converted to web based course it will take a lot of time, cost and effort, but will result in difficulties in students learning. If not designed developed and implemented with care students learning in WBI courses can be lower than in traditional classroom course.

With the current structure of the internet, web-based courses that emphasize directed learning/teaching are easier to implement. Unfortunately, this type of courses tend to be highly behavioristic in structure emphasizing memorization and needing extra classroom activities for cognitive and constructivist applications. Student motivation in these courses needs special attention to avoid high drop-out rates.

2.4 Online Teaching and Learning

In the current study online teaching and learning is understood as teaching and learning through computers and computer networks. Online teaching and learning requires the learners to have a connection to an information highway, which can be understood as a computer network at a distinct from the learner's personal computer. The distance between the personal computer and the information can be across the world (the Internet) or across campus (the Intranet). Closely related with online teaching and learning is the term Computer mediated communication (CMC). The term was used by Harasim et. al. (1995) to imply interactive exchange of written information in computer networks for the aim of teaching/learning. Another closely related term to online teaching and learning is computer mediated instruction (CMI). In online teaching and learning students teacher/instructor and student

communication can be either in real time (synchronously) or at different times and sequentially (asynchronously). Another term related to online teaching and learning that is starting with the word "Computer" is Computer assisted instruction (CAI). The term has its roots in Skinners (1968) Programmed and Learning Machine the student could see the presentation of material by hinting, prompting, suggesting and so on. Different than Skinners strongly behaviorist operant conditioning model of learning in which learning occurs when "a proper response is demonstrated following the presentation of a stimulus" (Ertmer & Newby, 1993, p. 55) the CAI takes also the cognitive and constructivist to a degree in to account. CAI was normally used at computer based drill and practice applications at local personal computer as a supplementary teaching and learning activity (Harasim et al., 1995, Kowalski, 1998). Because of its inherent behaviorist philosophy it was more suitable for military training or elementary education. In CAI the interaction of student is primarily with the learning and teaching materials than with each other and most often there is no exchange of ideas occurs. Distance Education is also related with online teaching and learning parallel to CMC, CMI, or CAI in terms of integration of computers in to the teaching learning process. The main differences between those are that Distance Education has its roots in exchange of information before computers and computer networks by post mail of textual materials, video tapes. More recently multimedia and video CD, and at last internet and teleconferencing.

While planning to teach and/or learn online, the learning experiences should be planned so as to include the positive pedagogical aspects of online delivery mode. In his research, Alexander (1995) argued that implementing new technologies to the course delivery should be based on a new teaching and learning pedagogy. Maguire and Matejka (2001) outlined that for building effective online teaching and learning environment, exploring the abilities of new media, being aware of the capabilities of various technologies is required but not enough. At least equal amount of time should be spend to find out what is needed to be learned by the students and how we can help them to learn. Only after that, it will be possible to develop strategies that will lead them to learn. The same researchers claimed that, while developing new learning strategies that use new technologies like multimedia, hypermedia or World Wide Web should be taken into consideration only if the use

of them brings new learning opportunities to the students. These opportunities might be visualizing, understanding or seeing complex relationships that would not be possible by other media.

Gardner (1999) points on the need for flexibility of teaching and assessing since not all humans' minds work in the same way. He stated that, with the implementation of the new technologies, online teaching/learning could be used to create such diverse learning environments. Flexible learning routes could be created that would support multiple intelligences. The need for timely feedback from the teacher, which is critical in student learning, could be achieved through new technologies like e-mail, videoconferencing and the WWW. Hiltz (1994) stresses timeliness and quality of instructors' responses to students' questions and feedback as the critical factors of the effectiveness of an on-line course.

2.4.1 Computer Mediated Communication

A satisfying definition for the CMC was made by Romiszowski and Mason (1997, p.439) as: "communication between different parties separated in space and/or time, mediated by interconnected computers". They argued that the "interconnected computers" component of the CMC would change some characteristics of the previous communication processes. These characteristics of CMC are categorized and summarized as (Romiszowski and Mason 1997);

- Highly Interactive Communication; computer combines the permanent nature of written communication with the speed and to some extend the dynamism of spoken communication.
- Multi-Way Communication; communication can be two-way, between two people, or multiway among all communicating people.
- Synchronous or Asynchronous Communication; communication can be in real time, or not on the same time. (p.440)

CMC is used in many types of technology integrated instruction/learning environments. Online teaching/learning, distance education, web-based instruction, hybrid instruction has to use CMC for message delivery and receive, student-student communication, teacher- student communication. Student support can be done cheaper through Internet (Simpson, 2000), with a good planned and implemented CMC. There are studies stating that students in CMC classroom communicated more than the face to face classroom (Jonassen, 1996).

In his study on CMC, Romiszowski (1997) made two conclusions: The first one was that CMC can be as much effective as a small-group discussion developing wide range of higher-order decision-making and planning skills when it is planned and implemented successfully. The second conclusion was that the scientific theory of conversation could be helpful in finding how to design effective instructional CMC environments.

Beside the above mentioned advantages there are some disadvantages of CMC. The disadvantages listed by Jonassen (1996) are summarized below;

- Hard to use features of CMC; In order to use the CMC tools the user has to have the required basic technical knowledge to use them.
- The mode of communication; CMS tools require read and write skills, the user should have high language and writing skills.
- Lack of nonverbal interaction
- Hardware dependency

In part of CMC and education, interaction, being able to use the computer as a communication tool for both, synchronous and asynchronous communication and integrating this into education process makes it a part of discussion in integration of technology to education.

2.4.2 Synchronous and Asynchronous Communication in Education

Computer mediated communication can be in to forms, either aysnchrounous (communication and interaction does not occur at the same time between the communicating people), or a synchronous (communication and interaction occur at the same time between the communicating people). The well known asynchronous web tools are e-mail, discussion forums, listserv and the well known asynchronous web tools are chat, teleconferencing, and electronic whiteboards. Asynchronous tools are stated to be used more widely because there is a possibility for time delay between the sender and receiver of a message (Romiszowski & Mason, 2001, p.398).

Klemm (1998) and Heller (1996) both pointed out that using an asynchronous communication system for a class can reduce social problems faced in face to face classroom instruction. Klemm (1998) also discussed the move form instruction to construction in courses taught with online components. He argued that the independent study skills developed through less frequent physical contact will help teach students to discover information on their own and relieves teachers of the duty of directing every student action.

2.5 Hybrid/Blended Instruction

The idea behind a hybrid/blended instruction is to redesign the instruction to maximize the advantages of both face to face and online modes of instruction. Some of the activities in which students previously engaged in classroom or laboratory, such as listening to lecture, taking notes, quizzes, pre-lab assignments can be done online. This change can have positive effects on teaching resources like teachers workloads, accommodating various learning styles and hours of classroom time, and budget constraints.

Actually hybridizing different methods of course delivery is not a new idea. Clark (2002) comments that hybridizing has deep roots that lay back to times where books, videos and print materials were used as an integral part of the instruction. Hybridizing can be understood as "mixing" or "blending". In general terms we can refer to hybrid instruction as the blending of classroom-based instruction with instruction via other media. Today these media can be understood as the Internet-based media. Hybrid instruction combines the flexibility and efficiency of the online environment with the practice and peer interaction of students in the classroom environment. Advantages of hybrid or blended instruction were defined by the Baker College's Instructional Technology web-site as follows:

- Providing tools to facilitate communication outside of scheduled class time and office hours enhances student-student and faculty-student communication.
- The blended learning environment supports different learning styles and methods. Students have time for reflection when participating in online discussions and can participate at a time and place that meets their needs.
- Online materials are available 24 hours a day, seven days a week, insuring that students always have access to assignments and other handouts.
- On-line testing can be used for student pretests and practice. On-line discussion between class sessions can identify areas of student difficulty that need to be addressed in class.
- Course management and administration is simplified with an online grade book and tools for email management. (2004,¶ 5)

There are few studies on hybrid instruction. Most of them point towards the advantages of these courses. These advantages mainly come from the online enhancement of the face to face courses. These advantages were listed by Valerie Landau (2002).

- Put handouts, syllabi and notes online, cutting down time and resources in photocopying.
- Allows peer to peer collaboration on projects, helping to facilitate and document group work.
- Allows automatic grading of quizzes and tests.
- Allows students to discuss topics after the face to face is over.
- Students can review notes or other course material after class is over.

2.6 Research Studies

Unlike the WBI and Distance Education there are few research studies done to determine the factors affecting the effectiveness of hybrid courses. Most of the research is focusing on design and development of hybrid instruction. Some of them have common points with the current study. One of these studies was conducted by Cho and Berge (2002). In their study, they examined the factors that affected the success of online teaching. As a result of their study, they outlined the major obstacles in front of success in these teaching/learning environments. They listed ten major obstacles:

- technical expertise
- administrative structure
- evaluation/effectiveness
- organizational change
- social interaction and quality
- student support services
- (feeling) threatened by technology
- access
- faculty compensation time
- legal issues

A detailed study on hybrid instruction and hybrid courses was carried out by Garnham & Kaleta (2002). They investigated the hybrid courses of seventeen instructors from five university of Wisconsin campuses who participated in the Hybrid Course Project and transformed a traditional course into a hybrid course. The findings of the study which were called "lessons learned" by Garnham & Kaleta (2002) are summarized below:

1. There is no standard approach to a hybrid course.
2. Redesigning a traditional course into a hybrid course takes time.
3. Start small and keep it simple.
4. Redesign is the key to effective hybrid courses to integrate the face to face and online learning.
5. Hybrid courses facilitate interaction among students, and between students and their instructor.
6. Students don't grasp the hybrid concept readily.

7. Time flexibility in hybrid courses is universally popular.
8. Technology was not a significant obstacle.
9. Developing a hybrid course is a collegial process.
10. Both the instructor and the students liked the hybrid course model.

These findings can shed light on development and implementation of a hybrid course for those interested in developing hybrid courses.

Another study similar to Garnham and Kaleta's was done by Sands (2002). He also worked on the hybrid courses in University of Wisconsin. As a result of his study, Sands came up with five proposals that could help teachers in preparing their hybrid courses. These proposals are the guides for linking online learning with face to face teaching successfully. The proposals are listed below:

1. Start small and work backward from your final goals.
2. Imagine interactivity rather than delivery.
3. Prepare yourself for loss of power and a distribution of demands on your time more evenly throughout the week.
4. Be explicit about time-management issues an be prepared to teach new skills.
5. Plan for effective uses of classroom time that connect with the online work.

One of the researches on design and development of hybrid instruction was done by Marques, Woodbury, Hsu and Charitos (1998). In their research paper they tried to find out how to we integrate the best features of Web-based learning into a conventional classroom-based model of instruction. They proposed a hybrid model for a course that was taught using primarily live lectures and conventional resources like classroom, textbooks, physical library and pen and paper assignments. They investigated the development and implementation o a hybrid course developed by two departments of Florida Atlantic University jointly. The new course was developed and implemented as a two-phase project. In the first phase the basic framework for the selected course was conceived, designed and implemented. In the

second phase the course was taught using both conventional as well as electronic resources. The course was tested and evaluated by the instructor and students. They investigated the first trial of the course and made conclusion based on students' surveys about their classroom experiences at the end of the semester. They concluded that the hybrid model of instruction worked well in spite of the strong dependence on text-based resources. The mixture of electronic and traditional classroom was encouraged and was stated as "well suited" to the progressive development and implementation of a learning centered model of instruction. The result o the study was summarized below (Marques, Woodbury, Hsu and Charitos; 1998):

- 46.7% of the students considered themselves (very) interested in computers before the course; this percentage grew to 73.3% after the course.
- Even though 86.7% of the students had used the Internet before the beginning of the course, only 20% had used it for bibliographic searches.
- 66.7% of the students considered e-mail a useful tool for school contacts and studies.
- All the students indicated that in the future the course should offer more (or at least the same amount of) Internet and computer technology
- No student considered the course website difficult to use.
- 80% of the students rated the organization of the Course Website good or very good, but only 33.3% rated it (very) useful for the course. (p.3)

The development process of a hybrid course was discussed in detailed by Jones, Cranitch and Jo (2001).They named the hybrid course delivery system a Hybrid-Web (HyWeb) course system. HyWeb included elements of web based and traditional instruction. The traditional instruction was reduced significantly and replaced by the Internet and a multimedia CD. The system was a based on the Hybrid Delivery System which was designed for use in a multimedia course. The lecture delivery was done trough the Internet in the system. The lectures were in the form of slideshows, videos, sound, animation and downloadable files. The CD was used as a delivery element in conjunction with the web-site. The requirement for the CD came from the speed and bandwidth limitations of the Internet environment.

For student to student and student to instructor interaction, internet communication tools like e-mail, online forum, and online notice board were used together with face to face communication. The authors concluded that the system needs continues improvements, and the combination of this approach with a stable and reliable communication network will result in a robust learning environment.

In their study Maddux and Cummings (2000) proposed guidelines for instructors who planned to develop web pages to support traditional instruction. They called this "mixture" web-enhanced instruction. This was actually a type of hybrid/blended instruction. They asked three questions that would help the developer in planning the hybrid course. The questions were:

1. What elements of the class will be placed on the web?
2. How will the students access the web materials?
3. Are those students who are not familiar with the Internet and the web supported with help?

The study proposed that the answers to these questions will lead to successful web-enhanced (hybrid) courses.

2.6.1 Student Achievement in Hybrid Courses

Several studies compared student achievement in hybrid courses with those in traditional and purely online courses. Student preferences of course format was investigated in a study in which a course on "Computer System Performance Analyses" was offered to students in four different course formats (Lilja, 2001). Students could freely choose which course they wanted to attend. The methods of course delivery for the courses were, (i) live on-campus, (ii) remote TV, (iii) remote-live, and (iv) web-based independent study. Student course preferences were; 60 students preferred the live on-campus course, 14 students preferred remote TV, 29 students preferred remote live, and 20 students preferred web-based independent study. One interesting point in student course preferences was that the students choosing web-based course claimed to take the course because they were free in

selecting the time and place in learning, although most of them lived near the campus. The study also compared the students' achievement in terms of final grades. The results showed that students in the remote classes and in the web based class performed better than those in the on-campus class.

Effectiveness of these hybrid courses was also investigated (Truckman, 2002). The study investigated a hybrid model called ADAPT (Active Discovery and Participation thru Technology). The model aimed to combine the features of traditional classroom instruction with those of computer mediated instruction. The model was used to teach a 10 week long study skills course. Students' academic performance in terms of grade point average was used to compare the effectiveness of the hybrid course with the traditional course. The findings of the study indicated that students taking the course in hybrid mode were the most successful ones with the highest GPA achievement relative to past performance.

In their study Christmann, Badgett and Lucking (1997) compared academic achievements of students in three types of instruction; traditional, hybrid and web based. They found that students in the hybrid course got higher academic achievement than 57.2% of the students in the traditional course. They also indicated that the students in the hybrid course increased their success from 50th percentile to 57.2th percentile.

A similar result to the above study on student achievement in hybrid courses was found by a later study (Christmann and Badgett; 1999). The study compared highschool science students' achievement in a hybrid course with those in a traditional course. The students in the hybrid course got higher achievement scores than 60.4% of the students in the traditional course. They study also found out that the students in general science course increased their grades more than those in biology, chemistry and physics courses when compared to the students in the traditional courses. The general science students in the hybrid course scored 78 % better than those in the traditional course.

A more recent study was done on achievement of high school students in hybrid courses in which physics students final scores for three four year periods, which is for a total of 12 years were compared (Persin, 2002). The courses were hybridized by a web-site on which weekly lecture notes, plans, assignments and additional links to other physics information sources were provided. The class time was used more for demonstrations, group lab activities and multimedia presentations. Significant increases in final exam scores of students were observed after the implementation of the web-site. The scores of the students decreased after the high school changed its class schedules and increased when the course was hybridized. In four year blocks the class mean and standard deviation of students final grades in before block scheduling, first four year of block scheduling and after starting to implement the hybrid course were, 78.2 and 7.4, 65.7 and 6.4, 72.4 and 7.1 respectively.

2.6.2 Student Satisfaction in Hybrid Courses

Student satisfaction in a hybrid course was investigated 84 students in two hybrid courses (Gray, 1999). Students were required to fill a numerical rating scale on their course satisfaction and write their comments on their ratings and their overall experience. The results were investigated and a subjective comparative analyses based on the ten dimensions of interactive learning on World Wide Web (Reeves, 1997) was made. The findings indicated that student satisfaction was high in the hybrid courses and students were generally satisfied with their learning experience.

A comparison of traditional, online and hybrid courses in terms of students course satisfaction was conducted by Black (2002). In his research Black investigated students' perceptions of the three course delivery methods. Students were asked to complete a survey on their course satisfaction. The results showed that students preferred hybrid course delivery method to either online only or classroom only methods. Another interesting finding of the study was that as student level of

computer expertise increased so did their level of satisfaction in online and hybrid courses.

2.6.3 Student Attitudes in Hybrid Courses

The effect of changing an ordinary course into a web-enhanced, hybrid course on pre-service teachers' attitudes towards computers was investigated by Gunter (2001). An "Introduction to Technology" course was re-designed to meet once a week for three hours throughout the semester. Class meetings were reduced to 50% lecture and 50% hands on study in Computer laboratory was added. A total of 171 pre-service teachers were given the Computer Attitude Scale as pre-test and post-test. The analyses of the collected data showed that the re-design of the course was successful and positively changed students' attitudes towards the use of technology. The results also showed a statistically significant change in students' attitudes toward computers. The study found out that the web-enhanced (hybrid) course was successful in significantly reducing computer anxiety.

Enhancing a traditional introduction biology course with a web component and investigating students attitudes were the scope of another study (Sanders & Morrison; 2001). A web component that allowed asynchronous learning outside the classroom was added to a biology course. 110 students could get access to chapter outlines, grades, questions, quizzes and course syllabus from the web. The effects of web-enhancement were measured by essays, short answer and multiple choice questions and in-class discussions. They found out that the web component had a highly positive effect on student learning, problem-solving skills and critical thinking skills. Student attitudes towards web-enhanced learning were found to be significantly positive.

Truell, (2001) investigated students' attitudes with different learning styles towards the use of Internet in hybrid courses. He used a four point scale survey to collect data. Student attitudes were grouped by learning style which was obtained by

the Group Embedded Figures Test (GEFT). The study found that the neutral learning style group had the most positive attitude towards the use of Internet in hybrid courses. Furthermore, female students had a more positive attitude toward hybrid instruction than male students.

The students' attitudes were investigated by several studies. One of them is made on a hybrid course in freshman mathematics course (León de la Barra, León de la Barra, & Urbina; 1999). In the study investigates students' course approvals in a special program in mathematics which combines traditional classroom teaching and "hands on" student activities, developed "off campus". The couse was offered 650 engineering freshmen, distributed in 10 sections of around 65 students in a university in Chile. Different types of "hybrid structure" were developed for the program: Traditional Classes – Real Workshop (TC– RW), Traditional Classes – Virtual Workshop (TC – VW) and (TC – RW – VW). The results of the study pointed towards the hybrid structure structure TC – RW – VW as the best one in terms of students interviews and written surveys. Other findings of the study was that while 70% of the students approved the hybrid course while this was 55% fort he traditional course. The interview results also showed that the students' attitudes towards the mathematics course changed positively.

2.6.4 Student Perceptions in Hybrid Courses

Brannan (2002) tried to understand students' perceptions about the interactions in a hybrid instruction, traditional instruction and online instruction. The results of a survey applied to 318 students equally divided into the tree type of instruction were as fallows:

1. In all four type of interactions, that are student-student, student-instructor, student-content and student-technology, interactions are impacted favorably by the use of technology.
2. Hybrid Instruction is excellent way of group work even when class meets only half of the time face to face.

3. Students rated online environment as the highest in interaction preference, then hybrid instruction, and least face to face instruction in student-instructor.

The communication and information flow in another web-enhanced (hybrid) courses was investigated by Driver (2002). In his research study, he investigated the effect of small group online activities on students' perceptions about overall interaction in a web-enhanced environment. The study investigated the use of communication tools like forum and chat in a course which hybridized web-based instruction with a broadcast-TV instruction. The students were expected to use the group-based projects and make online discussions. The data were collected trough a survey that revealed student perceptions on group interaction, class interaction and class satisfaction. The result of the study showed that students did not like to interact with other class mates and the instructor as much as they like to interact with their peers in their groups. Another interesting finding was that the students did not want to use the chat tool. Driver (2002) explained this by arguing that students could speak to each other in the face to face meetings, that's why they did not preferred to use the chat tool.

Similar findings on students' communication preferences to that of the above study were found in a research on the utilization of an online learning support system for pre-service teachers (İnan, 2003). The study showed that students did not use the web-site of the course for communicating. This was also explained by students having chance for face to face interaction.

2.7 Summary of Literature Review

The integration of technology to education and mainly instruction was discussed in the literature review. The discussion on how to understand technology, purely as a media that can not support learning/teaching or inherent to the

learning/teaching process enabling better learning resulted with the common view that: Just focusing on the technology would be wrong, learning should be the center of the interest. (Kozmo, 1994; Russel, 1999; Jonassen, Campell, and Davidson;, 1994; Ehrmann, 1999). For effective online teaching and learning environments, exploring the abilities of new media, being aware of various technologies was sated to be required but not enough. There was the need to understand how learning occurred in these environments. (Maguire and Matejka, 2001). Computer Mediated Communication (CMC) was defined as communication between parties separated in space and/or time, mediated by interconnected computers (Romiszowski and Mason, 1997). CMC was used in many types of technology integrated instruction/learning. Synchronous and Asynchronous communication were types of interaction and communication that could take place in CMC.

Distance Education was used to establish planned learning in environments where students and instructors were separated by time and place (Moore & Kearsley, 1996). The reports of Russell (1999) and Phipps and Merisotis (1999) showed that there were more than 300 studies, finding "no significant difference" between Distance Education courses and traditional courses. The studies claimed that some of those researchers were flawed.

Web Based Instruction (WBI) was defined as a learning environment in which learning was fostered and supported through the use of the attributes and resources of the World Wide Web (Khan, 1997). The major advantage of WBI was stated as being able to communicate with any person or/and access many resources independent from time and distance (Hill, 1997). This structure was suitable for constructivism because of the non-time dependency and freedom to access learning material at will. To understand the effectiveness of the WBI environment several instructional models were developed. The models of Reeves and Reeves (1997), Caladine (1999) and Welsh (1997), were important guidelines for the WBI designers.

The hybrid course design was different than WBI in that it combined the advantages of face to face and online modes of instruction. The studies of Harnham

and Kaleta (2002) and Sands (2002) were proving proposals for hybrid course design and development. Other studies on finding the ideal hybrid structure were done by (Marques et. al., 1998) and Jones, Cranitch and Jo (2001). In both studies hybrid courses were developed and descriptive studies were made. Both studies found the hybrid course mode superior on traditional course mode. Studies on student achievement in hybrid course showed that students were more successful in the hybrid courses that in purely web based or traditional courses (Lilja, 2001; Truckman, 2002, Christman et. al.,1997; Christman and Badget, 1999; Perisin 2002). The literature showed that students' course satisfaction was high in hybrid courses (Gray, 1999; Black, 2002). Student attitudes toward technology and technology integrated courses were indicated as positive in the hybrid course. Several studies showed that a "mixed" course structure was preferred by the students and that hybrid courses effected students learning positively (Gunter, 2001; Morrison, 2001, Barra et al., 199).

The literature generally showed positive attributes of the hybrid structure. There were no detailed, empirical studies on the effectiveness of the hybrid course and the effect of each component of the hybrid course to students learning.

CHAPTER 3

RESEARCH METHOD

In this section the research questions, design, procedures, subjects, variables, instruments and analyses procedures of the study will be explained. To investigate the effectiveness of a hybrid course two different research methodologies have been used in conjunction, quantitative and qualitative. Experimental study was carried out to understand if there is a significant difference between the hybrid course and a traditional course in terms of students' achievement, retention, satisfaction and attitude. Content analysis was done to understand students' perceptions about the effective dimensions of interactive learning.

3.1 Research Questions

The overall aim of the study was to examine the effectiveness of the hybrid course. The experimental group was exposed to the hybrid course while the control group was exposed to traditional classroom instruction. The research questions are serving for understanding two major purposes:

1. To compare the hybrid course with a traditional course in terms of students' achievement, retention, attitudes towards the course content and course satisfaction.

2. To investigate students perceptions about the effective dimensions of interactive learning.

The research questions that guide this study are listed below:

Question 1. Is there a significant difference between experimental (exposed to hybrid course) and control (exposed to traditional instruction) groups in the achievement tests at the end of the experiment?

Question 2. Is there a significant difference between experimental and control groups in knowledge retention one month after the experiment?

Question 3. Is there a significant difference between experimental and control groups in attitudes toward computer networks subject at the end of the experiment?

Question 4. Is there a significant difference between experimental and control groups in course satisfaction at the end of the experiment?

Question 5. What are students' (experimental group) perceptions about the hybrid course in terms of effective dimensions of interactive learning at the end of the experiment?

Sub Questions:

5.1. What are students' perceptions about the pedagogical philosophy employed in the hybrid course?

5.2. What are students' perceptions about the learning theories that formed a base for the hybrid course?

5.3. What are students' perceptions of goal orientation of the hybrid course?

5.4. What are students' perceptions of task orientation of the hybrid course?

5.5. What are students' motivation types in the hybrid course?

5.6. What are students' perceptions in terms of teacher role in the hybrid course?

5.7. What are students' perceptions of metacognitive support in the hybrid course?

5.8. What are students' perceptions of collaborative learning strategies employed in the hybrid course?

5.9. What are students' perceptions of structural flexibility of the hybrid course?

3.2 Hypotheses

1. There is no significant difference between experimental (hybrid course) and control (traditional instruction) groups in achievement at the end of the experiment.

2. There is no significant difference between experimental and control groups in knowledge retention one month after the experiment.

3. There is no significant difference between experimental and control groups in attitudes toward Computer Networks Subject at the end of the experiment.

4. There is no significant difference between experimental and control groups in course satisfaction at the end of the experiment.

3.3 Design of the Study

To compare experimental and control groups in terms of achievement, retention, attitudes towards the course content and course satisfaction, pre-test/post-test control group design was used in this study. For the purpose of this study a hybrid course covering computer networks topics was designed and developed. In the beginning of the semester, achievement and attitude tests were given as a pre-test to both control and experimental groups. As the treatment, the experimental group attended the hybrid course, while the control group was lectured in a traditional course. The same content was covered in both courses. At the end of the semester an achievement test and an attitude test were implemented to both groups as post-tests. One month after the post-test implementation, the achievement test was given again to both groups as a retention test. Just after the post-tests, all students in the experimental group were interviewed one by one about the effectiveness of the course. At the last meeting of the class, a course feedback form containing questions about course satisfaction was given to the students in both groups. In order to be sure that all students used the web-site of the course in the experimental group during the treatment students' activities were recorded with a log-system. The data in the log-system was also used to triangulate student perceptions.

Table 3.1-Design of the Study

	Pre-Test	**Treatment**	**Post-Test**	**Interview**	**Retention**
Control Group	Attitude scale Achievement test	Traditional classroom instruction	Attitude scale Achievement test Course feedback form		Achievement test
Experimental Group	Attitude scale Achievement test	Web-assisted (hybrid) instruction (Students' online activities were recorded by the log system.)	Attitude scale Achievement test Course feedback form	Interview guide	Achievement test

3.4 Procedures of the Study

A "Computer Networks and Communications" course was offered as an elective course to all Middle East Technical University students in 2001-2002 Fall. 50 students attended the course. The students have been assigned to experimental and control groups by using match pair sampling. The criteria used for matching was Cumulative Grade Point Average (GPA) grade and faculty type of the students. The control and experimental groups consisted of 24 and 26 students respectively. The study lasted for one semester, which was about 14 weeks. To understand the entry

knowledge levels of the students, before the treatment an achievement test on the topics that were covered in the course were given to the students in both groups as pre-test. To determine the initial attitudes of the students towards the subjects covered in the course an attitude test was also given to both groups as pre-test.

Experimental group took the course as hybrid course, while the control group took the same course in a traditional course structure with face to face teacher lecturing. Both courses were offered by the same instructor, who was at the same time the researcher of the current study. The experimental group met once a week for one hour to do classroom activities while the control group met once a week for three hours. During their one hour classroom meeting, the experimental group worked in groups, participated in classroom discussions, played educational games, planned their projects and took quizzes. The control group was exposed to classroom lecturing for two hours in a week, and in the remaining one hour was used for group activities, games, planning projects and taking quizzes. Students in both groups were exposed to the same instructional/learning group activities, games, homework, assignments, projects and quizzes. The major difference was in the way the content was given. The students in the experimental group were required to read the content from the course web-site, ask questions in the forum, take the assignments online, and investigate additional course related web sites. While the students were free in choosing when to read the content from the web site, they had to be active in going trough the content related web pages.

In the beginning of the first class of the hybrid course a short orientation about how to use the web-site, navigations and cognitive tools was given to the experimental group. Students were informed about, what was expected from them while using the web-site, what the security policies were, how the site was functioning, what the Internet address of the web-site was and how to choose their username and passwords. Students' web-site usage was logged by the log system, and each week the durations and activities of each student were controlled. When experimental group met once a week for one hour to participate in the classroom activities, no lecturing was done in the classroom. The control group was lectured by

the instructor using PowerPoint slides and the students in the traditional course did the same classroom activities as well. This treatment continued throughout the semester.

Every student in the experimental group had to visit the web-site of the course and had to be active for at least one hour each week. The student could not leave the page open and leave, since the system logged them out after 5 minute inactive time. In the one hour classroom meeting, students with suspicious activities and students with visiting time less than one hour were informed to be cautious about their performance related with the course web-site

The differences in learning and teaching activities between the hybrid course and the traditional course were shown by using Caladine's (1999) model which he called "A Model for Learning and Teaching Activities" (MOLTA). The differences between the two courses are summarized in Table 3.2. The common activities of the two courses are shown in Figure 3.1 This model was not restricted to on-line environments. It aimed to help teachers in embracing flexible delivery of material in a systematic manner.

MOLTA classified teaching and learning activities into five elements:

- Delivery of material
- Interaction with materials
- Interaction with the teacher
- Interaction among students
- Intra-action

Table 3.2-The Differences between the Hybrid Course and the Traditional Course

Element	**Traditional Course (3 hours of classroom meeting each week)**	**Hybrid Course (1 hour of classroom meeting each week)**
Delivery of Material	Lectures supported with PowerPoint presentation	Web-site, on-line materials
Interaction with materials	Text books, notes, library books, homework, quizzes, classroom activities	Multimedia, web browsing, cognitive web tools, homework, quizzes, classroom activities
Interaction with the teacher	Classroom discussion, face to face questions, consultation	Web announcements, forum, phone, face to face questions, consultation
Interaction between students	Group works, classroom discussions, projects, classroom games	Web forum, e-mail, group works, classroom discussions, projects
Intra-action	Classroom discussions, group works	Classroom discussions, group works, web forum

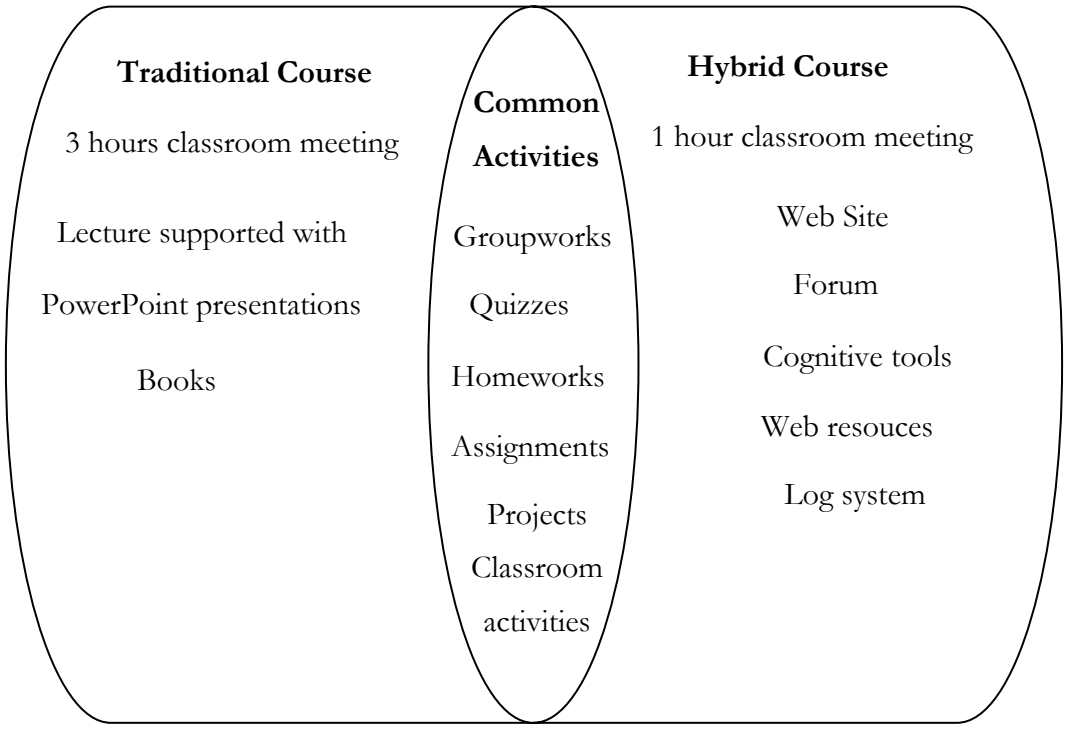

Figure 3.1 The Common Activities of the Traditional and Hybrid Course

At the end of the semester, the same achievement test and attitude test that were used as pre-tests were implemented to both groups as post-tests. After the post-tests, the students in the experimental group were interviewed individually to get their perceptions about the hybrid course in terms of effective dimensions of interactive learning. The students in the hybrid course were interviewed one-on-one during the last two weeks of the semester. Each interview lasted for about 40-60 minutes. The interviews were recorded having taken students' consent. The recorded interview data was transcribed and analyzed to find out the students' perceptions in terms of effective dimensions of interactive learning environment. To understand student perceptions on a dimension, content analysis was established on the answers to the questions on that dimension. The interviews lasted for two weeks. One month after the post-test, the achievement test was implemented again to both groups to measure knowledge retention.

3.5 Subjects of the Study

The subjects of the study were 50 Middle East Technical University students taking the "Computer Networks and Communications" elective course. 60 students registered to the course initially. The students were assigned to the hybrid course or traditional course by the instructor using the "matched-pair technique" to control Grade Point Average (GPA) and the faculty representation. Equal representation in terms of student achievement and student faculty type was achieved using this technique. Registered students were paired based on the GPA and faculty types and assigned to experimental and control group randomly. There were only three female students registered to the course. Two of them were assigned to the control group while one female student was assigned to the experimental group.

A total number of 52 students participated in the study at the beginning of the semester. The experimental and control groups consisted of 26 subjects. 8 students from a total of 60 students who made initial registration could not be matched or the students did not want to participate in the selected group and dropped the course. During the treatment, 2 students from the control group withdrew from the course. As a result, there were 24 students in the control group and 26 students in the experimental group yielding 50 subjects participating in the study.

3.6 Research Model

There are three types of variables in the study: (i) control variables, (ii) dependent variables, (iii) independent variables. The variables are listed and described below:

Control Variables:

1. Students' cumulative grade (GPA) in the beginning of the study.

2. Students' faculty types.

3. Students' pre-test scores on computer networks topics that were covered in the course.

4. Students' pre-test scores on attitudes toward computer networks topics.

5. Students' Log System data.

Dependent Variables:

1. Students' post-test scores on computer networks topics that were covered in the course.

2. Students' post-test scores on attitudes towards computer networks topics.

3. Students' retention test scores on computer networks topics that were covered in the course.

Independent Variable:

Treatment (Web-assisted instruction or traditional classroom instruction).

Table 3.3-Summary Table of the Variables

Control Variables	Independent Variables	Dependent Variables
Cumulative grade	Treatment (Web assisted instruction or traditional classroom instruction)	Post-test scores on computer networking
Faculty types		Post-test scores on attitudes
Pre-test scores on computer networks		Retention test scores on computer networks
Pre-test scores on attitudes towards the computer networks topics		
Log System		

3.7 Definition of Terms

Web Assisted Instruction (Hybrid Course): A hybrid course is a blend of face to face instruction with online learning that a significant part of the instruction is online and as a result the amount of classroom seat-time is reduced. It includes the learning materials developed by the researcher, classroom settings and face to face instruction.

Web Based Instruction: Web based instruction is a place, community or practice, in which the attributes and resources of the World Wide Web are utilized to support learning.

Traditional Instruction: It is the face to face classroom instruction. The students are taught in traditional classroom environment with the teacher lecturing.

Achievement Test: Measures students' achievement on the topics covered in Computer Networks and Communications course.

Attitude Test: Measures the subjects' attitudes towards the topics covered in the Computer Networks and Communications course.

Computer Networks: A computer network is a collection of computers that are interconnected.

Cognitive Tools: Cognitive tools are learning and thinking support tools to extend the cognitive processes of learners.

3.8 The Treatment – "Computer Networks and Communications Course"

To implement the experiment an undergraduate course offered by the Department of Computer Education and Instructional Technology at METU was chosen. The "Computer Networks and Communications" course was offered in two sections in the Spring Semester of 2001-2002 academic year as an elective course.

The course description of the course supplied by the METU 2003 Course Catalog is:

> "CEIT 314 Computer Networks and Communications": The course introduces the underlying concepts and principles of computer networks. It presents the different components of a network and how these components fit together. The course emphasizes the design and implementation of network software that transforms raw hardware into a richly functional communication system. Real networks (such as the Internet, ATM, Ethernet, Token Ring) will be used as examples to reinforce the concepts and demonstrate various protocols.

As a prerequisite to the course all students were required to have taken the IS100 "Introduction to Information Technologies and Applications" course, which covers computer literacy topics. The catalog information of the course is "Introduction to computers, computer hardware and software, word processors, spreadsheets, computer networks and Internet browsers. The material is taught totally in the laboratory." This course was required to assure that all students participating in the study had the basic knowledge level about computers.

The "Computer Networks and Communications" course was designed as a hybrid course for the experimental group, while it was offered as a traditional face to face lecturing course to the control group. The hybrid course required self-paced learning time since the course content was online, creating a significant reduction in classroom lecture time.

3.8.1 The Website of the Course

The course was offered to the students in the experimental group as a hybrid course, which required a mixture of face to face instruction with online learning. For this purpose, a web-site was developed to serve as the Web-based learning environment of "Computer Networks and Communications" course. The web-site of the course was developed by two faculty members Computer Education and Instructional Technology Department of Middle East Technical University. While one of them, the instructor of the course, designed the instruction, created and adapted the content and developed all activities related with the course. The other member who referenced below developed the user interface and the database system of the web-site. Some of the Internet technologies used in developing the web-site can be listed as, Active Server Pages (ASP), Microsoft SQL Server 7.0, Dynamic HyperText Markup Language (DHTML), and Cascading Style Sheets (CSS).

The course web-site consisted of course content, syllabus, announcements, assignments, forum and comments parts. In the web-site there were also some cognitive tools to support student learning. These tools were also designed and developed by the same faculty member mentioned above (Özçelik; 2002).

Before the study, the "Computer Networks and Communications" course was given to Middle East Technical University, Computer Education and Instructional Technology students as a must course. Although the course had been offered, there were no written goals and objectives. The course was redesigned as a hybrid course for the purpose of this study. The first step of redesign was analysing the data about the course. Informal and formal data of students who already took the course in terms of student feedback and grades were investigated. Existing knowledge and skills of the students who applied for the course were also investigated. As the second step, the desired outcomes of the course in terms of goals and objectives were specified and specific learning objectives, assessment instruments, exercises, and topics to be included were documented. These were used to determine the content and visual elements of the web-site of the course. While there were new created contents and visuals, because of internal validity concerns, majority of the visual elements and the content were adapted to be used from a commercially well-known information source with permission. As the third step, the graphical user interface of the web-site was designed by the researcher and developed by another faculty member and opinions of two instructional technology experts were asked. According to the suggestions of the experts, the required design changes were made. As the last step of creating the web-site, the content and the visual materials were coded. The content was structured in the web-site according to the syllabus, which organized content week by week. The design and the web-pages were ready to use before the course started. As implementation, every week one of the chapters was published for student access. The effectiveness of the design and training materials were continuously evaluated through students' comments. Moreover, the web-site of the course was a dynamic one, working with conjunction to a database.

Because of "Computer Networks and Communications" course had high technical base, loaded content, more procedural knowledge and skills, and had students with limited prior knowledge about the content the web-site was relying on guided learning and the activities in the classroom on discovery. The instructional design of the course was a mixture of objectivist and constructivists approaches. The web-site included objectivist/instructivist (directed learning) and constructivist elements. Since this was a hybrid course, objectivist structure in terms of content presentation structure in the web-site was supported with constructivist elements especially in classroom meetings. Group works, games, discussions and projects are constructivist elements planned to go hand in hand with the online part of the course.

The users were authenticated with username and password to access the web-site of the course. The username supplied in authentication initiated the log system, which was internally bound to a database, to keep track of the activities of the students while going trough the content and using the cognitive tools.

The screen design of the web-site separated the web page in to two main parts. One part was used for visual and/or graphical elements, and the other part was used for content related text in the whole content screen to provide the consistency. A sample content page is supplied in figure 3.3. A "Jump to" tool in the form of a drop-down menu enabled the students to navigate to any part of the web-site whenever they wanted. The students could always see where they were by the "You are here:" tool. Other tools to mention were, site map and help, which were useful for students in navigating between different parts of the web-site.

The main page of the web-site (Figure-3.2) included six links that the students could choose from (Course Content, Syllabus, Announcements, Assignment, Forum and Comments). Additionally, there were three message notes, first one was a message from the instructor, second one was a note written by the students themselves to remind them things, and the last one highlighted the last content students visited.

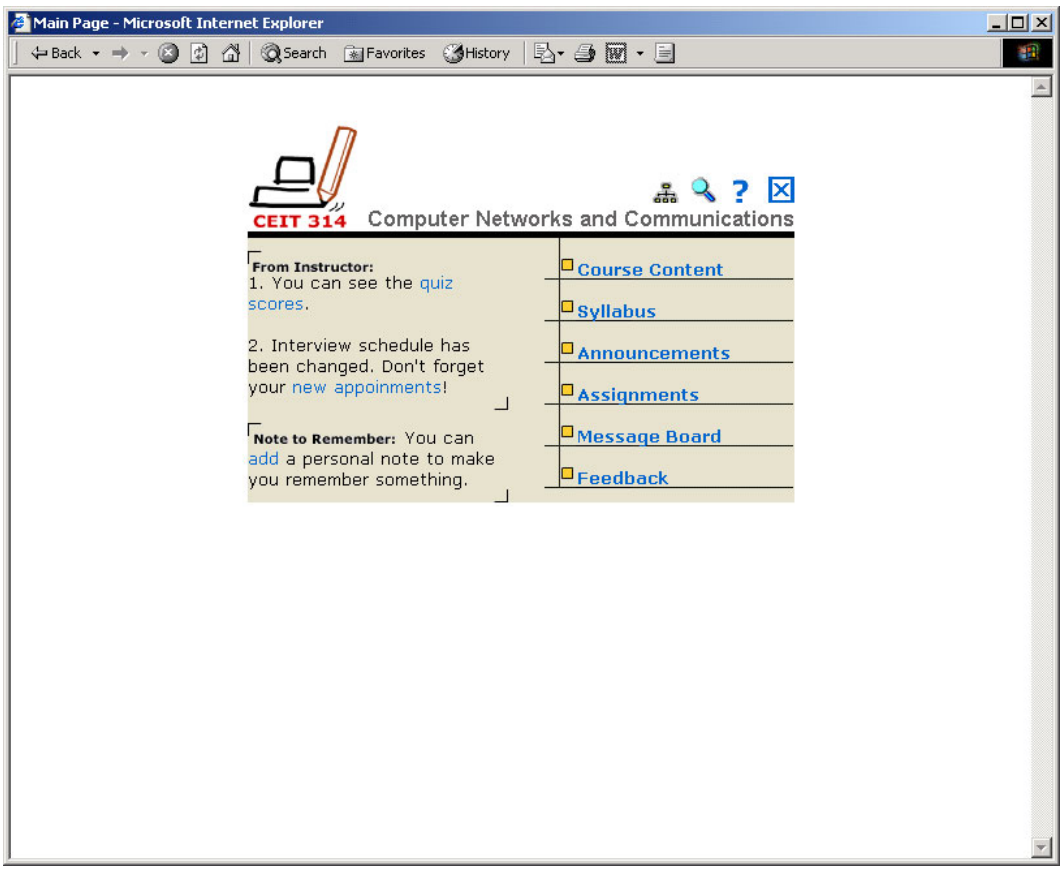

Figure 3.2 The Main Page of the Web-Site

3.8.2 Components of the Course Web-site

The content of each link that is reachable from the main page of the web-site is explained below;

Course Content: The content of the course was broken down to chapters which were numbered (Figure 3.3). While reading trough the content the students do not need to go back to the contents page after each topic. The students could start from any available topic and go through the content according to their own decisions. The navigation is user driven, so students can go to any link any time they want. There was no scrolling on any page of the web-site. When there were multiple pages, the

total number of pages and indication for the current page were shown on the bottom of the page. The content was supplied week by week parallel to the traditional class. The students could not access a future week topic but could go through previous and current week topics. After reading the content the students needed to go to the assignments link to do the weekly assignments.

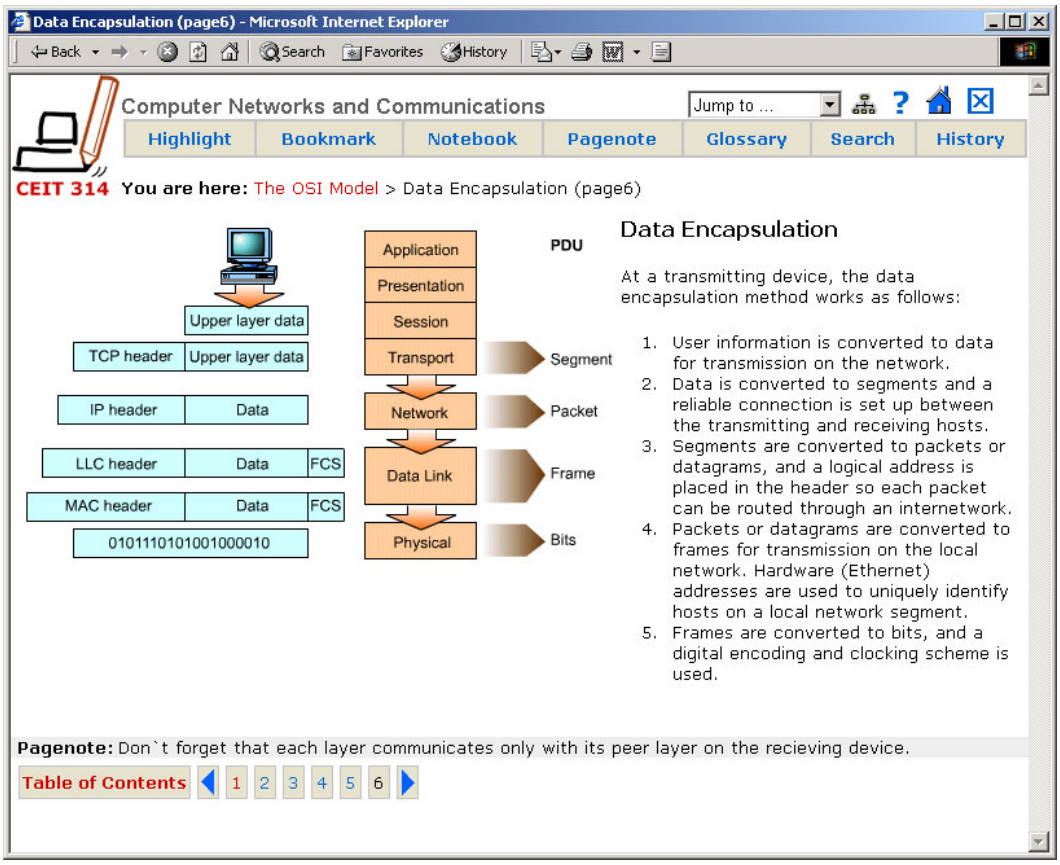

Figure 3.3 The Content of the Course

Syllabus: The course syllabus was provided on this page. The students could find detailed information about the course. The syllabus was reachable anytime the students wanted.

Announcements: The students could find announcements related to the course content on these pages. New announcements about additional web resources related to the topics covered were supplied each week. After reading the content in the web-

site students could visit the additional web resources to enhance their understandings of the topics. Like the content pages, announcements were separated week by week (Figure 3.4).

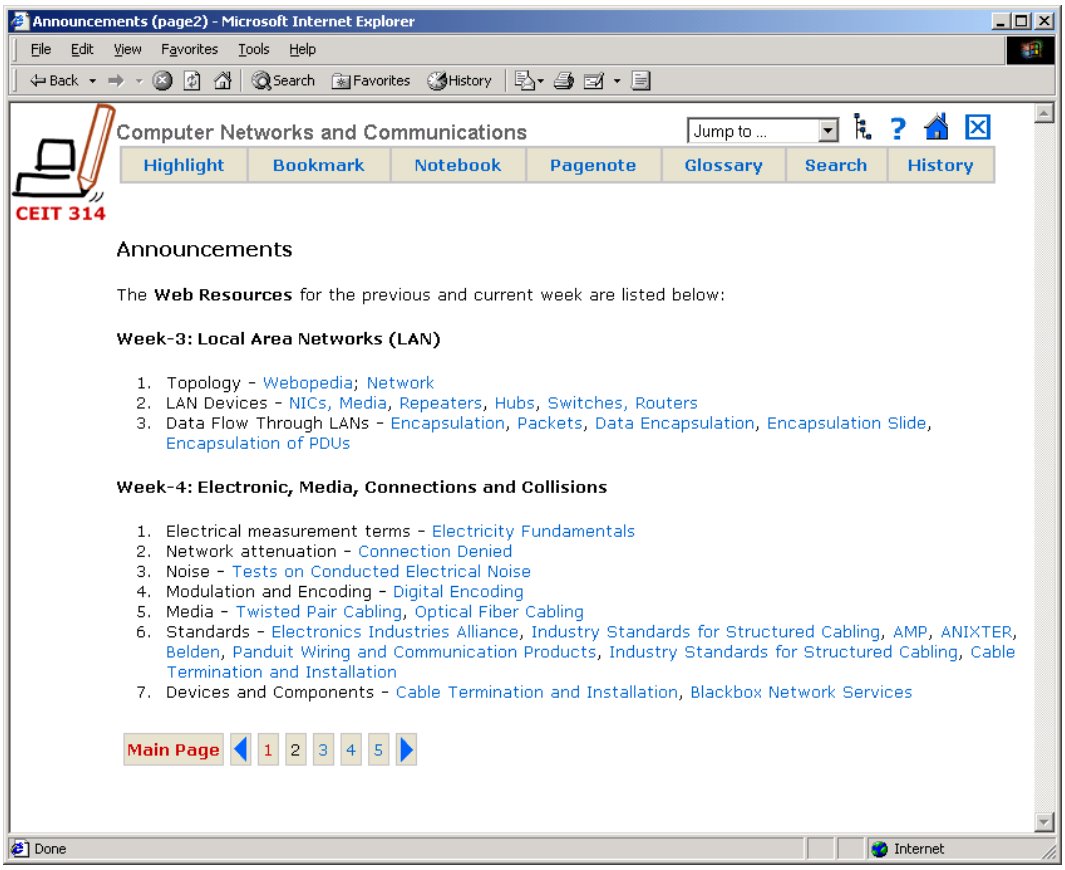

Figure 3.4 The Announcements Page of the Course Web-site

Assignments: Weekly assignments related to the topics covered on the week were supplied at this link. The assignments were in the form of small projects, extra readings or homework. The assignments had to be submitted to the instructor trough e-mail.

Forum: This link was for extra communication requirements, like questions to peers or questions to the instructor. Although students could ask their questions in the one hour face to face part of the hybrid course, this link was used especially to ask questions about the topics covered while reading the content.

Comments: Students could send their arguments, opinions and technical problems by using this link.

3.8.3 Cognitive Tools of the Course Web-site

A significant difference between the course web-site and a static web-site were the cognitive tools. The cognitive tools present in the "Computer Networks and Communications" course web-site were Highlight, Bookmark, Notebook, Pagenote, Search, Glossary, History, Sitemap and Note to Remember. The effective parts of the cognitive tools are that they are permanent. This means that whenever and wherever a student revisits the web-site he/she will see what he/she did on the pages previously. This gives the students a feeling of customized web-site for their own. The cognitive tools in the course web-site are explained below:

Highlight: The students could mark a part of the text in the content as if they mark text on a book with highlighter pen. In addition to marking or highlighting the text, the student could associate the marked text with a keyword. Students could see the marked text by easily selecting the keyword from a drop-down menu. The keyword and highlighted text association can be removed anytime the students want to. When the student points on the highlighted text with the mouse pointer, the keyword is shown on the mouse pointer.

Bookmark: By putting a mark on a web-page within or outside the course-website, the students could create navigation links. The students could return to the bookmarked page easily by accessing the bookmark list and clicking on the link. New links were added to the bookmark list every time a bookmark was created, and unused links could be removed from the list.

Notebook: The notebook tool was functioning similar to a real notebook, on which students could take notes. The students could copy and paste any portion of the text

from the content they wanted to read while studying later. The notes could be reached by clicking on their titles from a menu.

Pagenote: To associate a note to a particular page the students could use the pagenote tool. This tool allowed the students to write or copy-paste anything on the bottom of the page.

Search: The students could search a word or phrase within the web-site. Not only the course content but also anything within the tools was searched.

Glossary: The course had extensive amount of abbreviations and technical terms. The students could use this tool whenever they wanted to look up for an abbreviation or technical term.

History: The students could look up their past activities. The tool could show the visited web pages and performed cognitive tool activities for "today", "yesterday" or "this week".

Sitemap: By using this tool students could see all links of the web-site at one glance. The view could be condensed or extended by the minus and plus signs.

Note to Remember: This tool was a reminding note area on which the students could write their own notes. When the student leaves the site and returns, he/she could see the note in the main page.

3.9 Instruments

The following instruments were used to obtain relevant data to investigate the effectiveness of a hybrid course.

3.9.1 Achievement Test on "Computer Network & Communications" Topics

The Achievement test was used as pre-test to measure students' prior knowledge, post-test to measure knowledge acquisition and retention test to measure students' knowledge retention on "Computer Networks and Communications" subjects. The Achievement test was adapted by the instructor of the course and consisted of 69 multiple choice type questions in "Computer Networking and Communications" topics. The questions were chosen from a standardized test of a commercially well-known organization, working on online teaching of networking hardware and software issues. The questions were chosen parallel to the course objectives which were used to categorize different cognitive levels of learning so that different learning levels were included in the test. The test was developed in multiple choice format. The test prepared was examined by two subject matter experts for internal validity, and found to be valid. The test was piloted to 40 students that have taken the "Computer Networks and Communications" course in 2001 Spring Semester to examine the clarity of items, to understand the time required to fill out the test. The results of the item analysis showed problems with 9 questions. Those questions were eliminated from the test leaving 60 questions. The reliability coefficient of the achievement test was alpha=0.91. The achievement test can be found in Appendix-B.

3.9.2 Attitude Scale on "Computer Networks and Communications" Topics

"Computer Networks and Communications" Subject Attitude Scale was developed to investigate subjects pre-attitudes and post-attitudes toward computer networks topics. Some of the items in the attitude scale were adapted Yıldırım's (1999) subject attitude scale about circulatory and excretory systems in Biology to computer networks and communication topics, and some others are developed by the researcher. The attitude scale had initially 43 items. In order to check the internal consistency of the items, clarity of questions and to find the reliability, the test was piloted on 32 students who took "Computer Networks and Communications" course in 2001 Spring Semester. The results were investigated by the researcher and measurement and evaluation expert provided feedback for the scale. Based on the feedback gathered, 6 of the questions were excluded from the attitude scale.

The Attitude Scale had 37 items in the type of 5 point-likert scale (Strongly Disagree, Disagree, Neutral, Agree and Strongly Agree). There were positive and negative statements on the scale. The positive items were coded from 5 (Strongly Agree) to 1 (Strongly Disagree) the negative items were coded from 1 (Strongly Agree) to 5 (Strongly Disagree) for each statement. The answers of the students were triangulated trough at least 2 statements for each opinion about the computer networking topics. The attitude scale proved to be highly reliable (alpha=0,92). The minimum score was 76 and the maximum score was 156. The Attitude Scale can be found in Appendix-C.

3.9.3 Course Feedback Form

The course feedback form was developed by the researcher to collect data on students' satisfaction about the hybrid course. It included 14 questions in the type of 5 point-likert scale (1= Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree and

5= Strongly Agree). The form aimed revealing student satisfaction related to instruction and course design. Expert opinion was taken for the form. The form was given to the students at the end of the semester together with the achievement post-test. The Course Feedback Form can be found in Appendix-D.

3.9.4 Log System

The Log system was integrated in the course web-site database. It was used to track the student activities in the web-site. The Log system kept logs of each student in terms of username, the topic(s) visited, time spent on each topic and login-logout time.

Sample:

username	topicno	duration	enter time
kavzan	3	339 sec	2001-10-23 15:34:13.000

With the help of the log system, the time spent on a specific chapter and total time spent on the website for each user was calculated. Actions that the student performed on the course web-site were tracked. Total number of visited pages and total number of tool actions for each user were calculated.

- Some of the actions that are tracked by the log system are:
- Logging into the web-page.
- Logging out from the web page.
- Moving between main links.
- Moving inside the main links (between pages).
- History of the visited pages.
- History of the web tools (Cognitive tools within the web pages) used.

A screen capture from the Log system can be found in Fig 3.5.

2:Data in Table 'history'

username	conceptno	pageno	entertime	id	pagename	par1
mberigel	1-3-6	2	2/28/2003 2:43:34 PM	65751	Content	Converting binary numbers to
s_ates	1	2	2/28/2003 5:27:31 PM	65846	Content	Introduction to Computing Ba:
s_ates	1-1-1	6	2/28/2003 6:11:06 PM	65903	Highlight Text	Any time information goes into
ktepecik	0-1	3	3/1/2003 8:10:15 PM	66010	Component	Syllabus
mberigel	1-1-1	4	3/2/2003 4:48:38 PM	66113	Content	Components of a Computer
mcoskun	0-0	1	3/2/2003 8:14:48 PM	66177	Component	Course Content
mcoskun	0-1	1	3/2/2003 8:14:54 PM	66179	Component	Syllabus
mcoskun	0-1	3	3/2/2003 8:15:06 PM	66181	Component	Syllabus
mcoskun	0	0	3/2/2003 8:15:28 PM	66183	Main Page	
mcoskun	0-3	1	3/2/2003 8:16:50 PM	66185	Component	Assignments
mcoskun	0-0-1	1	3/2/2003 8:17:03 PM	66187	Component	Contents of Computing Basics
mcoskun	0-0-1	1	3/2/2003 8:17:09 PM	66189	Component	Contents of Computing Basics
1190594	1-1-4	1	3/2/2003 8:17:18 PM	66191	Content	The installation of a NIC in a P
1190594	1-3	1	3/2/2003 8:17:39 PM	66193	Content	Binary Numbers
1190594			3/2/2003 8:19:32 PM	66195	History	all
1190594			3/2/2003 8:20:11 PM	66197	Logout	
mcoskun	1-1-1	1	3/2/2003 8:21:02 PM	66199	Content	Components of a Computer

Figure 3.5 The Log-system

3.9.5 Interview Guide

In order to investigate students perceptions about the hybrid course an interview guide was developed. The guide was used to find out the students' perceptions about the effective dimensions of WAI environment developed for the study. In the guide there were 24 questions related to different effective dimensions of interactive learning. The dimensions that were addressed with the interview questions were (1) pedagogical philosophy, (2) learning theory, (3) goal orientation, (4) task orientation, (5) source of motivation, (6) teacher role, (7) metacognitive support, (8) collaborative learning, and (9) structural flexibility (Reeves and Reeves, 1997). The interview guide was developed by writing 5 questions for each dimension. The questions were asked so that the answer of the student could give valuable clues about their perceptions related to the dimensions. The questions for each dimension were written as a list and with the help of expert opinions misleading or ambiguous questions were eliminated. An interview form with 36 questions was obtained. It was also seen that, while not initially intended, some of the questions were giving answers on multiple dimensions. Interviews were conducted with two

students at the beginning of the semester. Because of time concerns and difficulty in understanding some of the questions, the interview guide was revised for a second time and the final version of the guide had 24 questions. Expert opinion for the final guide was taken, the guide was found valid by the experts. The Interview form can be found in Appendix-E and the list of questions on each dimension can be found in Appendix-F.

3.10 Data Analysis

Qualitative and quantitative data analyses methods were used in the study. The quantitative analyses were made through descriptive and inferential statistics. The data collected by the achievement test, attitude scale and course feedback form for the groups were compared through t-test and ANCOVA. The comparison was also done using the pre-test within t-test to eliminate the prior achievement and attitude difference of the subjects. The interview data for the students in the experimental group were analysed by qualitative methods. Students' perceptions were investigated by using the effective dimensions of interactive learning used in the interview form as themes. Students' responses were interpreted and categorized in to the dimensions. For the students interview results in each dimension data reduction, data display and conclusion drawing processes were done (Miles & Huberman, 1994). In the data reduction the interview results were categorized and simplified. In the data display, theses categorized and simplified results were organized for conclusion drawing. As the last process, from the reduced, categorized, simplified and organized data conclusions were drawn.

3.11 Assumptions

Following assumptions were made for this study;

1. All subjects in control and experimental group answered the questions to all measurement instruments used in the study accurately and sincerely.

2. All subjects in control group completed the "Computer Networks and Communications" course under equal conditions.
3. All subjects in experimental group completed the "Computer Networks and Communications" course under equal conditions
4. Students' grade point average (GPA) grades can be used as students' entry performance indicator.
5. Student profile is equal in control and experimental groups.
6. The grades of the students on the achievement test can be used as the measure of students' knowledge acquisition performance.
7. All students could easily access to computers and internet.
8. The administration of the instruments was under standard conditions.

3.12 Limitations of the Study

1. This study is limited to a sample size of 50 students.
2. This study is limited to two classrooms taking the "Computer Networks and Communications" elective course offered by the Department of Computer Education and Instructional Technologies During 2001-2002 fall semester.
3. The validity of the responses to the instruments used in the study was limited to the honesty of the subjects.
4. The interviews are limited with experimental group students. The qualitative results of this study are limited with the perceptions of the students taking the hybrid course.
5. Difficulties in getting access to computers and internet might have effected students' achievement and attitude scores.

CHAPTER 4

RESULTS

In this chapter the results obtained from quantitative and qualitative data analysis will be presented. In order to analyze the differences between the groups in terms of achievement, retention, attitude and satisfaction, the data obtained from the achievement test, course feedback form and attitude scale were subjected to inferential statistics. To understand student perceptions about the hybrid course, the qualitative data gathered from the interviews were analyzed using content analysis and were reported in detail. The results of the study were presented in the order of the research questions.

4.1 Quantitative Results

4.1.1 Comparison of GPA of Control and Experimental Group Students

To obtain equal groups as experimental and control groups, the subjects of the study were assigned to each group using match-pair sampling technique. The students in both groups, control and experimental, were matched based on achievement levels in terms of Grade Point Average (GPA) and faculty types (social,

science, engineering, education). However, the course was an elective course and some of the students dropped the course in the add/drop registration time, and some other students withdrew from the course after a few weeks. To be sure that the groups were still equal, control and experimental groups' prior achievement scores in terms of GPA were compared to find out if there was a significant difference between the two groups.

Table 4.1 shows the t-test results for the comparison of prior achievement mean scores of the control and experimental groups at the significance level of 0.05. As shown in Table 4.1 the GPA score for the control group was slightly higher (M=2.49) than that of the experimental group (M=2.43). However the t-test result shows that this difference in the mean scores is not statistically significant. There is no statistically significant difference between GPA's of the students in the experimental and control groups.

Table 4.1-Comparison of GPA of Control and Experimental Groups

Group	**N**	**Mean**	**SD**	**T value**	**df**	**2-tail prob.**
Control	24	2.49	.40	.62	48	.54
Experimental	26	2.43	.36			

4.1.2 Comparison of Pre-Test Scores of Control and Experimental Groups on Achievement

Control and experimental group mean scores on achievement pre-test scores were compared using a t-test at a significance level of 0.05. As shown in Table 4.2, the pre-test mean score on achievement for the control group was slightly higher (M=17.2) than that of the experimental group (M=14.5). However the t-test result shows that this difference in the mean scores is not statistically significant. There is no statistically significant difference between achievement pre-test scores of the students in the experimental and control groups.

Table 4.2-Comparison of Pre-test Achievement Scores of Control and Experimental Groups

Group	N	Mean	SD	T value	df	2-tail prob.
Control	24	17.2	7.4	1.34	48	.19
Experimental	26	14.5	7.5			

4.1.3 Comparison of Attitude Pre-Test Results of Control and Experimental Groups

T- test was carried out on the control and experimental groups' pre-attitudes toward computer networks topics. Mean scores of control and experimental group on pre-attitudes toward computer networks topics were compared using a t-test at a significance level of 0.05. As shown in Table 4.3, the pre-attitude mean score

for the experimental group (M=3.95) was slightly higher than that of the control group (M=3.87). However the t-test result shows that this difference in the mean scores is not statistically significant. There is no statistically significant difference between pre-attitudes of the students in the experimental and control groups.

Table 4.3-Comparison of Pre-Attitudes towards Computer Networks of Control and Experimental Groups

Group	N	Mean	SD	T value	df	2-tail prob.
Control	24	3.87	.29	-.84	48	.40
Experimental	26	3.95	.36			

4.1.4 Results on Hypothesis 1 - Difference between Experimental (Hybrid Course) and Control (Traditional Instruction) Groups in Achievement.

To test the first hypothesis t-test and ANCOVA were carried out on achievement scores. Mean scores on post-test achievement of control and experimental group were compared using a t-test at a significance level of .05. As shown in Table 4.4, the post-test mean score on achievement for the control group (M=48.2) was slightly higher than that of the experimental group (M=45.1). The t-test result showed that this difference in the mean scores was statistically significant at a significance level of .05.

Table 4.4-Comparison of Post-test Achievement Scores of Control and Experimental Groups

Group	N	Mean	SD	T value	df	2-tail prob.
Control	24	48.2	5.19	2.17	48	.035
Experimental	26	45.1	5.13			

To eliminate the effect of GPA and pre-test results on post-test achievement of the two groups' analysis of covariance (ANCOVA) with two covariates was conducted. A preliminary analysis evaluating the homogeneity-of-slopes assumption indicated that the relationship between the covariates (GPA and pre-test) and the dependent variable (post-test achievement scores) did not differ statistically significantly as a function of the independent variable (treatment), F (1, 45) = 1.78, p=.189, $\dot{\eta}2$ = .038. This result indicates that we can proceed to ANCOVA. The results of the preliminary analysis are shown in Table 4.5.

Table 4.5-Test of Homogeneity of Slopes for Relationship between the GPA, Pre-test Achievement Scores and the Post-test Achievement Scores of Control and Experimental Groups.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Eta Squared
Corrected Model	665.045	4	166.261	10.152	.000	.474
Intercept	51.936	1	51.936	3.171	.082	.066
Group	43.432	1	43.432	2.652	.110	.056
Pre-test	64.615	1	64.615	3.945	.053	.081
GPA	113.419	1	113.419	6.926	.012	.133
Pre-test * GPA	29.143	1	29.143	1.780	.189	.038
Error	736.955	45	16.377			
Total	109980.000	50				
Corrected Total	1402.000	49				

As given in Table 4.6, the ANCOVA results showed no significant difference $F(1, 46) = 2.426$ $p= .126$, $\dot{\eta}2 = .050$. Thus, after adjustment by covariates, post-test achievement of students did not vary significantly by treatment. Both covariates, GPA and pre-test achievement were significantly related with the dependent variable (post-test achievement), $F(1, 46)=11.68$, $p<.001$ and $F(1, 46)=19.21$, $p<.001$, respectively.

Table 4.6-Analysis of Covariance of Post-test Achievement Performance with GPA and Pre-test as Covariate.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Eta Squared
Corrected Model	635.902	3	211.967	12.727	.000	.454
Intercept	772.200	1	772.200	46.366	.000	.502
Pre-test	319.933	1	319.933	19.210	.000	.295
GPA	194.440	1	194.440	11.675	.001	.202
Group	40.402	1	40.402	2.426	.126	.050
Error	766.098	46	16.654			
Total	109980.000	50				
Corrected Total	1402.000	49				

As a result of the analysis, Hypothesis 1 was not rejected. It can be concluded from the results that there was no significant difference between experimental (hybrid course) and control (traditional instruction) groups in achievement.

4.1.5 Results on Hypothesis 2 - Difference between Experimental (Hybrid Course) and Control (Traditional Instruction) Groups in Knowledge Retention

To test the second hypothesis t-test and ANCOVA were carried out on achievement scores. Mean scores on retention of control and experimental group were compared using a t-test at a significance level of .05. As shown in Table 4.7, the retention mean score on achievement for the control group (M=45.5) was higher than that of the experimental group (M=43.6). The t-test result shows that this difference in the mean scores is not statistically significant at a significance level of .05. This result indicated that there was no statistically significant difference in retention of knowledge between control and experimental groups.

Table 4.7-Comparison of Retention Achievement Scores of Control and Experimental Groups

Group	N	Mean	SD	T value	df	2-tail prob.
Control	24	45.5	6.1	1.00	48	.320
Experimental	26	43.6	7.1			

To eliminate the effect of pre-test and post-test results on retention of the groups an analysis of covariance (ANCOVA) with two covariates was conducted. A preliminary analysis evaluating the homogeneity-of-slopes assumption indicated that the relationship between the covariates (pre-test and post-test) and the dependent variable (retention achievement scores) did not differ statistically significantly as a function of the independent variable (treatment), $F(1, 42) = 2.276$, $p=.115$, $\dot{\eta}2 = .098$. This result indicates that we can proceed to ANCOVA. The results of the preliminary analysis are shown in Table 4.8.

Table 4.8-Test of Homogeneity of Slopes for Relationship between the Pre-test, Post-test Achievement Scores and the Retention Achievement Scores of Control and Experimental Groups.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Eta Squared
Corrected Model	1573.123	7	224.732	15.801	.000	.725
Intercept	14.189	1	14.189	.998	.324	.023
Group	11.914	1	11.914	.838	.365	.020
Pre-test	25.678	1	25.678	1.805	.186	.041
Post-test	85.729	1	85.729	6.028	.018	.126
Group * Pre-test	23.188	1	23.188	1.630	.209	.037
Group*Post-test	7.894	1	7.894	.555	.460	.013
Group*Pre-test*Posttest	64.751	2	32.376	2.276	.115	.098
Error	597.357	42	14.223			
Total	101272.000	50				
Corrected Total	2170.480	49				

As given in Table 4.9, the ANCOVA results indicated no significant difference $F(1, 46) = 1.825$ $p= .183$, $\eta 2 = .038$. Thus, after adjustment by covariates, retention of students did not vary significantly by treatment. Only one covariate, the post-test achievement was significantly related with the dependent variable (retention), $F(1, 46)=65.33$, $p<.001$. The other covariate pre-test was not significantly related with the retention achievement of students.

Table 4.9-Analysis of Covariance of Retention Achievement Performance with Pre-test and Post-test as Covariate.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Eta Squared
Corrected Model	1498.611	3	499.537	34.201	.000	.690
Intercept	6.074	1	6.074	.416	.522	.009
Pre-test	16.274	1	16.274	1.114	.297	.024
Post-test	954.204	1	954.204	65.330	.000	.587
Group	26.659	1	26.659	1.825	.183	.038
Error	671.869	46	14.606			
Total	101272.000	50				
Corrected Total	2170.480	49				

As a result of the analysis, Hypothesis 2 was not rejected. The results indicated that there was no significant difference between experimental (hybrid course) and control (traditional instruction) groups in knowledge retention one month after the treatment.

4.1.6 Results on Hypothesis 3 - Difference Between Experimental Group and Control Group in Attitudes toward Computer Networks Subject at the end of the Treatment.

To test the third hypothesis t-test and ANCOVA were carried out on attitude scores. Control and experimental group mean scores on attitudes toward computer networks subjects were compared using a t-test at a significance level of .05. As shown in Table 4.10, the mean score on attitude toward computer networks subject for the control group (M=3.82) was slightly higher than that of the

experimental group (M=3.78). The t-test result shows that this difference in the mean scores is not statistically significant at a significance level of .05. This result indicated that there was no statistically significant difference in attitude toward computer networks subject between control and experimental groups at the end of the treatment.

Table 4.10-Comparison of Attitude toward Computer Networks Subject of Control and Experimental Groups

Group	N	Mean	SD	T value	df	2-tail prob.
Control	24	3.82	.41	.31	48	.760
Experimental	26	3.78	.48			

To eliminate the effect of pre-attitudes on post-attitudes of the groups, a one-way analysis of covariance (ANCOVA) was conducted. A preliminary analysis evaluating the homogeneity-of-slopes assumption indicated that the relationship between the covariate (pre-attitudes) and the dependent variable (post-attitudes of students) did not differ statistically significant as a function of the control and experimental groups, $F(1, 46) = .265$, $p = .609$, $\dot{\eta}2 = .006$. This result indicated that we could proceed to ANCOVA. The results of the preliminary analysis are shown in Table 4.11.

Table 4.11-Test of Homogeneity of Slopes for Relationship between the Pre-Attitudes and the Post-Attitudes toward Computer Networks Subject of Control and Experimental Groups.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Eta Squared
Corrected Model	7.386E-02	3	2.462E-02	.119	.948	.008
Intercept	4.790	1	4.790	23.162	.000	.335
Group	5.953E-02	1	5.953E-02	.288	.594	.006
Pre-attitudes	5.711E-03	1	5.711E-03	.028	.869	.001
Group * Pre-attitudes	5.477E-02	1	5.477E-02	.265	.609	.006
Error	9.512	46	.207			
Total	731.814	50				
Corrected Total	9.586	49				

As given in Table 4.12, the ANCOVA results indicated no significant difference $F(1, 47) = .089$ $p= .766$, $\dot{\eta}2 = .002$. The covariate pre-attitudes toward computer networks subject was not significantly related with the dependent variable (post-attitudes toward computer networks subject). After adjustment by the covariate, the difference in the mean scores of control and experimental groups in post-attitude towards computer networks is not statistically significant ($p>.05$).

Table 4.12-Analysis of Covariance of Post-Attitudes towards Computer Networks Subject with Pre-Attitudes towards Computer Networks as Covariate.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Eta Squared
Corrected Model	1.909E-02	2	9.545E-03	.047	.954	.002
Intercept	4.847	1	4.847	23.814	.000	.336
Pre-attitudes	1.959E-04	1	1.959E-04	.001	.975	.000
Group	1.816E-02	1	1.816E-02	.089	.766	.002
Error	9.567	47	.204			
Total	731.814	50				
Corrected Total	9.586	49				

As a result of the analysis, Hypothesis 3 was not rejected. The results indicated that there was no significant difference between experimental (hybrid course) and control (traditional instruction) groups in students attitudes towards computer networks subject.

4.1.7 Results on Hypothesis 4 - Difference Between Experimental Group and Control Group in Course Satisfaction

To test the fourth hypothesis, t-test was carried out on course feedback form mean scores. Control and experimental group mean scores on course feedback form results were compared using a t-test at a significance level of .05. As shown in Table 4.13, the mean score on attitude on course feedback form for the control group (M=4.11) was slightly higher than that of the experimental group (M=4.01).

The t-test result shows that this difference in the mean scores is not statistically significant at a significance level of .05. This result indicated that there was no statistically significant difference in course satisfaction between control and experimental groups.

Table 4.13-Comparison of Course Satisfaction of Control and Experimental Groups

Group	N	Mean	SD	T value	df	2-tail prob.
Control	24	4.11	.48	.73	48	.470
Experimental	26	4.01	.51			

As a result of the analysis, Hypothesis 4 was not rejected. The results indicated that there was no significant difference between experimental (hybrid course) and control (traditional instruction) groups in students course satisfaction.

4.2 Summary of the Quantitative Results

The findings of the quantitative data analyses can be summarized as follows;

Preliminary analyses results;

1. GPA score for the control group was slightly higher than that of the experimental group. However the statistical analysis shows that there is no statistically significant difference between GPA's of the students in the experimental and control groups.

2. Achievement pre-test mean score for the control group was slightly higher than that of the experimental group. However the statistical analysis result shows that there is no statistically significant difference between achievement pre-test of the students in the experimental and control groups.

3. Pre-attitudes mean score of the experimental group was slightly higher than that of the control group. However the statistical analysis result shows that there is no statistically significant difference between pre-attitudes of the students in the experimental and control groups.

Analyses results on hypothesis;

1. Traditional course (control group) and hybrid course (experimental group) students achievement post-test scores were compared using ANCOVA inferential statistics technique. Students GPA and achievement pre-test scores were taken as covariates. The result of the ANCOVA showed that there was no statistically significant difference in achievement post-test scores between the two groups

at a significance level of 0.05. It can be concluded that there was no significant difference between experimental (hybrid course) and control (traditional instruction) groups in achievement.

2. The analyses result showed that there was no statistically significant difference in retention achievement scores between control and experimental groups.

3. The analyses result showed that there was no statistically significant difference in attitude toward computer networks subject between control and experimental groups.

4. The analyses result showed that there was no statistically significant difference in course satisfaction between control and experimental groups.

4.2 Results of Qualitative Data Analysis

To understand students' perceptions about the hybrid course, effective dimensions of interactive learning model proposed by Reeves and Reeves (1997) was used as a conceptual framework. This model includes ten dimensions from which nine were chosen as appropriate to the current study. An interview guide that included these dimensions was prepared and one on one structured interviews were made with the students. The questions in the interview were asked to reveal student perceptions about the hybrid course in terms of; (1) pedagogical philosophy employed, (2) dominant learning theory, (3) goal orientation, (4) task orientation, (5) source of motivation, (6) teacher role, (7) metacognitive support, (8) collaborative learning, and (9) structural flexibility. The results of the interviews are presented in detail, parallel to the dimensions of interactive learning. Data analysis was made trough three phases: data reduction, data display, and conclusion drawing.

4.2.1 Students' Perceptions about the Pedagogical Philosophy Employed and the Learning Theories that Formed a Base for the Hybrid Course

The questions asked to the students in the interview form to understand their perceptions about the pedagogical philosophy and learning theory of the hybrid course were related with:

- If they could relate their previous knowledge and skills with the newly acquired knowledge and skills.
- What the role of the instructor was, what their role as student was.
- If the face to face component supported their learning.
- Which features of the web-assisted instruction aided their learning of the content.

- What advantages and limitations the weekly content providence had.
- What problems they had faced throughout the semester.
- What features of the hybrid course they liked.
- If they made printouts of course content or studied from the screen.
- What sources they used while studying.
- How they used the web-site throughout the semester.
- Which of the cognitive tools they made use of.

Two contrasting values in pedagogical philosophy are instructivism and constructivism. Inline with the design consideration of the hybrid course, the interview results showed that the pedagogical philosophy of the hybrid course was closer to instructivist side than constructivist side. Closely related to these pedagogical philosophies are the learning theories behaviorism and cognitivism. In the hybrid course, both, pedagogical philosophies and learning theories were considered but the essential part of the course was based on instructivist philosophy and behaviorist learning theory. While the overall design of the hybrid course was closer to instructivist philosophy, the web-site of the course and the classroom activities, such as group work and classroom discussion were closer to constructivist epistemology.

The interviews with the students indicated that, because of the planned learning expectations and pre-determined skill and knowledge based goals and objectives, students perceived the structure of the course as instructivist. On the other hand, they perceived the whole course as a mixture of constructivist and instructivist environment. They indicated that they were happy with the predetermined objectives.

The heavy technical content was giving the course a sense of objectivist structure. Students stated that: "The topics in the course were too theoretical. Reading the technical and theoretical content in the website was not enough to learn the topics. More practice would have been better for us to remember the lesson content when we need to use it in daily live." Moreover, students found the content too overloaded and the course too difficult. Students in general stated: "There were

too many things every week to learn. Sometimes it was quite hard to deal with so much content in one week."

In the hybrid course, some of the students complained about having to read every week. About this, one of the students said: "So much reading every week was very hard for me. There were interesting and uninteresting topics. Reading the interesting part was OK for me, but reading the parts that I was not interested in was boring. It was good that we had classroom activities in which I could ask questions about the things I read from the web." There were other students adding to the comment "having to read and understand the predetermined topic from the web-site was boring."

Related to the web-site of the course, students liked the cognitive tools. One of the students said that: "I didn't need anything else than the website of the course to study for this course. I could take notes and underline things that I needed to remember. It was very helpful for me to customize the web pages according to my way of learning."

The predetermined objectives of the course and lack of students' previous knowledge were two factors impacting students "learning by their own". One of the students said: "In the website there were things that I would learn more about and there were things that I was not interested in. Having to learn all content decreased my performance in the course." Another student stated: "I was interested in computers and that's why I took the course. But the course was hard for me because there where so many new technical terms. The course would be more useful for me if I had a bit more knowledge in this area."

The design of the hybrid course was so that the students could relate their existing knowledge with the newly acquired knowledge from the hybrid course. They were asked if they could relate new knowledge with their prior knowledge. The results indicated that the student could do this to one extent. Only four of 25 students stated that they couldn't relate their existing knowledge with the newly

acquired knowledge. These students claimed that they had no previous knowledge on computers and computer networks. 11 students stated that they could relate or understand relation between a few of the newly learned subjects with their previous knowledge. Seven students stated that they could relate what they learned in the course with what they knew. Three students indicated they had a good background in the computer networks subjects and that they could build everything they learned from the hybrid course on their knowledge background. Among the "Computer Networks and Communications" course topics, binary and hexadecimal numbering system, physical and logical network topologies were said to be related to previous mathematical knowledge. Other topics in which the students could refer to their previous knowledge were stated by the students as data encapsulation, data flow, general computer hardware, network devices and network troubleshooting. The answers of the students showed that the hybrid course was successful in relating previous knowledge to the newly acquired knowledge if the students had previous knowledge.

Interesting results were found on student interviews on questions related to the components of the hybrid instruction. Students were asked to state which features of the hybrid course supported their learning the course content. Almost all student (24 students) agreed that the home works and assignments given for each week through the course web-site were the most effective activities supporting their learning. One student's comment reflecting the students' perceptions as well was: "While doing the home works and assignments one had to do research on the related subject. One could finish the assignment based on the found research results. In addition to that we could also find additional information resources (web sites) related to the course content." Another student related the assignment to extrinsic motivation by saying: "One could not forget to study on the course while there was an assignment or homework to be delivered for that week."

The second important feature on which 16 students agreed to be effective in supporting their learning were the weekly announcements and additional web links on that weeks topics. Students agreed that the weekly pre-determined web sources

enhanced their learning. In general they liked to have different information sources of which they could choose to study. They could either study directly from the provided content or they could choose to study from the source most appropriate for them. A student said: "Sometimes I could not understand some of the subjects of the week that good. Sometimes the English of the course content on that week's subject was too difficult to understand. In these times I preferred to use the supplied web site links to get additional information sources to support my knowledge on the week's subject.

As perceived by 15 students, the third effective feature of the hybrid course supporting students learning were the quizzes given weekly in classroom settings. The interview results showed that the students used the home works and assignments together with the quizzes to organize and schedule their learning. This was stated by a student as: "I think that there should be a quiz every week. It would have forced us to read and study the content week by week." Some of the students perceived the quizzes as self assessment tools as one student said: "The quizzes we took were very helpful for self assessment. After reading the content one could not be sure whether he knew the subject or not." Besides using them as assessment tool, students also stated that they "remember" the knowledge they gained for a longer time when they took a quiz on that. A student expressed this by saying "this is always like that. If you don't test what you have learned the knowledge will not stay long."

Student interviews revealed interesting findings on the group works and classroom discussions conducted in the face to face meetings of the hybrid course. 11 students indicated that the group works and classroom discussions supported their learning in the hybrid course. The results on students perceptions on groupworks and classroom discussions are supplied in detailed under the "4.2.7 Students' Perceptions about Collaborative Learning Strategies in the Hybrid Course" section.

Students' perceptions on hybrid course features indicated that the Message Board (Forum) in the course-website was referred by almost 1/3 of the students

(eight students) as an effective learning support feature. The students agreed that they did not use the message board as effectively for information exchange as they used it for sharing web site addresses on the subjects. A few students said that the sharing web site address helped them in the first place. One student said that "actually the forum helped me most when I was learning the content because everyone was sending messages whenever they found a new web site address on the subjects." Another student mentioned that "we used the Message Board more for exchange of web site addresses that could be as additional information sources." The Message Board was indicated still as an effective communication tool. One student said: "The forum of the web-site was very useful for me. I could ask anything to my friends and to the instructor without having to wait the class meeting. I could share my knowledge and I could see how much the others knew."

1. The student perceptions on course features that support students' learning in the hybrid course were ranked as:
2. Homeworks and Assignments – Supplied through the web-site (by 24 student)
3. Announcements and Additional Links – Supplied through the web-site (by 16 students)
4. Quizzes – Given in the classroom (by 15 students)
5. Group works and Classroom Discussions – Conducted in the classroom (by 11 students)
6. Message Board (Forum) – Supplied through the web-site (by 8 students)

The above features do not include web usage of the students like cognitive tools and course content in the course web-site.

The direct learning/instruction structure of the topics in the web-site were based on behaviorist view but at the same time students were asked to work by themselves and in groups in short term projects, assignments and homeworks. The face to face part of the hybrid course was based on cognitive activities, and small and large group classroom discussions were done. There was a broad range of learning

activities, from independent online learning to project based learning. Students were happy when they could apply what they have learned through the web-site in the classroom. Some students stated that: "I enjoyed the assignments and the project, they were really challenging for me. Not only being on the web, but also coming to the classroom and seeing my friends and the teacher were helpful in understanding the topics."

The lack of online assessment tools for drill and practice and student self assessment was one of the criticism of the students. One student stated that: "The quizzes in the class hour were causing to lose my motivation in the course. If I had the opportunity to test my knowledge just after going through the web-site, that would be more beneficial for me. The only way to know how much you know was the quizzes and the exams." Students also complained about lack of feedback on what they did on the web.

To understand student preferences in terms of learning resources students were asked if they used other information sources than those supplied on the course content, reading materials, announcements and additional links in the course web-site. Eight students said that they only used the supplied information on the course web-site. 11 students indicated that they used books on computer networks in addition to the supplied information. 10 students said that they used other web sites in the Internet that they found through search. Two students used a multimedia tutorial CD on computer networks. Although students stated these resources, almost all students said that they used the course web-site as the primary information source and the other mentioned sources as supplementary sources.

Students were asked to describe how they used the course web-site. The majority of the students (16 students) said that they used the web-site at random intervals, whenever they had time and wish. Nine of the students stated that they used the course web-site to read the course content once or twice in a regular, scheduled base for 2-4 hours each week. The above knowledge was triangulated with the log-system and it was seen that most of the students connected to the web-site at

weekends, one day before or on the day of classroom meeting. This was also stated by the students; naturally they said their preference in being in a comfortable environment like their homes or dormitory rooms or they were cautious on the possibility of a quiz in the classroom meeting. Moreover, since the students were informed every week on their activities on the web, which was recorded by the log-system, they knew that they had to be active at least one hour each week. One student said on this: "I preferred to read weekly content either just before the course meeting or on the weekend. Especially when there was an exam, I read the content before the classroom meetings, so my knowledge was fresh when I could succeed in quizzes or group work."

The students were also asked if they studied on the course content directly from the computer screen or made printouts of the content. The students were informed in the first classroom meeting that the course content on the web was copyrighted material. The students were requested to use it from the course web-site and informed that it was only for their personal use. Despite many criticisms from the students, a majority of them, 17 students said that they studied the content from the web-site on computer screen. The common criticisms of students were on availability and cost of Internet access and health issues because of sitting in front of the computer. One student said: "The only disadvantage of reading the course material from the computer screen was that one should use dial-up connection to the Internet." Interestingly there were also two students who preferred to read from the screen because printing of the content was not cost effective. Five students said that they generally used the computer to study but sometimes they also made printouts of the course content. Another student said: "I read once from the computer and while reading I took notes to study later. This also helped me in understanding the subjects better." Those students preferring to print out some portion of the course content argued about the availability and cost issues related to Internet access. A student said: "Most of the time I studied from the web-site, but I made copy-paste of the most important parts of course content and printed them to study later." There were only three students saying honestly that they took print outs of the course content when they wanted to read. Their argument was almost the same: "I had no Internet access

at home, that's why I preferred to print the reading materials on the web. I also made some Word documents to have lower printing pages."

To understand what difficulties students faced, they were asked what problems they had to deal with while taking the hybrid course, throughout the semester. The problems the students stated where general problems related to students learning habits, problems related with the face to face component, problems related with the web based component of the hybrid course. The problems are listed below.

1. *The course content was overloaded.* (indicated by 13 students)

   The hybrid course content was related to introductory computer networking subjects. Most of the concepts and technologies were new to the majority of the students. The content included many definitions, terminologies and abbreviations of the important concepts and technologies. Students stated that they had difficulties in covering all of the weekly content while studying. The students found the content loaded, the weekly topics were said to be "more than enough". On the other hand, the same students agreed that each topic was essential and no one could be left outside the content. One student said on this that "there were too many things to read weekly. Sometimes I got bored wile reading all of them." Another student said: "There were many new terms to remember. Most of them were new to me. I couldn't remember many of them after finishing studying the content. Students indicated that the course content is overloaded for the time period, but essential for the course requirements.

2. *Students' tried to use their learning habits obtained in traditional courses* (indicated by 11 students)

   Some of the students wanted the instructor to lecture in the face to face meetings. A student said that "the instructor was passive, he expected everything from us. I would like that he presented us the topics we read from the web-site." This was an expectation coming from students

learning habits they gained through their school years. Another problem as indicated by the students was students communication habits with the instructor. They wanted to ask questions especially to the instructor, not to their peers. The students did not prefer to use the Message Board for their questions but they want to ask the question directly at the moment they have one. They stated their preference to ask questions while or just after they read the content. They did not want to wait until the class hour. One student said on this: "I would like to ask question to the instructor as soon as possible after reading the content. I had to wait the class hour, sometimes I forgot the question until that time."

3. *The type of the course- The hybrid course was an elective course* (indicated by 10 students)

   Students' expectation on the course was not to dedicate so much time on the course. They took the course as an elective course and they had not expected that it would be that demanding. Students stated the problem of finding enough time for the "Computer Networks and Communications" course in their interview answers and during informal communication with the instructor of the course. Students complained that the weekly readings, the assignments and homeworks were hard to complete each week. They stated that they could not devote that much time on one course, since they had also other courses which should be taken care of. This was also stated by some students as the reason not visiting the web-site as frequently as required. One student stated: "I took seven courses this semester. The total time that I dedicated for this course was almost equal to the time I devoted for the remaining six courses. Still I could not read the content week by week." Another student said: "The assignments were research based. I had to search for them a whole day. They took to much time."

4. *Problem on the "computer based environment".*

   (indicated by 16 students)

   The computer based environment in the web based component of the hybrid course was stated as "problems" by several students. The interview results were investigated and the common problems were selected. One student comment for each problem is given below:

   a. "The computer screen harmed my eyes."
   b. "Sitting in front of the computer for so long threatened my body health."
   c. "The internet connection from home was to slow."
   d. "I could not find a computer or internet access from everywhere."
   e. "Internet connections from home disconnected from time to time, it was not reliable."
   f. "Internet connection was expensive."

   Among the stated problems the availability and cost of the Internet access were the most frequent stated problems. One student said: "I live outside the university campus, sharing a flat with a friend of mine. We share the same telephone line because the building is old and the telephone company could not connect an additional line. That's why I could not hold the line busy for several hours. Besides that, I could not afford the cost of the line." Some other students said that they connected to the web-site, visited all pages quickly without reading, disconnected from the Internet, and read the materials from the computers cache memory.

The above stated problems were external factors that could have affected the students perceptions about the pedagogical philosophy, learning theory and/or student motivation related with the hybrid course. They could be especially important for the students with more extrinsic motivation than intrinsic motivation.

Intrinsic motivation is very important for constructivist epistemology and cognitive learning theories since they expect the student to learn from in internal impetus.

A constructivist application in the course web-site was the cognitive tools. The cognitive tools were small applications within the general structure of the web-site to support student learning. They were metacognitive support tools enabling the students to customize their web-site usage according to their leaning habits. In the interviews students were asked to which of these tools they used and which of then sported their learning in the web based component of the hybrid course. A much more detailed analysis is supplied at the "4.2.6 Students' Perceptions about Metacognitive Support in the Hybrid Course" section. The findings from the students answers indicated that students ranked the most effective cognitive tools in terms of their support on their learning as; (1) Glossary, (2) Search, and (3) Highlight. These tools were used most frequently while studying trough the web-site. The other tools, Sitemap, Bookmark, Pagenote, History and Notebook were indicated as less preferred tools. These tools were important elements of the web-site. In parallel to the directed learning/instruction structure of the course content, these tools were used to hybridize the pedagogical philosophies and learning theories because of their constructivist philosophy base and cognitivist structure.

According to students' perceptions, the presentation structure of the course material on the web-site was evaluated as behavioral. Students found the objectives useful in understanding what is expected from them. One student said: "From the written objectives, I could determine how deep I was expected to learn each week's topic." Students' perceptions about the learning theory of the hybrid course were parallel to their perceptions about pedagogical philosophy. Although there were written behavioral objectives, some of the features in web-site of the hybrid course, the assignments, project and the classroom activities were based on constructivist epistemology and cognitive learning theory.

4.2.2 Students' Perceptions about the Goal Orientation of the Hybrid Course

The questions asked to the students in the interview form to understand their perceptions about the goal orientation of the hybrid course were related with:

- Which of the cognitive tools in the course web-site they made use of.
- How they used the web-site throughout the semester.
- If they could solve the computer networking problems they could face.

Goal orientation of the hybrid course was near to the sharply focused part of the orientation continuum defined in Reeves and Reeves (1997) effective domains of interactive learning in WWW. The reason for this might be the goals and objectives of the "Computer Networks and Communications" hybrid course. They ranged from sharply focused ones (e.g. following pre-defined troubleshooting methods for handling network problems) to more or less general ones. The learning goals of the course were established sharply to avoid students getting lost in "hyperspace". They reminded the students of the purpose of the course and why they should navigate and read the web-site. Clear objectives were set for direct instruction trough the web-site. While the presentation of the course content in the web-site was based on strictly defined, sharply focused objectives, the classroom activities like group works and the projects and assignments were prepared on general objectives for discovery learning.

Students found the hybrid course more or less sharply focused in terms of goal orientation. This was so because course topics were divided into topics according to measurable objectives. Students were happy with these pre-determined goals and objectives. Most of them stated that knowing the goals and objectives they could answer the metacognition related question: "What information do I need to know?" The hierarchic structure of the course web-site to present information was also pointing towards focused goal orientation structure. On this, one student said: "Each week I knew what I had to learn for that week. I read the web-site to

understand the topic as good as I could. I also knew that we would be going through these topics in the classroom."

Students' perceptions showed that they could integrate the focused and general goal orientation strategies while learning. The classroom meetings were based on unfocused goal orientation. A student said: "We did every week something like a discussion, watching a film, a group work or a game related to the things we had read that week from the web. Sometimes I was interested in one of the topics and I asked the teacher for detailed information or an information source. "

To understand how the students made use of the sharply focused structure of the course contents and in the course web-site students were asked how they used the web-site throughout the semester. The students' interviews showed that 16 students first entered the course content pages when they logged into the course web-site. After that, the students viewed the assignments and additional links. Last they looked to the Message Board for anything interesting. Triangulating the students statements with the log-system records showed that most of the students first visited the main page (comes default after the login information is supplied by the students) than visited the course content, assignments, announcements and message board as indicate by he students. This could be interpreted as, first the students wanted to achieve the pre-defined sharply focused goals of the course in terms of content knowledge. Then they wanted to see what is required to do from them throughout the week, assignment based on general goal orientation. Then they investigated the additional links, and last they asked questions or see if anything was asked by others.

To understand how the general goal orientation had affected their learning they were asked if they could use the knowledge they got from the course in their future lives. 21 students stated that they could use many of the topics in their future live experiences related with computer networking topics. 14 students stated that they needed extra practice to use the knowledge they learned from the course content. Three students having previous knowledge on the content said that they

"definitely" benefit from their learned knowledge. There were seven students that the course has given them theoretical knowledge, rather than practical knowledge. A student said on this that "I need to practice the things we learned, after that I can relate the knowledge with real life situations." The course as an introductory course and the students were aware that they need further knowledge to get hands-on advanced skills. 15 students stated that they could help someone in troubleshooting a network problem but that they need to learn some more advanced topics to troubleshoot by themselves. A student's comment on this was: "Up to know I had no knowledge on these topics, all of my knowledge comes from this course. This much is not enough, I need to learn more. Now I can only help someone in troubleshooting a network problem." The students' answers indicated that they especially could help in issues they practiced in the classroom activities or the assignments. As indicated before these mentioned learning activities were based on general goal orientation. Students were given the chance to learn by discovering. The general goal orientation strategies were the projects, assignments and group works. A student said about one project assignment: "The cabling project helped me in understanding the real-life application of the topics we learned in the web-site. After finishing the project I had enough knowledge and skill to design and install a small network on my own."

It would be appropriate to conclude from the students' statements that the hybrid course as a whole, which consisted of the classroom meetings and the web-site was more sharply focused in terms of goal orientation. The overall structure of the course web-site was perceived by the students as more sharply focused than general. The classroom meetings and the learning activities that were put into place in the classroom and trough the web-site were general goal orientation applications. Sharply focused goal orientation was effective in students learning week by week the academic fundamentals of the course content like technical issues, protocols, models, and other abstract concepts. The general orientation based on learning/instruction activities were effective in students learning while acquiring skills and practical knowledge.

4.2.3 Students' Perceptions about the Task Orientation of the Hybrid Course

The questions asked to the students in the interview form to understand their perceptions about the task orientation of the hybrid course were related with:

- What they did to learn the course content.
- What features of the hybrid course they liked.
- How they used the web-site throughout the semester.
- If students could relate their previous knowledge and skills with the newly acquired knowledge and skills.
- If the examples, practice questions and visuals provided in the web-site were useful to relate the information with the real-life.

The context of learning in the hybrid course was based equally on academic and authentic task orientation procedures. Some characteristics of the course web-site, like content structure and course objectives depended heavily on having the learners carry out traditional academic exercises. At the same time, an authentic design was used for the practical activities such as projects and weekly assignments. Assignments like preparing a network cabling project helped students situating practice and obtaining feedback within realistic scenarios. The classroom meetings were basically designed with authentic exercises, like group works and educational games.

To understand which tasks were more effective on students learning students were asked what they did to learn the contents of the course and to acquire the skills required to pass the course. The majority of the students (21) stated that they read the content from the web-site. The course content and the course objectives were based on traditional academic exercises like learning the definition of a protocol, understanding a function of a network device or being able to convert binary, decimal and hexadecimal numbers to each other. Students had some complaints on this one, one student said: "The content was heavy (loaded) and sometimes the exercises were hard to do. The thing that I did not like the most in the course was to remember so many technical terms and standards. I am not good in

computer issues, but I took the course because I wanted to learn more. Having no knowledge and trying to understand the course content with so many technical terms was hard for me." Some students complained about the academic learning tasks that required them to do traditional academic exercises like remembering the computer networking standards, memorizing the OSI Layers, remembering cabling standards and some other memorizing activities. Although some of the students complained about the load of the course there were students searching, finding and reading additional books, journals and other reading materials.

A smaller group of students (11) said that they did the weekly assignments and 6 students indicated that the project supported their learning. The weekly assignments were authentic in nature, requiring research. 10 students indicated that the classroom activities supported their learning. The classroom activities were also authentic in terms of task orientation. Nine students made internet search and used additional web-sites than the course web-site. An interesting point was the learning source of five students. From time to time these five students made informal communications with network professionals on computer networks subjects. The students enjoyed to talk about this. This is an important point for the source of motivation. Obviously these students had internal motivation, the intrinsic force, and the impetus to learn because of self satisfaction. Almost all students said that they liked to do the projects and assignments. They were satisfied to use the knowledge they learned through reading the course content. In addition to the directed-learning structure used in the web-site, there were also academic learning tasks to practice on the content.

In order to understand what type of tasks the students used to learn, the students were asked which factors inhibited and/or limited their success in the hybrid course. There were no obvious common patterns in students' answers. Some of the important inhibitors of success stated by more than one student were:

- The "heavy" and "loaded" course content
- The hybrid structure being new to the students.

- The absence of self-assessment tools in the course web-site.
- Other group members in the groupworks.
- The absence of online communication tools like chat.
- Requirement to study from the computer screen.
- The lack of computers and internet access.

Student comments on the course content revealed student perceptions pointing on academic task orientation. They found the course content abstract and complained about not having enough real-life examples. The criticisms were that the content was based on theoretical and academic learning. A few students said: "I would like to have more examples on some topics. Doing the assignments and projects would be easier for me if I could see some more examples." On the other hand, there were students who wanted even more academic learning tasks. Related with this one, one student pointed out that "I would like to do some more exercises, drill and practice on the content. The assignments were not directly related to the content but were general. I could not learn the topics while making the assignments but I had to use what I learned while doing them."

To understand which type instructional elements in the course web-site were more effective in students' learning, students were asked if and how the examples, practices, and visual materials given in the course web-site helped students to relate their knowledge with real life. The theoretical and academic learning/instruction through reading the course content was supported with case examples, pictures, graphics and small animations, and practice questions. Students' answers indicated that more than half of the students(14), stated that those materials helped them to relate their knowledge with real life. Students said that the pictures, graphics and small animations were useful to visualize abstract concepts like design standards or network protocols. A student said: "The pictures and animations supported the information in the text. We could see what was meant in the text." Some of the students stated that the case examples and practice questions helped them to understand the subject in detail. The practice questions were indicated specially helpful in mathematics based concepts like, binary, decimal, hexadecimal numbers and IP addresses and subnetting. The cases given were helpful to students

in network design. They stated that they could see the design principles on real examples. Nine students said that the examples, visual materials and practice questions did not help that much in relating their knowledge with real life. Although they agreed that the materials were useful in understanding abstract content, they were not as effective as the classroom activities to relate the content to real life. One student said: "The pictures and graphics were useful to understand the concept, but nothing can replace the place of a real experience, I would like to see a real operating system."

Most of the students were satisfied with the authentic learning tasks in the course. Projects, assignments, group works, games and a film on the course content aimed to engage students in practical activities. Students were required to personalize the knowledge and make it their own knowledge. Students stated positive comments on these tasks. One of the students said: "The project was very helpful to see the practice of what I have learned. I could see how things really work in the real world. For example, I had not thought about the human factor when designing and installing a network. I could see how hard it is to work with people." Another student said: "What I liked most in the course was the game that we played about the technical terms and the film that we watched. I could easily remember the things in the game. The simulation in the film helped me to visualize how packets flow and how devices function." Students were encouraged to ask for help about the assignments from computer networking professionals. One student said: "I talked to people working in the network group of computer center (of METU) about the assignment on Internet addresses and subnetting. I could see the practice of how they worked and how they used IP and subnetting on the University campus."

Generally, in terms of grading requirements, having to pass quizzes, midterms and finals the hybrid course was perceived by students as academic. But, in terms of learning requirements, the hybrid course was perceived by the students as authentic.

4.2.4 Students' Motivation Types in the Hybrid Course

The questions asked to the students in the interview form to understand their perceptions about the source and type of motivation in the hybrid course were related with:

- If their studying habits effected taking this course.
- What their expectations from the course were.
- Which of the attitudes and behaviors of the instructor affected their learning.
- What problems they had faced throughout the semester.
- If they would recommend this course to their friends.
- How they used the web-site throughout the semester.

There are many factors affecting the learning in hybrid courses and one of the important factors is the source of motivation of students. While some students have extrinsic motivation some others have intrinsic motivation. Extrinsic motivation in hybrid courses can lead to externally rewarded learning. Examples of this extrinsic motivation are grades, time, income, legislative power and so on. Intrinsic motivation can lead to internally rewarded learning. Intrinsic motivation is the desired motivation type in courses since individual meaning-making is a critical element of learning. This type of motivation is based on internal values like, the will to learn, the desire to solve a problem, the will to understand the course content, and the meaning of course content. Intrinsic motivation can lead to higher levels of learning and critical thinking abilities.

Student interview results showed that one external factor demotivating students in the hybrid course was the requirement to read the content from the web-site. Students stated that they had physiological problems while studying the course content trough the web-site. They complained about headaches, eye watering, myalgia and lumbago. One student said: "Reading trough the web-site every week was threatening my health. I had headaches and red eyes after studying." Another student stated: "While working with the computer I had to stay in sitting position for hours, which was really boring after some time." The physiologic and ergonomic

problems of studying in front of a computer screen were important factors for losing students' internal motivation.

To understand if the structure and the course content of the hybrid course had effected students' motivation to take the course, and to understand what type of motivation was dominant at the beginning of the course, students were asked if their learning preferences had affected their choice to take the hybrid course. 15 students stated that they preerred the course because of its hybrid structure. They believed that the course structure would positively affect their learning. Some of the comment on why they took the course pointed towards intrinsic motivation. Common reasons student indicated for taking the course in hybrid mode were:

- "I enjoy to work on and with computers. I also enjoy learning by researching."
- "I believed that I would learn the course contents better in this structure."

Some other students stating their preference to take the course as hybrid gave reasons based on extrinsic motivation. Some common comments of these students were:

- "I preferred taking the course in hybrid format since I prefer individualized learning."
- "I prefer to work on my own preferred time. I could choose when and how much to study. I usually prefer at nights."
- "I took the course as hybrid because of time concerns. Attending the class for only one hour was favorable for me."
- "I never took a course in this structure. Actually I was curios how it would be."
- "I could not concentrate myself for three ours of lecture. I rather liked to study in a comfortable environment at home."
- "I have difficulties in attending classes."

The students stated their motives in taking the course. These showed that almost equal number of the students had initially intrinsic and extrinsic motivation. There were 7 students stating that it was a hybrid course had not affected their choice to take the course. 3 students did not preferred to take the course in this structure; actually they preferred a traditional lecturing course. However, these students had not dropped the course since the course topics were interesting to them and they had no other option. Some of the students' comments with no preference in taken the course because of its structure were:

- "I took this course as hybrid because it was the only course fitting to my program." (extrinsic motivation)
- "I would prefer the traditional section but the course content was so interesting that I did not want to drop the course just because of that." (intrinsic motivation)
- "I was interested in the course content of the course, I had no specific course preferences." (intrinsic motivation)

Inline with initial motives of students in taking the course, students expectations from the hybrid course were analyzed with a different question. Students with internal motivation answered the question about why they took the course with answers like, "I am highly interested in computer networks", "I like to work on computer networks topics", "I enjoyed doing the classroom activities." or "I like to read about technical issues, especially computer networks". Answers pointing to extrinsic motivation were more about "finding a job in this area", "I want to make a career on computer networks", "I had to take a technical course because of departmental curriculum requirements", "a course on this topic will look good in my transcript", or " I want to obtain a professional certificate on this topic". A student answer having an intrinsic motivation base was: "I plan to take an IT certificate. It is quite hard to find a job without having IT certificates." Another one said: "The courses in my department are social courses (Student was from faculty of education), but I plan to work in private sector. I needed technical courses in my transcript." Another student stated: "I took this course because it is in a web based format. I'm

working at a company so I don't have time to come to the school for long time periods" (This student had a very low grade at the end of the course).

One indication for intrinsic motivation was "enjoying" the course. Students indicated that they enjoyed some learning activities. Students did not enjoy reading the content from the website, but they enjoyed the real-life experiences, like making a cable installation, configuring a computer or a network device, making a cabling design for a given building floor plan. They also enjoyed reading and applying real network protocols and addressing schemes like IP. A student said: "I always wondered why we configured the computers with IP address and subnet mask. Now I understand why and how we use it." There were parallel comments regarding student motivation and metacognition.

Students indicating their "joy" of learning the topics in the course were those students with metacognitive abilities knowing "what they learned" and "why and how they learned". For example such a student said: "I expected that this course would change my way of understanding computer networks topic. My expectation became true, now I look at many things different. For example, when I enter a student computer lab I can determine that the line is going from there, the switch is located there, these is a good or bad way of installation."

Students were asked which features of the hybrid course they liked most. The students indicated their like of the fallowing features:

1. The content of the hybrid course (22 students)
   Computer networks subjects were found interesting by most of the students. Students stated that they liked to learn about these subjects, because they would be useful in their professional life. Almost all students said that they would benefit from the course content in the future.
2. The hybrid structure of the course (16 students)
   Students indicated their like in taking an alternatively delivered course after so many traditional courses. It was something new for them. They

stated that they found the course structure interesting and useful. They especially liked the course not being fully web based or fully traditional.

3. The learning/instruction activities done in the classroom (15 students)
   Students stated that they prefer doing activities rather than sitting silently and listening to the instructor. They indicate that they have enjoyed to do practice on the information they read from the web-site.
4. The cognitive tools in the course website (14 students)
   According to student comments, the cognitive tools were giving the course web-site a professional feeling, making it different than standard, electronic page turning web-sites. One student said on this: "The tools in the web-site were very usable. I used them for accessing to information quickly and easily."
5. The web-site of the course (12 students)
   The web-site was found to be very user-friendly, nice looking in terms of graphics and well organized in terms of access to information. The students liked the navigation structure and the information presentation structure.

When the students interview results on their likes and dislikes are compared, it could be seen that the students had internal and external motives throughout the course. The new hybrid structure, the user-friendly structure of the web-site and the cognitive tools were adding to students' external motivation. Students enjoyment of the classroom activities, their interest in learning the technology related to computer networks were internal motivation in the hybrid course.

One common view of students was that the classroom meetings and the face to face communication with instructor and the peers was a source of motivation. Students indicated that they liked especially to see the instructor and they got motivated through this. Regarding this, while some students said that they understood the topics better through interaction with the teacher and their friends, others indicated they liked to "talk" with the others.

In order to understand if the students were satisfied with and if they were honest in their course activity evaluations related to the hybrid course, they were asked if they would recommend their friends to take the course with the same (hybrid) structure. Almost all students (22) said that they would recommend the course to their friends. The students also said that they would warn the students about the time requirement for the course activities. One student said on this: "Although this is an elective course, the course needs dedication like a must course. Still it is much better to take this course, which has important information on computer networks than an easier elective course." Some of the students especially liked the face to face meetings because they got motivated by seeing the instructor and their peers. Two students said that they would not recommend it, not because of the hybrid structure but because the content was too technical for their department. One student did not prefer to give an answer to this question.

Initially, the students' interest in the course content was relatively high. There were also students taking the course because of logistic preferences. While 12 students stated extrinsic motives like class seat time, course schedule, place to study and type of course (elective), 10 students indicated intrinsic motivation like enjoyment and interest on the course content. Three students did not give any reason for taking the course.

The interview results related to source of motivation in a hybrid course revealed that intrinsic motivation plays a more important role than extrinsic motivation does on student success. When students' achievement grades and their answers in the interview regarding their expectations from the course were compared, it was found out that students with higher grades were high in interval motivation. 8 of the students stating intrinsic motivation were on the top 40 grade percentile. The lowest 5 five grades were all students with extrinsic motivation.

4.2.5 Students' Perceptions about the Teacher Role in the Hybrid Course

The questions asked to the students in the interview form to understand their perceptions about the instructor's role in the hybrid course were related with:

- What the role of the instructor was, what their role as student was.
- Which of the attitudes and behaviors of the instructor affected their learning.
- How they used the web-site throughout the semester.

There was no lecturing in the hybrid course. Students were not required to sit silently and listen to the instructor week by week. Students were happy that they did not need to come every week for three hours. A student said that: "I always prefer to learn by myself. In other courses most of the times I went to the classroom to take notes that I could study later. Since in this course the notes are already on the web-site I could easily focus on learning."

In the interviews, the students were directly asked about their own and the teachers role in the hybrid course. Almost all students agreed that the teacher was more of a "guide" than a "teacher" in traditional meaning. One student said: "There were times on which I didn't like that everything was expected from me. Sometimes I would like the teacher to teach me." Another student said: "The teacher was more like a guide, a planner, a knowledge source to ask questions. He did not dictate us what we needed to learn, but he just helped us to learn from the web-site and in the classroom."

The majority of the students (20) stated that the role of the teacher was a guide leading their learning. According to one student comments the teacher was "outlining the important points of the course, did not lecture, planned the activities in the classroom and on the web." 16 students pointed out that the teacher was motivating them to study on the content and to come to the classroom. Another student said on this "meeting weekly just one hour made keeping the interest to the

course topics harder. The instructor was the one who helped us to carry on our studying and attending the classes. According to the students another role of the instructor was bringing the parts of the whole subject of the course together. The communication of the students with the instructor was in a friendly manner. About this point seven students stated that the instructor was like a "friend" helping them. All students were aware that the instructor was expecting them to do the assignments, homeworks and projects, and to use the website as much as possible for their learning.

While 13 students described their role in the course as "active", Three students stated that they were "passive", doing the requirements expected from them. The remaining students could not specify what their status as a student in the hybrid course was. 17 students stated that they fulfilled the requirements of the course. Eight students stated that they "partially" fulfilled the requirements. The students who defined them as active learners stated their responsibilities in the hybrid course as; (1) reading and studying on the content week by week, (2) doing the assignments, home works and projects, (3) to ask the things they did not understand in the message board, and to do the group works, discussions and ask questions in the classroom. One of the students defining them as passive in the course said: "I was the passive one in the course, I made the requested things, I had no effect on the course and content structure, I could not change how the course was carried on."

From students statements it was seen that the teacher was more of a facilitator than a didactic lecturer. A student said: "In the classroom meetings I could understand which topics are more important than others. The teacher planned activities to stress the important points." Students perceived the teacher as a guide, as someone to ask questions and someone who plans activities. Another student said: "He was more like a guide, he did not lectured or instructed anything."

Students were also asked which attitudes and behaviors of the teacher effected their learning positively or negatively. 17 students stated that friendly, giving, motivating and easy to communicate attitudes of the teacher affected their learning

positively. Related with this, one student said that "If the teacher (instructor) were someone stricter, I could get easily demotivated since I did not knew anything about the course content at the beginning." Another student said: "The teacher attitudes were motivating me and he was easy to talk with." Eight students pointed out that the attitudes and behaviors of the instructor had no effect on their learning. The students found the face to face meetings too short to have an idea about the teacher of the course. One student stated: "I can not say anything about the instructor, I only saw him for 1 hour each week." No students said that the teachers had a negative effect on their learning.

More than half of the students were aware (13) that the course was student centered and that they were expected to be active learners. On this, one student said: "My role as a student was to read and learn the topics on the web-site before coming to the classroom." Another student said: "First of all I was expected to fallow up everything from the web, I mean I had to fallow up the course. Beside this I had to work extra on my own time, because the information on the web might not be enough." Students also indicated that the teacher wanted them to research and find answers through projects and assignments. A student said: "He gave us assignments that could be done by searching and investigating. The assignments were not related with past topics but with future topics, which were quite demanding for me. Besides that he was rather a guide than a teacher.

4.2.6 Students' Perceptions about the Metacognitive Support in the Hybrid Course

The questions asked to the students in the interview form to understand their perceptions about the metacognitive support in the hybrid course were related with:

- If their studying habits effected taking this course.
- If they could relate their previous knowledge and skills with the newly acquired knowledge and skills.
- If there were any factors hindering their success in the course.
- Which of the attitudes and behaviors of the instructor affected their learning.
- If accessing the course content from the web-site had any advantages or limitations.
- If taking this type of course changed made any change n their learning habits.
- How they used the web-site throughout the semester.

Metacognition is explained by Falvel (cited in Reeves, 1997) as "learner's awareness of objectives, ability to plan and evaluate learning strategies, a capacity to monitor progress and adjust learning behaviors to accommodate needs." The cognitive tools in the web-site of the hybrid course were used as tools supporting metacognition of students. Students could customize their web-site which was valuable in terms of monitoring and regulating their own learning environment. Specifically, the cognitive tools were developed to support the learning of the students by helping them in monitoring, visualizing and regulating their learning activities.

In general, students were satisfied with the metacognitive support in the hybrid course. The perceptions of the students were that the course was integrated rather than unsupported in terms of metacognitive support. A student stated: "The web-tools (he/she meant cognitive tools) were especially helpful when I was going over a topic after a few weeks later. I could read the most important parts that I had

underlined before. I could easily locate and find the topics that I wanted study in the web-site using the bookmark tool. The jump tool and glossary tool were also very useful for me. I could easily go to anywhere in the web-site. I could lookup an abbreviation while I was reading the content from the glossary." Another student comment was showing how cognitive tools helped students in internal negotiation of meaning making and personalizing meaning and knowledge. The student said: "It was amazing for me to remember a whole sentence or a technical definition by remembering a word or phrase that I used as a link to a highlight. While I was studying for the exam, I shutdown the computer and wrote down the words and phrases that I used as link to highlighted content. Then I wrote the content for each word."

The cognitive tools were used in the web-based component of the hybrid course to enhance students learning. The tools were used as integral metacognitive support of the course web-site. They enabled students to customize their web-site, classify the information presented at the course content pages, use their own learning habits while using the web-site by underlining important points in the content, taking notes, searching for an information and/or looking up for a meaning of an abbreviation within text. The results related to the students interviews on their cognitive tool usage and how that tool supported their learning according to their perceptions is given below. Table 4.18 summarizes the number of students using each cognitive tool.

Table 4.14-Number of Students Using Cognitive tools

The Cognitive Tool	Number of students stating that they made use of it
Glossary	23
Highlight	21
History	20
Sitemap	18
Search	17
Bookmark	15
Pagenote	13
Notebook	10

The above table shows the students using each tool once or more throughout the course. To understand how much each tool was used the log-system that keeps track of students activities was investigated. According to the records on the log system the use of each tool was summarized on Table 4.19

Table 4.15-Students Activities on Cognitive Tools

The Cognitive Tool	Activity count in the Log-system
Highlight	1728
Glossary	438
History	194
Sitemap	156
Bookmark	140
Search	123
Pagenote	80
Notebook	75

Many students stated that they used the cognitive tools to underline (highlight) texts, to lookup abbreviates and to find a specific topic within the content. Students especially pointed on the search and glossary tools as most "helpful" in studying for the course. The tools helped the students in structuring their knowledge and "knowing what they know".

Students were asked how these tools supported their learning. The students' answers were presented here in the same order to their cognitive tool preferences. Almost all students indicated that they used the Glossary once or more. The reason of this was stated as the high number of technical terms and abbreviations in the course content related to the names, protocols and concepts. The students found the glossary easy to use and well-organized. A student stated that: "I could lookup easily to the new terms from the glossary. The glossary was good and well-organized, the hierarchic structure helped me in finding a technological term easily." Another student said: "The hardest thing in the course was remembering the technical terms and abbreviations. Thank you for the glossary, I made a lot use of it." It was also personally observed by the instructor that the glossary was used so much because the course was an introductory technical course. Many of the existing terminology were

new to the students. The log-system records showed that the Glossary was the second most used tool.

The second preferred cognitive tool was the Highlight tool. The students stated that they used this tool to outline the most important parts of the course content from the other information. Moreover, students used the tool to quickly and easily get information by searching associating keywords to important passages. Students resembled the highlight to underling book passages while reading or taking notes of the important parts while studying. Actually the tool made both of them, enabling students to save time while restudying the content by eliminating the information they want to neglect and showing only those they highlighted and indicated as important. A student stated on this that "while studying for the exams it was not easy to read through all topics covered up to that time, but with the use of highlight I could easily pre-determine what parts need to be studied." Besides that, the highlight tool was also making the student active while reading the content. Some students indicated that they got bored while reading the content. With the help of this tool the students were engaged in active learning by doing the highlighting of the concepts. This was indicated by a student as "In the beginning of the course I had not enough experience on using the tools. Sitting in front of the computer and just reading the content was very boring. After some time I tried and get used to the highlight tool. After that I enjoyed the new information on the web-site much more". According to students activities recorded in the log-system the highlight tool was used more often than the other tools.

The History tool was the third preferred and third frequently used cognitive tool. The students used the History tool to see which course topics and how much they studied. In terms of metacognition, this tool helped the student to organize their learning directly. Students using the History tool frequently stated that the tool was a useful tool to monitor and visualize their own learning. Related with this a student stated that "especially in topics with long readings I could not read all related course content pages. Since I studied whenever I had time, sometimes I forget up to which point I already studied. I looked to the History to see how much I studied and how

much remaining topic there was to study on." Moreover the students could go to the last page they visited from the history page, which was indicated as easy to navigate, adding to the structural flexibility of the hybrid course.

Although it was not used as much as the top three tools the students using the bookmark tool stated all positive and strong comments. These students agreed that the tool provided easy and direct access to the related contents within the course web-site. A student said on this: "Instead of going through main page, course contend and content pages to get to a topic, I could easily jump to a topic by using the Bookmark." The students also indicated their like of being able to access other web-sites in the internet they visited before and bookmarked as related sites. This tool also added to the structural flexibility of the hybrid course.

The remaining tools which are, Search, Sitemap, Pagenote and Notebook were preferred by a few students and used less frequently. Among those is to mention is the Search tool. Although the students did not use this tool very often they identified the tool as one of the useful tools. The student interviews indicated that the students used this tool to find information while reading the content. They also mentioned that they used this tool to find the most related web-pages of the concepts explained in several places throughout the course content. The Search tool was resembled to the index of a book by one of the students using it. The Sitemap, Pagenote and Notebook were also used several times by many students. The students did not indicate any positive or negative view on these tools in their answers.

There was also some criticism related to the metacognitive aspect of the web-site. Some students claimed that they had difficulties in getting used to the cognitive tools. They also criticized the navigation structure of the web-site. A student said: "It was hard for me to find the page I wanted to study. Every time I wanted to lookup something from the earlier week's content I had to go to the index page." Another criticism was related to the heavy technical terminology within the content. "While I was reading something there where technical terms that I saw for

the first time. I knew that I could lookup for them in the glossary but that diverted my attention to elsewhere and I would lose the topic where I was studying on."

Students were asked if taking a hybrid course made a change in their learning habits. 14 students said that it did not make any change in their learning habits, but that they got aware of this structure of course delivery. They commented that an information source like the internet should not be left outside the courses. One student stated that "taking the course as web supported had many advantages but it did not change my learning habits. I don't believe that learning habits can change by taking one course. It will take some time for us to get used to learn from the web without searching any other information source." Most of the students believed that the learning habits would not change quickly. Still there were eight students stating that the course had changed their habits and preferences in learning. One interesting comment of a student showing what was going on in student learning habits was:

> Yes it did make a change. Until now I was used to get into the class, listen to the lecture, take notes, go home and study on those notes, study the chapter questions from the book, and if you have not understood something, there is nothing you can do about it than thinking where this came from. Here, in this course you were left alone in learning but you could always ask questions to the others from the web. After sometime, my reading the content and understanding what was written became much faster than before.

Three students preferred not to answer the question because they had no idea clear idea about their learning habits. All of the students were aware that the course was functioning different than traditional courses in terms of students learning. Students knew that they were expected to learn from the resources provided through different media and in different environments.

A majority of the students said that they used the cognitive tools highlight, search, glossary and notebook frequently and that these tools helped them in customizing their learning from the web-site. There were individual preference in using the cognitive tools and there were differences between students in the

frequency of using a tool. According to the perceptions of the students, the web-site of the course and the hybrid course in general was integrated in terms of metacognitive support.

4.2.7 Students' Perceptions about the Collaborative Learning Strategies Employed in the Hybrid Course

The questions asked to the students in the interview form to understand their perceptions about the collaborative learning strategies of the hybrid course were related with:

- If the face to face component supported their learning.
- Which features of the web-assisted instruction aided to their learning of the content.
- What features of the hybrid course they liked.
- How they used the web-site throughout the semester.

In the hybrid course, collaborative learning strategies were rather used in the classroom meetings, projects, group works and educational games, than the web-site of the course. Students were expected to work in groups to accomplish shared goals. A few of the weekly assignments and homework on the web-site were expected to be done in pairs. There was a semester project to be done in pairs of two students. In terms of the web-site of the course there was little integrated collaborative learning. Student perception indicated that the web-site was based on individual learning.

The learning/instructional activities of the face to face component in the hybrid course were investigated in detailed. Students were asked if the classroom activities contributed to their learning. If it had, how was that achieved. 16 students stated that the face to face part had effected their learning directly. Seven students stated that although the class meetings had an effect on their learning, it was not as much as the web-site of the course did. Only two students stated that the face to face part of the instruction did not add anything to their learning. The question to the

students on "how" it contributed to their learning yielded various answers. Some of the common arguments were:

- "The concepts became more concrete after the class hours."
- "By discussing and asking questions one could assess if he understood the concepts correctly.
- "Half-understood concepts could be fully understood in the face to face meetings."
- "I could get feedback on my learning of the course content. The class hours were guiding our learning"
- "I could feel that I took the course, I got motivated."
- "I could interact with other students and see what they knew. I also could interact with the instructor."

Students answers related with the most useful classroom activities are ranked. The ranking and number of students stating that they benefited from the classroom activity are supplied below:

1. Asking Questions (14 students)
2. Groupworks (11 students)
3. Educational Games (9 students)
4. Classroom Discussions (7 students)
5. Watching Films (5 students)

Students used especially the classroom meetings to ask questions to the instructor and their peers related to the content they had read from the web-site. This was understandable because the students criticized the inefficiency of communication tools like chat in the course web-site. Communication, collaboration, motivation and cognitive support seemed to be the most obvious benefits of the face to face component in the hybrid course. Moreover, the face to face part was near to constructivist epistemology and cognitive learning theories, helping students to build their own knowledge by collaboration and communication. Students also stated their enjoyment on doing the classroom activities. A student answer on the question if the

liked doing the classroom activities was: "Absolutely. While being on the web one gets a feeling of isolation and loneliness, one loses the joy of learning new things." This answer is one of those student views indicating that the face to face component and the collaborative learning strategies of the hybrid course improved students' motivation too.

Some of the students expressed their like on the feedback supplied by the teacher at the end of each group work done and discussion made in the classroom. A student stated that: "It was good that the correct answers were supplied at the end of each group work. I could see where I made mistakes." There were students using the group works and discussions as comparative assessment tools as it is indicated by one of the students as "At least I could see the knowledge level of the others. I could see that I was far behind those." The communication and information exchange in group works were referred as useful by the students. On this a student said: "Group works did not require individual learning like the quizzes. We worked in groups, creating a discussion environment in which we exchange information with each other." However, some of the students criticized how groups were formed and group members were chosen in group works. "Group works were not that effective in our learning because we could not choose the group members by ourselves. In many group work studies I had not met with some of the group members before. In these groups whenever someone in the group seemed to have more knowledge the others preferred to leave the work to him." There was one student saying just the opposite of the above comment; "It would be better that the instructor chooses the members of the group in the group works by placing the ones with good knowledge with those having poor knowledge. Group member selection should not be left to students." Another interesting comment was made by a student complaining that the group works effected his learning the content in negative way. He said that "while doing the group works, when one or two of the group members showed their knowledge on the subject the others preferred to do nothing."

Student perceptions showed that students liked the face to face part of the course. Students' perceptions were also indicating the face to face part as the part

where the collaborative learning strategies were used. The classroom meetings were designed to achieve collaborative learning. A student said: "In the classroom meetings I got the opportunity to compare what I had done for the assignment or the project with those of my friends." According to the perceptions, the group works were also found to be effective in students learning by majority of the students. About this, a student said: "I liked the most the group works that we did on IP and subnetting. When I first read the topic from the web-site I could not do the assignments. In the group work that we did in the classroom I understood how it was done by listening to my group peers." Students stated that they could evaluate their learning while working in a group. Moreover, they said that they benefited from these by learning from their friends what they did not know before the class. One of the students indicated: "I was not sure how well I learned the topic before the class meetings, while doing the group works and classroom discussions I could organize my knowledge and learn new things from others."

The collaborative learning tool in the course web-site was the Message Board. As it was stated before students' perceptions on hybrid course features indicated that the Message Board (Forum) in the course-website was referred by almost 1/3 of the students (eight students) as an effective learning support feature. The students indicated that they did not use the message board as a tool for information exchange but rather for sharing web site addresses on the subjects. Sharing course related web-site address still was useful to some of the students. As it was indicated by one student: "…. the forum helped me most when I was learning the content because everyone was sending messages whenever they found a new web site address on the subjects." The Message Board was indicated as rather an effective communication than a collaboration tool. Yet, another student said: "The forum of the web-site was very useful for me. I could ask anything to my friends and to the instructor without having to wait the class meeting. I could share my knowledge and I could see how much the others knew."

All students agreed that collaborative learning facilities were limited on the course web-site. As stated by the students, this was one of the reasons why they wanted to attend the classroom meetings. On the other hand, almost all students

stated that the projects, group works and class discussions were activities to be done with the other students and that these increased their learning. Overall, in terms of collaborative learning strategies, while students perceived the web-site of the course as more unsupported, they perceived the classroom learning activities in the hybrid course as integral collaborative learning strategies.

4.2.8 Students' Perceptions about the Structural Flexibility in the Hybrid Course

The questions asked to the students in the interview form to understand their perceptions about the structural flexibility of the hybrid course were related with:

- If they could easily access a topic they wanted to study in the web-site.
- Which features of the web-assisted instruction aided their learning of the content.
- If accessing the course content from the web-site had any advantages or limitations.
- What advantages and limitations the weekly content providence had.
- Which of the cognitive tools they made use of.
- If they used any other information source than those provided in the course web-site.
- How they used the web-site throughout the semester.

Student perceptions about the structural flexibility of the course web-site pointed towards open type. The site accessibility was not limited with time and/or place. Students could get access to the content any time, any place they wanted. That was indicated by some of the students as the wish to take the course as a hybrid course. A student commented on this by saying: "I was the one who decided on when to study and where to study. Sometimes study time was 8:00 am or 9:00 pm."

The course web-site was found to be user-friendly and students stated that the interface features like buttons, icons and links were quite clear and

distinguishable. The students could access information trough multiple ways, such as navigation links ad the cognitive tools. They said that they easily could locate information they wanted to study. They also stated that they liked the hierarchic structure of the web-site and that each week a new topic was added. A student said: "I knew which day the new topic would be added and according to that, I tried to finish reading the topic of that week. I made my study plan according to the weeks. Sometimes I turned back and restudied the older topics. It was easy to find the topics that I wanted to study from "table of contents", "site map" or other links. The weekly structure was very useful for me."

There were different ideas related to the presentation of the information on the web-pages. While some of the students stated that they liked the no-scrolling property of the pages, some others stated that they would prefer scrolling. However, the majority of the students were satisfied with access to content structure, and information structure of the web-site. About this, a student said: "The web-site of the course was very professional. I could easily go from somewhere of the content to elsewhere. The organized structure of information on the web-site was helpful in planning my study."

The cognitive tools integrated to the course web-site were important tools for searching, accessing and organizing information within the course web-site. A detailed analysis of these tools is supplied at the "4.2.6 Students' Perceptions about Metacognitive Support in the Hybrid Course" section. The findings from the students answers indicated that students ranked the most effective cognitive tools in terms of their support on their learning as; (1) Glossary, (2) Search, and (3) Highlight. These tools were used most frequently while studying trough the web-site. The other tools, Sitemap, Bookmark, Pagenote, History and Notebook were indicated as less preferred tools. These tools were important elements of structural flexibility of the web-site. The students used the tools find and access information and organize their learning. Using the tools, students with different preferences could access the same information from different sources.

The cognitive tools and the web-site of the course were among the most liked features of the hybrid course as indicated by the students. While 14 students stated that they liked the cognitive tools, 12 students said that they liked the course web-site. Students indicated that the cognitive tools were giving the course web-site a professional feeling, making it different than standard, electronic page turning web-sites. One student said on this: "The tools in the web-site were very usable. I used them for accessing to information quickly and easily." The web-site was also indicated to be very user-friendly, nice looking in terms of graphics and well organized in terms of access to information. The students liked the navigation structure and the information presentation structure.

The majority of the students perceived the hybrid course and especially the web-site of the course open rather then fixed in terms of structural flexibility. The students could easily search, access and organize knowledge. The access to the web-site was not limited with time or place; the students could access the website anytime from anywhere they wanted.

CHAPTER 5

CONCLUSION AND IMPLICATIONS

5.1 Conclusion

This study was an experimental-control group experimental research and it aimed to investigate the effectiveness of a hybrid course which was referred in the current study as Web-assisted Instruction. Data for the study were the students' responses to different instruments, achievement test, attitude test, and course feedback form, and interview guide. Four key effectiveness factors, achievement, knowledge retention, attitudes and course satisfaction were compared for the two groups with two different types of instructions; traditional and hybrid.

The quantitative results of the study indicated "no significant difference in achievement, knowledge retention, attitudes and course satisfaction" between the two modes of instruction. Based on these findings, we can conclude that both instruction types are equally effective and we can substitute hybrid instruction for traditional instruction whenever needed. This conclusion could be drawn by just looking to the quantitative research results, but when we also look at the student perceptions we can see that the findings should not be generalized that much. We also know from previous research that, technology does not increase learning over and above traditional methods (Ehrmann, 1999).

5.1.1 Students Achievement

The current study found no significant difference between the students' achievements in the hybrid course and the traditional course. The preliminary analyses on the groups equality showed that because of the withdrawing students the GPA score for the control group was higher (M=2.49) than that of the experimental group (M=2.43) and the pre-test mean score on achievement for the control group was higher (M=17.2) than that of the experimental group (M=14.5). The t-test results for both showed no significant difference between the groups but the two tailed probability was near the significance level. At the initial analyses the result from the t-test showed significant difference between the control group and experimental group in student post-test mean scores in achievement. To eliminate the effect of GPA and pre-test results on post-test achievement of the two groups an analysis of covariance (ANCOVA) with two covariates was conducted. The result of the analyses showed that there was no significant difference between experimental (hybrid course) and control (traditional instruction) groups in achievement at the end of the experiment.

The results indicated that students' previous knowledge and GPA had affected the results. This was also observed in students interview results related to students' ability to relate their newly acquired knowledge with their previous knowledge. The students indicated that they had difficulties to build their knowledge on their previous knowledge because the course content was highly technical. The difference in the mean scores of the student in the achievement pre-test indicates that there were students with previous knowledge in the control group. The students' previous knowledge and GPA were controlled by taking them as covariates in the statistical analysis.

The "no significance" phenomena indicated by Russel (1999), and Phipps and Merisotis (1999) found for more than 300 distance education and WBI courses came out to be true for the hybrid course. However, the finding of the study was

different than the findings of the past studies. The past studies that compared achievement of students in hybrid courses with other modes of course delivery like traditional and web based found that students scored significantly higher in hybrid courses than the students in the other courses (Christman, Badget and Lucking, 1997). The difference between the hybrid course in the current study and the previous studies was the course type. The hybrid course in this study was a highly technical course with computer networks content, in the study of Christman and Badget (1999) the hybrid courses were science courses. They found that the students in the hybrid course were more successful than their peers in the traditional course. Similar findings were reported by Persin (2002).

The hybrid course in the current study did not report any superiority in terms of student achievement of the hybrid course on the traditional course and visa versa. This result may be due to the nature of the course content which was indicated as technical and procedural and/or due to the characteristics of the students as stated above. Most of the subjects in this study did not have prior knowledge, they were taking the course as elective and they were from different departments. This can be understood as; (1) if the students achievement scores are interpreted as success of students in acquiring the knowledge in the course content, hybrid instruction does not support students learning any better than the traditional instruction with lecturing, and/or (2) the students learned the same in both courses although the ones in the hybrid course came to the classroom only 1/3 of the traditional course time. The second way of interpretation is the more optimistic view. The physical resources like classroom, seat place, student-teacher time can be used more effectively. More students can take the course, exactly three times more, and more students can be reached who can not come to the campus because of time or other concerns.

5.1.2 Students Knowledge Retention

Students' knowledge retention in the hybrid and traditional courses was investigated by another research question in the current study. The t-test results indicated no significant difference in students' knowledge retention between the hybrid course and the traditional course of the students mean scores in achievement test, one month after the treatment. To eliminate the effect of pre-test and post-test results on retention of the groups an analysis of covariance (ANCOVA) with two covariates was conducted. The ANCOVA result showed that there was no significant difference between experimental (hybrid course) and control (traditional instruction) groups in knowledge retention one month after the treatment after adjustments by covariates.

The research findings suggest that learning/teaching activities in both types of instruction, hybrid and/or traditional which are relevant and meaningful to students are most effective in students learning and knowledge retention. Most of the students indicated that they could relate what they learned in the course to real-life experiences and that they were able to apply their new knowledge to other situations in the future. The learning/teaching activities' enabling them to do this was stated as the classroom activities like groupworks, educational games and classroom discussion. The finding is parallel with the research of Dewey (1933), Piaget (cited in Jacob, 1984), Gardner (1999), indicated that students in experiential learning method demonstrate the ability to use their experiences successfully over time.

There were many factors affecting students' knowledge retention in the hybrid course. Two important once to mention here are the learning habits of the students and the technical and procedural content of the course. The students indicated that they were used to be lectured, take notes and study later on those notes. The students in the traditional course settings could keep on doing what they did in their previous courses. The students in the hybrid course had to get used to the new structure. The hybrid course expected students to be intrinsically motivated,

independent and active learners, well organized with metacognitive skills. These expectations and the fact that the content of the course was technical and procedural might have affected the learning and knowledge retention of the hybrid course students. This study did not indicate any advantage or disadvantage of either instructional modes, traditional or hybrid to students' knowledge retention.

In summary we can conclude that the students in the hybrid course who were expected to read the content from the course web-site and learn them by themselves retained knowledge as good as the students in the traditional course with lecturing. This result indicates that meaningful learning occurred in both courses.

5.1.3 Students Attitudes towards Computer Networks Subjects

The hybrid course was compared to the traditional course in terms of their effects on students' attitudes toward the course content. At the initial t-test analyses the study found no significant difference in students' attitudes toward computer networks subjects between the hybrid course and the traditional course of the students at the end of the treatment. To eliminate the effect of pre-attitudes on post-attitudes of the groups an analysis of covariance (ANCOVA) with one covariate was conducted. The ANCOVA result showed that there was no significant difference between experimental (hybrid course) and control (traditional instruction) groups in students attitudes towards computer networks subject at the end of the experiment.

The results of the study indicated that hybrid and traditional courses were not different in terms of their effect on students' attitudes toward the computer networks subjects. This is inline with students' perceptions, where students stated their interest and motivation on learning the course content. The study does not indicate any superiority of one course to the other in terms of student attitudes. This result can still be understood as successful because the new course structure did not change students' attitudes negatively although there was a much more work load on students. It can be concluded that the hybrid course was successful in shifting the

course structure from teacher centered to student centered without causing a drop in students' attitudes towards the course content.

Attitudes may not change easily and it takes long time to see the changes in the attitude. Since the course was an elective one and students were willing to take the course in both groups, they already had a positive attitude in the beginning. The positive attitudes of the students towards the course content can be seen in their pre-attitude mean scores for control group (M=3.95) and the experimental group (M=3.87). The mean scores of both groups were above the neutral score of 3.00 as measured by the 5 point-likert scale (Strongly Disagree, Disagree, Neutral, Agree and Strongly Agree). The results of the t-test and ANCOVA analyses showed that the course did not change the students' positive attitudes.

Previous research shows students attitudes were affected positive by hybridizing a web component to traditional courses. Gunter (2001) found that reducing the lectures by 50% and putting an individual study in computer laboratory affected students' attitudes towards the use of technology positively. Similarly, the current study removed all of the lectures, decreased the classroom seat time and put the content to the web for individual learning. The study indicated that removing the lecturing had not affected students' attitudes negatively. Student attitudes did not depend on lecturing if instructional design considers students learning based on activities in the classroom. Sanders and Morrison (2001) found that students' attitudes toward hybrid courses are positive. This was also the case in the current study. Students positive attitudes towards the course content in the hybrid course were also related with students attitudes towards the hybrid structure. The literature shows that hybrid course structure has positive but not negative effect on students' attitudes toward both, the use of technology in courses and the course content.

5.1.4 Students' Course Satisfaction

In the current study, it was found that there was no significant difference between experimental (hybrid course) and control (traditional instruction) groups in students course satisfaction at the end of the experiment. These finding indicated that student satisfaction was high in both type of courses and as indicated by the students in the hybrid course students were satisfied with the teaching and learning activities of the hybrid course. A result on students' course satisfaction indicating the hybrid course structure as better was found by Black (2002). His study showed that students preferred hybrid courses to purely web based and purely traditional courses. Students tend to be passive in the classroom if not taken care. Traditional courses expect student to listen silently to the lecture and take notes. In the current study this was criticized in the student interviews by several students as not supporting their learning. Students also indicated their will to stay in touch with their peers and the teacher in classroom environment and that this aids to their learning.

Even though there was no significant difference, the students were satisfied with the hybrid course structure. They used the advantages of the WBI environment while at the same time they could do classroom activities. Classroom activities affected especially the affective domain of the students; they could give meaning on what they learned. It is not a surprise that there was no difference between the courses in student satisfaction because they did the same classroom activities.

5.1.5 Students' Perceptions about the Hybrid Course

The students perceptions' about the hybrid course part of the current study was important to understand the effective dimensions of students learning in the hybrid course parallel to Reeves and Reeves (1997) model. The students in the experimental group were interviewed one on one at the end of the experiment.

Students were asked questions that would reveal their perceptions. The findings and conclusions on the students' perceptions are supplied below.

Students' Perceptions About the Pedagogical Philosophy Employed and the Learning Theories that Formed a Base for the Hybrid Course

From students perceptions it could be seen that the web-assisted (hybrid) course was closer to the instructivist philosophy and behaviorist learning theory. The features of the hybrid course outlined in the interviews by the students, the theoretical base of these features, and students' perceptions on those are summarized in Table 5.1.

The literature shows that there are fundamental philosophical differences between objectivist and cognitivist learning theories based on instructivist and constructivist epistemologies (Bednar, Cunningham, Duffy & Perry, 1995; Dick, 1995; Rowland, 1995). However, in the real classroom environment, a "mix" of objectivist and cognitivist, and inline with that, instructivist and constructivist instruction/learning design is being used (Davidson, 1998). There is no one to one correspondence between what was stated by instructional design theorists and the real instructional settings in the hybrid course designed and developed in this study. Different parts of each theory was used according to "what", "where" and "how" questions. In the design of the hybrid course the aim was to produce the best practice by means of key concepts of instructional design. This was reflected in students perceptions about to pedagogical philosophy and learning theory of the hybrid course. While students' stated their primary source of information as the course content in the web-site, which was closer to objectivist theory, they also used other components of the hybrid course for supporting their learning like classroom activities and cognitive tools, which were closer to cognitivist learning theory and constructivist philosophy.

The course content was supplied in objectivist lesson format, but the classroom meetings and tools in the course web-site were designed and developed based on constructivist philosophy. According to Jonassen's (1999, p.221) constructivist learning environment model, each classroom activity in the hybrid course provided students with an authentic, real-life experience. Classroom discussions were guided by the instructor and the questions were presented so as to assist students in understanding the concepts and technologies supplied in the course web-site. The students stated that they could relate the content with their real life experiences and pointed towards the classroom activities for being useful in that. The visuals like graphics and simulations were also effective in supporting students learning. Although the course content was objectivist in content delivery structure, the textual information was supported visual images to help learners construct mental images and visualize the concept. Another constructivist element in the course web-site supporting students learning were focusing questions and information resources (e.g, assignments, suggested readings, links to related Internet sites).

The cognitive tools in the course web-site were successful implementations of the cognitivisit learning theory and constructivist philosophy. Students' perceptions indicated that they were effective tools for students searching, organizing and individualizing content and knowledge. They were implemented to support students' learning from the hybrid course web component. As indicated by the students they enabled them to process large amount of information, providing help to them in searching, accessing and organizing information which are indicated as important factors for learning in open learning environments by Land & Hannafin (2000). The cognitive tools were also effective in students' perceptions indicating that the course web-site was as open in terms of structural flexibility. The learning support tools like the cognitive tools in the course web-site are indicated to be needed by the students to involve in interaction and cognitive activities (Clarebout et al., 2002). Learning support tools are said to provide the overt means through which individuals engage and manipulate both resources and their own ideas (Hannafin et al., 1999, p. 129) and structure or help problem-solving process (Clarebout et al., 2002).

Constructivist methods like collaboration and knowledge sharing was also provided in the classroom setting and was indicated as useful by the students, supporting their learning. In the collaborative activities students were required to work in groups of four to solve a given problem and submit their responses as teams. Collaborative work and responsibilities of team members were described in written format, together with the required tasks to accomplish. The group size was consisting of 4 members and teams were asked to record their work on a piece of paper. The instructor observed individual members' active participation and contributions to the task and worked with the teams from time to time for guidance. The instructor initiated classroom discussions on especially abstract content. Students indicated that they used these activities to understand what they have learned and what their peers knew. Constructivist elements like groupworks were also effecting the students' intrinsic motivation, the joy of learning in a positive way. Students stated that they enjoyed working in groups and discussing with their peers and the instructor.

Table 5.1-Summary of Students' perceptions about the features based on the pedagogical philosophy and learning theory of the hybrid course

Feature of/effecting the Hybrid Course (Component)	**Pedagogical Philosophy**	**Learning Theory**	**Students' Perceptions**
Design of the Course (Whole Course)	Instruct. & Constructivist	Behaviorist & Cognitiv.	Was successful in relating previous knowledge to newly acquired knowledge.
Pre-determined objectives (Whole Course)	Instructivist	Behaviorist	Were useful to know what is expected.
Learning habits of students (Whole course)	Instructivist	Behaviorist	Desired lecturing, preferred face to face communication.
Time management (Whole course)	Constructivist	Cognitivist	Good to come for one hour to class. Overall too demanding, needs devoting to much time.
Quizzes (Face to face)	Instructivist	Behaviorist	Useful for self-assessment.
Groupworks (Face to face)	Constructivist	Cognitivist	Helped in learning from others, reflecting on what the others knew.
Announcements & Additional Links (Web)	Constructivist	Cognitivist	Useful in learning from different sources.
Assignments & Homeworks (Web)	Constructivist	Cognitivist	Supported learning the course content.
Course Content (Web)	Instructivist	Behaviorist	Was too loaded, too much reading.
Message Board (Web)	Constructivist	Cognitivist	Useful in exchanging web resources.
Web-site usage (Web)	Constructivist	Cognitivist	Preferred to study at home at weekends and before the class meeting.
Reading content from the computer screen (Web)	Instructivist	Behaviorist	Problems related with health, like eye watering, and internet access.

Table 5.1 (*Continued*) Summary of Students' perceptions about the features based on the pedagogical philosophy and learning theory of the hybrid course

Feature of/effecting the Hybrid Course (Component)	Pedagogical Philosophy	Learning Theory	Students' Perceptions
Cognitive Tools (Web)	Constructivist	Cognitivist	Used to organize their learning, search and access information quickly and easily.

The table 5.1 was provided to see the whole picture on what students' perceptions were with regard to pedagogical philosophy and learning theory of the hybrid course. The students found the pedagogical philosophy of the hybrid course as a mixture of instructivist and constructivist elements. This structure is also recommended by Passerine & Granger (2000) as the ideal paradigm of online course design. Moreover, as stated by Mayer there is no need for discovery learning to have constructivist learning (Moreno & Mayer, 1999). Constructing meaning can also be achieved by a well-designed and organized directed learning. This is parallel with what the students said in their interviews related to the pedagogical philosophy. Most of the students found the overall design of the course good for the aim of hybrid instruction.

The discussion about "how much of the course should be online?" was an issue for the hybrid course in this study. As it was proposed by Garnham & Kaleta (2002), the amount of online information should be limited. Student interviews showed that the information supplied online in the hybrid course was "overloaded" and too much. Special attention is needed in selecting the content of a hybrid course. From the interview results it can be said that two factors can be drawn that should be taken into consideration in selecting and determining the content. The first one is the amount of information covered in the content. The second one is the timing or scheduling of access to the content. Students also stated that they

sometimes had difficulties in studying the whole content in one week time duration. The content published each week for students access in the course web-site should be organized with respect to students studying habits. Students in the hybrid course preferred to study on weekends and before class meetings. The scheduling of the content release in the course web-site should be planned accordingly. As a result, two questions to be asked and answered by the instructor in designing the hybrid course content are; "how much?" and "when?"

The findings of the current study revealed important clues on how to "hybridize" or "mix" face to face part and online part without breaking them apart, keeping them side by side and integrated to each other. Every week there was a groupwork, classroom discussion or some other activities in which the students could practice on the content they read. Students' comments showed that the students had some difficulties reading and understanding the content from the course web-site. They demanded additional classroom meetings and even lecturing. Almost all students agreed on the support of the classroom meetings to learn especially abstract content. This is understandable, after years and years of traditional, lecturing courses in their secondary and high school years with the same structure, students can not be blamed for their difficulties in getting used to new instructional contexts in the hybrid courses.

Students' Perceptions of Goal orientation and Task Orientation of the Hybrid Course

The conclusion for the closely related instructional concepts goal and task orientation was presented together. The findings of the current study were that students found the goal orientation of the hybrid course more sharply focused than general. This was also observed in their web-site usage, starting from sharply focused goals by visiting the course content first, and going towards general goals in the assignments. The sharply focused goal orientation structure affected the students' use of their knowledge in their real-life. They demanded extra practice for the highly theoretical concept of the course. The general goal orientation strategy in the

projects, assignments and groupworks helped students acquire to do hands on real-life skills of what they read in the course web-site.

The task orientation of the hybrid course was a balance of academic and authentic procedures. While some of the web components of the hybrid course like course content structure and course objectives were including more of traditional academic tasks, they were supported with authentic tasks in the assignments, project, and classroom activities. The students' used both type of tasks, majority of the students learned the content trough the course content in the web-site even though they found it "heavy" and "loaded". The half of the class made use of the assignments and the classroom activities as the primary learning source. The academic and authentic tasks were going hand in hand as the instructional elements enabling students learning. The authentic tasks came out to be more effective in making the students relate their formal knowledge with real-life experiences.

In the light of the above findings, one important conclusion of the current study in the pedagogical domain was the work requirement from the student and the teacher. Student perceptions related to the goal orientation and task orientation were; (i) goal orientation was more focused than general, and (ii) task orientation was a balance of academic and authentic tasks. This combination can be interpreted as; the hybrid course was a student centered course with direct learning from the course web-site. Students were required to do academic and authentic exercises. This picture requires a great amount of work from both, the instructor and the student. This overwork issue was also pointed by Garnham & Kaleta (2002). Their findings related to the overwork issue are also applicable to the current study. Hybrid course designs should start from small and simple and should not overwork the instructor and the student. Student criticisms related to the amount of work for the hybrid course in this study was indicated by "too overloaded", "too much to read", and "too demanding". The reason behind these criticisms lies on the characteristics of the course, students studying habits and students lack of technical background. The hybrid course was based on individualized learning. Students were expected to read the content, to see the graphics, use additional web links for their learning. In

addition, the course was an elective course and student expectations were not parallel to the course requirements. Students used their learning habits they obtained in years and years of traditional courses. They tried to communicate with the instructor and their peers only in classroom settings although they were able to use the forum in the web-site. In addition, students were from different departments with different knowledge backgrounds. Most of them had no technical background. The technical content of the course with all the terms, concepts, protocols and abbreviations needed not much but a little bit of knowledge on computers, internet and/or computer networks. From these findings we can say that the hybrid course design should be evolutionary. Every semester new content and activities should be added or activities and content should be replaced. While doing this new web technologies should be integrated to the course. Moreover, the classroom activities should be integrated to the online part of the course. Actually, they should go hand in hand.

Students' Motivation Types in the Hybrid Course

The findings of the study showed that motivation and rewarded learning is very important for students learning in the hybrid course. The analysis of the interview data to find out the type of motivation that was more effective on students learning in the course showed that students had both type of motivation, intrinsic and extrinsic but one of them was more dominant. Detailed analysis pointed towards intrinsic motivation as the key element for success in the hybrid course. The findings about the factors effecting the students' motivation are summarized in Table 5.1

Table 5.2-Summary of students' motivation types in the hybrid course

Factors effecting students motivation	**Type of Motivation**	**Effect on Students**
Studying to the course content through the web-site	*Extrinsic* was an obligation to read at least for one hour, students were logged	Negative – complained about health problems like eye watering, and availability of internet access
The structure of the course in terms of "students learning preferences"	*Intrinsic* Individual learning was supported	Positive - students were used to individual learning Negative- students expected to carry on their learning habits
The structure of the course in terms of "logistic preferences"	*Extrinsic* to choose their own study time class hour was only one hour	Positive - students preferred to study at their homes, get access to course content whenever they want.
Expectations from the course related to "external rewards"	*Extrinsic* expecting to find a job, to get a certificate, dedicate less time to the course	Negative - Students were frustrated easily when faced with the requirements of the course.
Expectations from the course related to "internal reward"	*Intrinsic* Enjoying learning computer networks related topics.	Positive - Students liked to understand the meaning and functioning of computer networks and internet they used in their daily life.
Classroom activities	*Intrinsic* enjoying to do practice of what is in the course content. being active rather than passive listeners.	Positive – Students could use and show their knowledge to their peers and the instructor.
Cognitive tools in the course web-site	*Extrinsic & Intrinsic* organizing, searching and accessing information fast and easily.	Positive – Students could customize the course web-site usage according to their learning preferences, like taking notes, highlighting and searching, bookmarking so on.
The web-site of the course	*Extrinsic* appealing in terms of graphics design, navigation structure and information presentation	Positive – Students found the web-site easy to study, user-friendly and well organized.

Table 5.2 (*Continued*) Summary of students' motivation types in the hybrid course

Factors effecting students motivation	**Type of Motivation**	**Effect on Students**
Course content	*Intrinsic* new technology, subjects are valuable in the information society	Positive – Students were aware of that they learned new technologies. Negative – Students with non technical background or previous knowledge found the subjects too technical and hard to understand.
The instructor of the hybrid course	*Intrinsic* student-teacher interaction was informal and friendly, teacher motivated students with positive feedback	Positive – Students were relaxed, and easily communicated with each other and the instructor during the classroom activities.

Students' responses were interpreted and categorized into two types of motivation; extrinsic and intrinsic. The study results found out that intrinsic motivation and internally rewarded learning is the key element of the hybrid course. Interviews revealed that students with extrinsic motivation are more prone to losing motivation. It was seen that some students in the hybrid course with extrinsic motivation lost their motivation and were frustrated by the course content. On the other hand, students with internal motivation were more aware of objectives of the course, had the ability to plan and evaluate their own learning. They also had the metacognitive skills which are referred by Flavell (1979, cited in Revees and Reeves, 1997) as skills one has in learning to learn. The interview results also indicated that the source of motivation is not discrete but a continuum. This means that students have both types of motivation while learning.

Research points on motivation as an important factor on student achievement. There is also research evidence that motivation is not only a determinant for student achievement but it has to be activated for each task (Weiner,

1990). There are different opinions about which type of motivation is more effective on students learning. The findings of the current study points towards intrinsic motivation as the dominant motivation type in students learning in the hybrid course. This result supports the findings of Lin and McKeachie (1999, cited in Lee & Park, 2003, p.657) who suggested that intrinsically motivated students engage in the task more intensively and show better performance than extrinsically motivated students. However, some older studies showed opposite results for traditional classroom settings (Frase, Patrick, & Schumer, 1970, cited in Lee &Park, 2003, p.657). The contradictory findings have been explained as "possible interaction effects of different types of motivation with different students. For example, the intrinsic motivation may be more effective for students who are strongly goal oriented, like adult learners, while extrinsic motivation may be better for students who study because they have to, like many young children" (Park & Lee, 2003, p.657).

The literature shows two models for defining motivation of students for learning. The first one is Malone's (Malone, 1981; Malone & Lepper, 1987, both cited in Alessi and Trollip, 2001, p.25) motivation theory in which he suggested four relevant factors of motivation: challenge, curiosity, control, and fantasy). Malone and Lepper (1987 cited in Alessi and Trollip, 2001, p.26) identified motivators as either intrinsic or extrinsic. Extrinsic motivators were described as independent of instruction. Lepper's (1985, cited in Alessi and Trollip, 2001, p.26) research provided evidence "that extrinsic motivators diminish one's interest in learning because the goal becomes the reward rather then their learning". Malone and Lepper (1987) proposed that intrinsic motivators play a more dominant role on students learning than extrinsic motivators. This is parallel with the findings of the current study. Students indicated that intrinsic motivation provided within the course activities affecting their learning had more positive effects to their learning. They stated that they were more successful in the course because they enjoyed it more by these activities (Table 5.2). Moreover, students indicating towards intrinsic motivation as the major motivation were observed to be more active in classroom activities and got higher grades.

The other motivation theory was that of Keller (Keller & Suzuki, 1988, cited in Alessi and Trollip, 2001, p.25). Similar to Malone's theory he also suggested four components as essential factors of student motivation, namely: attention, relevance, confidence, and satisfaction. The theory is known as Keller's ARCS model of motivation design. Keller did not indicate any desirability of intrinsic or extrinsic motivation, but rather he argues that the instructional designer must be proficient at motivation design as well as instructional strategy and content design. This is especially important for hybrid courses because the student interviews indicated that especially students with extrinsic motivation tend to lose their motivation. The course web-site alone was not enough to hold learning motivation high. Students wanted to see their peers, talk to them, show their knowledge and skills, and use their theoretical knowledge in real cases. These activities were effective on students "enjoyment" of the course.

Students ' Perceptions about the Teacher's Role in the Hybrid Course

Students' perceptions about the instructor in the course were that he was a guide, a facilitator of the classroom activities leading their learning. Students indicated that they could communicate with the teacher in a friendly manner. The students perceived their role as "active" and the course as student centered. The student interviews showed that the teacher was an important motivation source for them. They stated the instructor as the person who;

- outlined the important points of the course content (information source)
- motivated the students to come to the classroom and read the content (motivation source)
- controlled the students if they did their assignments, homeworks and projects (authority figure)
- helped them in doing their assignments, projects and classroom activities (friend, facilitator)

Students also described their role as;

- reading and studying the course content weekly
- doing the assignments, homeworks and projects
- asking questions in the classroom and in the Message Board, working in groups, participating in discussions

The results of students' interviews indicated that the instructor's role was closer to constructivist orientation. The instructor provided learning environments and was open to interaction and communication. The students gained some knowledge about hybrid courses and expectation of this mode of instruction from them selves. During the implementation of the hybrid course, the students felt that face to face component of the hybrid course offered more student participation than the web component. They stated their expectation of other communication tools besides the forum used in the web-site. The classroom meetings facilitated student-to-student and student-to-instructor interaction. The web component facilitated student-to-content and student-to-interface interactions. Students indicated that the methods used by the teacher effective on their learning were classroom discussions, working in groups, assignments and homeworks, and the project. The stated activities were authentic rather than academic in nature. The teacher was perceived as a guide, stated as the constructivist teacher role by Mercer et. al. (1994, cited in Berge, 2000, p.4). Mercer stated that the role of the teacher is to guide the students to achieve success and become a self-regulated strategic learner. Berge (2000, p.3) listed the change in roles of the instructor in constructivist courses based on computer mediated communication. Some of these listed changes were indicated by the students as the instructor's role in the hybrid course. The common changes are listed below.

The teachers' role in the hybrid course changed with respect to a traditional course;

- from lecturer to consultant, guide, and resource provider

- expert questioners, rather than providers of answers
- provides structure to student work, encourages self-direction
- solitary teacher to a member of learning team

In summary, the teachers' role was close to the constructivist epistemology. The students stated that this role supported their achievement, satisfaction and motivation in the hybrid course.

Students' Perceptions of Metacognitive Support in the Hybrid Course

Student perceptions on metacognitive support of the hybrid course showed that the course was integrated rather than unsupported. The integration of the cognitive tools to support the students in monitoring, visualizing and regulating their learning activities and searching and accessing information easily and quickly provides metacognitive support for the students in the hybrid course. The cognitive tools enabled students to customize the course web-site according to their own learning habits. The students could underline important points in the content, take notes while reading, search for a meaning of a technical term or abbreviation and perform quick access to different parts of the information supplied on the course content pages. The most preferred cognitive tools according to the students' interviews were Glossary, Highlight and History. The log-system showed that the most frequent used tools were Highlight, Glossary and History. As stated by the students, the tools helped them in structuring their knowledge and "knowing what they know".

The students were expected to learn from the course web-site reading the course content provided weekly. Previous research shows that in web-based learning environments the students are expected to access, organize, and analyze information (Jonassen & Grabinger 1990, Newmark 1989, citied in Iiyoshi, 1999, p.2). The new role of the students puts high cognitive demands on them. These cognitive load has the potential to cause problems in cognitively ill-equipped learners, making them feel "disorientation" and causing "cognitive overload" in these learning environments

(Marchionini, 1988; Oren, 1990). As a solution to these problems, the need for metacognitive support was mentioned by previous researches (Jonassen, 1996; Gordon, 1996). Metacognitive support tools were given different names, as it is cited in Jonassen and Reeves (1998), these tools were called "cognitive technologies" by Pea (1985), "technologies of mind" by Salomon, Perkins, and Globerson (1991) and "mindtools" by Jonassen (1996). Jonassen (2000, p.9) defines mind tools as "computer-based tools and learning environments that have been adapted or developed to function as intellectual partners with the learner in order to engage and facilitate critical thinking and higher order learning". The cognitive tools in the hybrid course web-site were successful implementations to overcome the "dissordation" and "cognitive overload" problems. Besides that, students' perceptions indicated that they were effective tools for students searching, organizing and individualizing content and knowledge. In addition to decreasing the cognitive load they were implemented to support students' metacognition while learning from the hybrid course web-site. They were important factors for learning in open learning environments, which were described by Land & Hannafin (2000) as environments in which students need to process large amount of information. Cognitive tools are required in these environments for providing help to the students in searching, accessing and organizing information (Land & Hannafin, 2000)

There were differences in preferences of students in using the cognitive tools and the frequency of using a tool. Overall, the student perceptions indicated that the course web-site was integrated in terms of metacognitive support. The important finding of the study was how important metacognitive skills of students in the hybrid course were. Hybrid courses expect students to understand their responsibilities and manage their learning by them selves. In the current study the metacognition and time management skills of the students were supported through cognitive tools in the web-site and with a log-system. With the feedback from the log system, and the help of the cognitive tools integrated to the course web-site, students were supported in controlling their learning. Student perceptions related to metacognitive support and structural flexibility showed that the cognitive tools and the log system were in place. Students actively used them to organize knowledge and to organize learning activities. The cognitive tools were also investigated by Özçelik

(2002) and found to be useful tools for understanding how students interact with and learn through the web-site.

Students' Perceptions of Collaborative Learning Strategies Employed in the Hybrid Course

The face to face component of the hybrid course was where the collaborative learning strategies were implied. Students worked in groups, played educational games and participated in classroom discussions. The Message Board feature of the course web-site was also used to create collaboration among students. The students were asked which of these features supported their learning. They stated that the classroom activities had affected their learning in a positive way. Students were further asked which of the classroom activities they benefited most while learning. Students' answers indicated that they benefited most from (1) asking questions in classroom discussion to their peers and the instructor, (2) working in groups, (3) playing educational games, and (4) listening to classroom discussions. The Message Board was indicated as useful but not as effective in student collaboration as expected. In general, in terms of collaborative learning strategies, while students perceived the web-site of the course as more unsupported, they perceived the classroom learning activities as integral collaborative learning strategies. Inline with this, the students perceived the instructor as a facilitator or guide. In successful collaboration, the instructor is needed to act as a facilitator who guides, encourages, and manages the student to student, and student to instructor interactions. Collaboration is described as "a purposive relationship based upon the need to solve a problem, create something, or discover something within a set of constraints" (Schrage, 1991, p. 36). This description indicates that the project required to do from the students was also a successful strategy for the aim of collaborative learning. Collaborative learning was supported in activities closer to cognitivist learning theory. The collaboration was pointing towards discovery learning and cognitivist theories according to students' perceptions.

The groupworks, classroom discussions and educational games in the face to face meetings were directed toward solving a problem, creating or discovering something that was provided as theoretical information in the course web-site. These activities were useful in students learning as stated in their interview results. This was how collaboration occurred between students in the hybrid course and this is described as how learning occurs by the collaborative process. (Edelson, Pea, & Gomez, 1996). The students' preference of collaboration especially in classroom meetings points towards the social aspect of collaboration. Actually, the collaboration of students in the hybrid course could be based on the social development theories of Bandura (1975) and Vygotsky (1978). In his social learning theory Bandura's emphasizes on modeling of behaviors, attitudes, and emotional reactions while doing purposive, goal directed activities in a collaborative group. Students' behaviors, attitudes and emotions affected each other while working in groups, discussing a concept or playing an educative game. A similar notion was outlined by Vygotsky by claiming that social interaction is fundamental in cognitive development (Vygotsky, 1978). The collaborative classroom environment provides opportunities for the social interaction of students.

Collaboration in the web component of the hybrid course was trough e-mail and forum implemented as Massage Board. These tools were for communication and were necessary but not enough for accomplishing collaboration. The reason for this might be students' communication habits throughout their school life. Students preferred to communicate face to face with their peers and the instructor. The collaboration among students was in each other's presence and verbal communications. Students preferred real time communications in the classroom. The e-mail and Message Board in the course web-site were asynchronous mediums of communication. Moreover, students' preferred to make written communications in the web-site as contrasted with the verbal communications in face-to-face classroom. Therefore, the collaborative learning strategies were employed in the face to face meeting. One of students' criticisms was the lack of other communication tools like the chat in the course web-site. The chat tool could provide real time (synchronous) written communications and interactions. On the other side, there are researches showing that students do not prefer to communicate trough chat or other

communication tools if they are able to see them in the classroom (Driver, 2002; İnan, 2002).

Students' Perceptions about the Structural Flexibility of the Hybrid Course

The structural flexibility of the hybrid course and especially the web-site of the course were open rather than fixed. The students could access information anytime they want and there was no restriction with time or place, the web-site was accessible 7 days 24 hours. With the integration of the cognitive tools the students could easily search, access and organize knowledge. By using the tools different students could access the same information from different links. The course web-site was stated as user-friendly and the graphical and navigation features of the web-site like buttons, icons and links were clear, easy to understand and distinguishable. The access to any information within the course content could be achieved through multiple ways. The hierarchic structure of presenting content was also adding to the structural flexibility of the course.

Closely related with structural flexibility of the hybrid course was the usability of the course web-site. Usability refers to the factors in the web-site that make the experience for the learner simpler and stress free. The usability factors were especially important for the course web-site, which was a dynamic web-site prune to technical problems. The download time was also important since most of the students stated that they prefer to connect to the internet from their homes with a modem. The usability and simplicity of design is given special attention in the web based course design literature. One of the researchers in this area is Jacob Nielsen, who advocates web design not to include graphics and sounds unless they are absolutely essential (Nielsen, 2000, cited in Hall et al., 2001). The design of the web-site of the hybrid course is based on the requirement to get information simply and quickly through avoidance of unnecessary audios and visuals. The cognitive tools were implemented to increase the usability of the web-site and provide flexibility in accessing information. The course web-site is simple to use as indicated by the students. In the design and development of the course web-site the literature on

usability was used as a guide. Some of the findings in the literature that guided the design and development and positively affected the structural flexibility and usability of the course web-site were (all cited in Hall et al., 2001, p.8);

- Text presented on a given page should be limited (Cotrell & Eisenberg, 1997; Jones & Farquhar, 1997)
- Scrolling should be avoided (Shotsberger, 1996).
- Graphics and multimedia should be used only when they directly support the materials and serve a clear instructional purpose (Cotrell & Eisenberg, 1997; Debra, 2000; Everhart, 1997).
- Design components that increase download time should be limited as much as possible. (Cotrell & Eisenberg, 1997)

Students' perceptions about the amount of text in one page and the no scrolling feature were generally positive. There were only few students stating that they would like scrolling in the web-pages. The graphics were selected with care and student perceptions showed that they were helpful in understanding abstract content. Students stated that they would like to have more simulations and multimedia in the web-site. On the other hand they also wanted to download the pages as fast as possible because they connected from their homes with a modem and had to pay for the line and the internet connection. With the implementation and widely use of new Wide Area Network technologies like ADSL this problem can be solved in the near future.

General Conclusion

As a conclusion, the instruction type under investigation was a newly developed hybrid/blended course. As indicated by Clark (2002), the hybrid/blended instruction is not a new paradigm. The use of alternative methods of course delivery came to the spot several times with different means, parallel to that time periods favorite media. Some of them in the near past can be listed as correspondence courses, broadcasting media like radio, television, distributed media like video and audio cassettes. The broadcast media (TV) was used since more than 20 years in

Turkey to deliver courses. The effectiveness of these courses is discussed for so long, but still they are continuing to accept students and deliver courses. The pedagogical problems are more related with the "broadcast" nature and one way communication feature of these courses. New technologies like e-mail, the Internet, chat and teleconferencing tools introduced new type of media which actually could contain all the others that were used in the past. However, the use of these new technologies is limited. As mentioned before, the problems of the Turkish educational system require innovative solutions based on new technologies. The finding of the current study was that there is no difference in effectiveness between hybrid and traditional courses. This is good news since students having classroom seat time reduced by 2/3 were as successful as the student of a traditional course. This means about 66 % of seat time, teaching time and travel and cost reduction. Can this finding be a solution for logistic problems and a key factor to deal with the high demand for university degree in Turkey? That might be a generalization beyond the effect size of this study, but we can say that hybrid instruction "works" for a computer networks course. To make more generalizations there is need for further research. In the light of the findings, it can be concluded that there is no evidence against using hybrid course as an integral part of instructional design in university courses. The student perceptions support the finding that hybrid courses are as effective as traditional courses.

Student perceptions indicated technology integration problems. Especially the need for some additional tools enabling peer to peer or student-teacher communication was obvious. In contrast to our expectations, the students in the hybrid course required more communication with each other and with the teacher. The communication tool in the form of a forum in the web-site of the course was not enough and student perceptions pointed towards the need for some other, chat like communication tools.

A major limitation of the hybrid course indicated by the students and that should be mentioned here was the limited amount of multimedia, which is video, audio, simulation and animation in the web-site. Actually, this was a criticism that was expected but could not be solved in the design of the web-site. The

consideration in accessing the web-site was "bandwidth limitation". Bandwidth limitation was a handicap for the hybrid course. Components of the hybrid course that were affected by this problem were, interactivity of the web-site, assessment strategies and amount of multimedia used in the web-site. Students indicated that they preferred to get access to the web-site from their homes with dial-up modems. A typical modem connection with 36-56 kbps bandwidth was the basic requirement of the web-site. This problem will be overcome by use of new wan technologies, like ADSL, for home users. In their interviews students indicated that they would like to have more multimedia in the course web-site. This was not possible due to the download time with a home user's bandwidth resources. This will be possible when the technical limitations like bandwidth are overcome.

The quantitave and qualitative results of the study showed some weaknesses and advantages of the hybrid course used in the current study. This can be listed and summarized as below.

Weaknesses of the Hybrid Course

- Student access to Internet was required whenever students needed to access the course content. Cost and computer resources were inhibitors of access to the course web-site.
- Bandwidth requirements were important inhibitors of audio and video support in the hybrid course web-pages.
- General interaction and real-time personal interaction did not occur as well as face to face interactions.
- Textual information was required to be read from computer screen. This was criticized as not being user friendly as reading a book or a magazine.

Advantages of the Hybrid Course

- Student seat time was reduced to 1/3 ratio. Resources could be saved.
- Students could access the course content on their will, anytime, anywhere, 7 days 24 hours.
- Students could easily navigate within the content, access to any part of the course content was one "click" away.
- By means of additional related web-site links, students could use the Internet as a huge information resource.
- By means of the cognitive tools, students could organize their learning, customize their web-pages according to their individual learning preferences.
- Students could be monitored and given feedback on how much they studied trough the web-site.

5.2 Implications for Practice

The design, development and implementation processes for a hybrid course is different than a purely traditional, face to face lecturing course or a purely web based course. In the literature there are limited numbers of research studies related with hybrid instruction. In that sense the current study revealed valuable insights that could help and guide other educators, instructors or designers in developing hybrid courses. There will be some implications and suggestions for practice, but before that it should be noted that there is no clear answer to the question: "What is the ideal mix for a successful hybrid course?"

From the results of this study the following suggestions are made for development and implementation of hybrid instruction.

1. *Don't just hybridize the technologies; hybridize the pedagogical philosophies, theories and instructional design methodologies.* In many ways hybridizing a course is similar to cooking. If you want to have a delicious meal at the end you have to select the proper ingredients and the proper cooking processes. As it is stated by Rosenberg (cited in Barbian; 2002); "The question is not if we should blend. Rather the question is what the ingredients are?" How learning is understood is another important point in developing hybrid instruction. What the hybrid course will look like at the end of design and developments depends on how learning will be supported and how it is understood. Therefore, when hybridizing new or existing courses, the focus should not be on the medium or technology to be used but rather on hybridizing teaching/learning activities to support learning. The design and development should be based on deeply rooted learning theories like Gagne's "Nine Events of Instruction". The theories should be adapted and hybridized with modern, strong instructional design principles like Merill's (1994) Component Display Theory or Clarks (2002) new ISD on applying cognitive strategies to instructional design. This could lead to more successful and effective hybrid instruction. Moreover, this strategy could yield better quality learning/teaching activities. It should not be forgotten that as important as doing the "mix" of theories with design principles is the implementation of the course.

2. *Student motivation in hybrid courses needs special attention.* Student motivation should be taken into account while designing, developing and implementing hybrid instruction. The findings of the current study together with previous research on hybrid/blended learning showed that students get bored while studying in front of computer screen (Carman; 2002). Learning activities for the face to face and web based components of the hybrid course should be designed to hold students interests high. Hands-on, real life activities are important factors for student motivation. They should be included as much as possible. By these activities the course content becomes relevant to students. Moreover, they could gain self confidence if they could see their

skills on real life problems. Being able to do come out to be an important factor for students' course satisfaction and intrinsic motivation.

3. *Tools for metacognitive support should be supplied to students.* Students needed further support for planning their learning to achieve the stated course goals and objectives. The web component of the hybrid course should be used to support students in scheduling and monitoring their own learning. One important assumption of web based and hybrid courses was that self-paced learning is occurring. Like the one in this study, most of the hybrid courses are reducing their face to face lecturing parts by putting those materials online. This is done on the assumption that student will learn by themselves if supplied with the required resources. The "learning to learn" should be supported with cognitive tools so as the student can organize his/her own learning. Students should at least be able to customize their online learning materials.

4. *Use of multimedia in the web component could enhance learning.* When looking to the studies on web based learning we can see that the use of multimedia is encouraged. Parallel finding in the current study indicated that students wanted to have more media support in the course web-site. Recent research on multimedia showed that it is a critical element in course web-pages. It is stated that adding graphics to text can help student in learning. Putting graphics next to text improves learning (Clark; 2002). It is important to use multimedia for educational reasons, not to decorate the course web-pages. Multimedia use should be done according to human sensing. Cognitive overload from parallel process in one sense should be avoided.

5. *Student-student and student-instructor communication should be encouraged and necessary facilities should be provided.* In the current study students wanted to reflect on what the "others" and the "teacher" was thinking. Moreover there were students who evaluated their learning through understanding how much the others knew. We are humans and humans are social beings. The constructivist theory claims that humans develop new understandings and

knowledge through their social interactions with a community of others (Brown; 1998). Both, the web and the face to face components of the hybrid course should include synchronous and asynchronous communication environments. Some of the communication tools suggested to be used in the web environment was teleconferencing, chat, forum and e-mail. The face to face component, rather than lecturing what is supplied in the web, should include collaborative learning methods like classroom discussions, group works and educational games. The students should be able to communicate and collaborate with each other and the teacher. Communication with the teacher played also an important role in the current hybrid study. For example, in the forum and the classroom discussions, students were curies about what the teacher would say about the issue discussed.

6. *Students should be provided with online self-assessment tools.* In the current study students pointed towards the absence of online assessment in the course web-site. Some of the students stated that they needed to test their learning on the content. In addition, students' online assessment results can be used as performance indicators, giving insight knowledge about the effectiveness of a hybrid course. Another important point to mention is the type of online assessment. Online assessment should be different than pen and paper exams by using multimedia and simulation abilities of the computer environment. The assessment should include higher levels of cognitive learning (Bloom; 1956). Last thing to mention is that online assessment in the hybrid courses should not measure solely theoretical knowledge but also skills and abilities.

7. *Print materials should be provided.* Books, hardcopy reading materials should be supplied to students. Most of the student in the current study indicated that the web-site of the course was their primary source of learning materials, but most of them preferred to print out the materials on the content web-pages. They criticized the absence of printer friendly version of the content. They claimed that it was hard to read the content from the computer screen. Providing students with additional materials could enhance students understanding in the hybrid course.

8. *In technical courses students previous knowledge should be considered.* Hybridizing of technical courses that require students to understand technical terms and abbreviations should be made with care on students' previous knowledge. Students can get overwhelmed by the content when exposed to a technical and procedural knowledge they have no background on which they can build their new knowledge. In this type of courses for the content that requires prior knowledge, students should be given an introductory section, or students' background should be considered.

5.3 Suggestions for Further Research

The current study yielded important information that can help those interested in designing, developing, implementing and evaluating hybrid courses. It is important to know that the hybrid courses have a wide spectrum in how, where, how much, who, when and why they are used. The current study investigated a hybrid course for university students, at a public university, as an elective course on "Computer Networks and Communications". Similar and/or further research on hybrid with the below stated characteristics are needed to see a more detailed picture on effectiveness of hybrid or web-assisted instruction.

Further research is needed that include;

1. Different student characteristics like grade level, background, and learning styles.
2. Similar settings with more multimedia components in the course web-site.
3. Similar setting with more synchronous and asynchronous online communication tools integrated to the course web-site.
4. Similar settings with non-technical content.
5. Web-component designed and developed by professional teams instead of faculty members.

6. Students with prior knowledge of course content.
7. Web-component with integrated professional Learning Management Systems.
8. With additional control variables like age, learning style and gender.
9. With longer face to face and web-site access durations.
10. With more than one course, with a hybrid curriculum.
11. With other measuring instruments than achievement test, attitudes scale and course satisfaction form used in the current study. With more constructivist assessment tools like portfolios.
12. With different hybrid course design, including more authentic learning activities like laboratories, field trips, case studies.

With the help of the finding of the current study and the addition of the finding from further research on hybrid courses, the successful integration of information technologies to the educational system can be achieved.

REFERENCES

Achacoso, M. (2003). *Evaluating Technology and Instruction: Literature Review and Recommendations*, The University of Texas Austin. Division of Instructional Innovation and Assessment. Retrieved February 20, 2004, from, http://www.utexas.edu/academic/mec/LiteratureReview.pdf

Alden, B. S. (2000). Effective Programs for Training Teachers On the Use of Technology, *Computer Learning*. Retrieved February 25, 2004, from, http://www.computerlearning.org/articles/Training.htm .

Alessi, S. M. and Trollip, S. R. (2001). *Multimedia for Learning: Methods and Development*. 3rd Ed. Allyn & Bacon, A Pearson Education Co., Needham Heights, Mass.

Alexander, S. (1995). Teaching and learning on the World Wide Web. *Proceedings AusWeb95*. Retrieved June 6, 2002, http://ausweb.scu.edu.au/aw95/education2/alexander/

American Council of Education, *Guiding Principles for Distance Education in a Learning Society, 1996*. Retrieved June 16, 2004, http://www.ihets.org/progserv/education/distance/guiding_principles

Bandura, A. (1975). *Social Learning & Personality Development*. Holt, Rinehart & Winston, INC: NJ

Baker College. (2004). *Web-Enhanced Delivery*. Retrieved March 15, 2004, from, http://www.baker.edu/departments/instructech/webenhanced.html

Barbian, J. (2002). Blended Works: Here's Proof. *Online Learning Magazine*. Retrieved March 16, 2004, from, http://www.onlinelearningmag.com/onlinelearning/magazine/article_display.jsp?vnu_content_id=1526767.

Barkley, S., & Bianco, T. (2002). Part digital training, part human touch. *Journal of Staff Development*, 23(1), 42-45.

Barry, M. R., G. (1995). A review of distance-learning studies in the U.S. Military. *The American Journal of Distance Education* 9(3): 37-47.

Berge, Z.L. (2000). New roles for learners and teachers in online higher education. In G. Hart (Ed.). *Readings & resources in global online education*. Australia: Whirligig Press. pp.: 3-9. Retrieved February 16, 2002, from, http://www.globaled.com/articles/BergeZane2000.pdf

Bednar, A. K., Cunningham, D. Duffy, T. M. & Perry, J. D. (1998). Theory into practice: How do we link? In T. M Duffy and D. H. Jonassen (Eds.) *Constructivism and technology of instruction: A conversation*, Hillsdale, NJ: Lawrence Erlbaum Associates, 17-35.

Bell, M. and Lefoe, G. (1998) Curriculum Design for Flexible Delivery – Massaging the Model, *Conference Proceedings ASCILITE'98*, Wollongong, Australia.

Black, G. (2002). A comparison of traditional, online, and hybrid methods of course delivery. *Journal of Business Administration Online*,1(1). Retrieved February 16, 2004, from, http://jbao.atu.edu/old/Journals/black.htm

Bloom, B. S. (1956). *Taxonomy of Educational Objectives: The Classification of Educational Goals. Handbook I: Cognitive Domain.* New York: Longmans, Green.

Brannan, T. A. (2002). *Learner Interactivity in Higher Education: Comparing Face-to-Face, Hybrid and Online Instruction.* Dissertation Abstract International (Umi No. 3074977)

Brown, A. (1997, April). Transforming schools into communities of thinking and learning about serious matters. *American Psychologist*, 54 (4), 399-413.

Brown, B. L. (1998). *Distance Education and Web-Based Training.* ERIC Clearinghouse on Adult, Career, and Vocational Education, Center on Education and Training for Employment, The Ohio State University. Retrieved June 10, 2002, from, http://ericacve.org/mp_brown_02.asp

Brown, G., and Wack, M. (1999). The Difference Frenzy and Matching Buckshot with Buckshot. Retrieved June 10, 2002, from, horizon.unc.edu/ts/reading/1999-05.asp

Boettcher J. V. (1999), Faculty Guide for Moving, Teaching and Learning to The Web, *League for Innovation in the Community College*, 1999 Retrieved June 11, 2002, from, http://www.aln.org/resources/reviews/pdf/review13.pdf

Bonk, C. J. & Reynolds, T. H. (1997). Learner-Centered Web Instruction for Higher-Order Thinking, Teamwork and Apprenticeship. In Khan, B, H. (Ed), *Web Based Instruction* (pp 167-178) Englewood Cliffs: Educational Technology Publications.

Bostock, S. J. (1997). Designing Web-Based Instruction for Active Learning. In Khan, B, H. (Ed), *Web-Based Instruction* (pp 225-230) Englewood Cliffs: Educational Technology Publications

Caladine, R.. (1999). *Teaching for Flexible Learning.* Abergavenny Monmouthshire: GSSE

Cantelon, John E. (Fall, 1995). The evolution and advantages of distance education. In Rossman, Mark H. and Rossman Maxine E. (Editors). *Facilitating Distance Education*. San Francisco, CA: Jossey-Bass Publishers.

Carman, Jared M. (2002). *Blended Learning Design: Five Key Ingredients.* KnowledgeNet. Retrieved March 25, 2004 from, http://www.knowledgenet.com/pdf/Blended%20Learning%20Design_1028.PDF

Carswell, L. (1997) Teaching Via the Internet: The Impact of the Internet as a Communication Medium on Distance Learning Introductory Computing Students, In the *Proceedings of the Conference of Integrating Technology into Computer Science Education*, June, 1997, Uppsala, Sweden, pp. 1-5. Retrieved March 17, 2002 from, http://portal.acm.org/citation.cfm?id=268821&dl=ACM&coll=portal

Clarebout, G., Elen, J., Johnson, W. L., & Shaw, E. (2002). Animated pedagogical agents: An opportunity to be grasped. *Journal of Educational Multimedia and Hypermedia*, *11*(3), 267-286.

Clark, R.E. (1983). Reconsidering research on learning from media. *Review of Educational Research, 54*(4), 445-459.

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

Clark, R.C. (2002,). The New ISD: Applying Cognitive Strategies to Instructional Design. *ISPI Performance Improvement Journal, 41*(7). Retrieved from http://www.clarktraining.com/CogStrat.pdf.

Christmann, E., & Badgett, J. (1999). A comparative analysis of the effects of computer-assisted instruction on student achievement in differing science and demographical areas. *Journals of Computers in Mathematics and Science Teaching, 18*, 135-143

Christmann, E. P., Lucking, R. A., & Badgett, J. L. (1997). The effectiveness of computer-assisted instruction on the academic achievement of secondary students: A meta-analytic comparison between urban, suburban, and rural educational settings. *Computers in the Schools*, 13(3/4), 31-40.

Cho, S.K. & Berge, Z.L. (2002). Overcoming Barriers to Distance Training and Education. Education at a Distance [USDLA Journal] (16)1. Retrieved February 8, 2002 from, http://www.usdla.org/html/journal/JAN02_Issue/article01.html

Comunale, C. L., Sexton, T. R., & Voss, D. J. P. (2002). The effectiveness of courseWeb sites in higher education: an exploratory study. *Journal of EducationalTechnology Systems, 30*(2), 171-190.

Crossman. DM (1996) The evolution of the World Wide Web as an emerging instructional technology tool. In Khan, B, H. (Ed), *Web-Based Instruction* (pp 19-23) Englewood Cliffs: Educational Technology Publications

Davidson, K. (1998). Education in the Internet-linking theory to reality, Retrieved June 20, 2002, from http://www.oise.on.ca/~kdavidson/cons.html

Dalgarno, B. (1998) Choosing learner activities for specific learning outcomes: A tool for constructivist computer assisted learning design. In C. McBeath and R. Atkinson (eds), *Planning for Progress, Partnership and Profit.* Proceedings EdTech'98. Perth: Australian Society for Educational Technology. Retrieved March 15, 2003, form, http://cleo.murdoch.edu.au/gen/aset/confs/edtech98/pubs/articles/abcd/dalgarno.html

Dewey, J. (1933). *How we think: a restatement of the relationship of reflective thinking to the educative process.* Lexington, MA: D.C. Heath and Company.

Dick, W. (1995) Instructional Design and Creativity: A Response to the Critics. *Educational Technology, 35* (4), pp. 5-11.

Draves, William A. (1999). How the Internet will change how we learn. *Distance Learning '99 Conference Proceedings*, Madison, WI.

Driver, M. (2002). Exploring Students' Perceptions of Group Interaction and Class Satisfaction in the Web-enhanced Classroom. *Internet and Higher Education. 5*, 35-45.

Duchastel, P. (1997). A Motivational Framework for Web-Based Instruction. In Khan, B, H. (Ed), *Web-Based Instruction* (pp 179-184) Englewood Cliffs: Educational Technology Publications

Edelson, D. C., Pea, R. D., & Gomez, L. (1996). Constructivism in the collaboratory. In B. G. Wilson (Ed.), *Constructivist learning environments: Case studies in instructional design* (pp. 151-164). Englewood Cliffs, NJ: Educational Technology Publications.

Ehrmann, S. C. (1999). Technology in higher learning: A third revolution. Retrieved March 25, 2001, from, http://www.tltgroup.org/resources/dthirdrev.html.

Ellis, A. & Phelps, R. (2000). Staff development for online delivery: A collaborative, team based action learning model. *Australian Journal of Educational Technology, 16*(1), 26-44. Retrieved October, 28, 2003, from, http://cleo.murdoch.edu.au/ajet/ajet16/ellis.html

Ertmer, P.A., & Newby, T.J., (1993). Behaviorism, cognitivism, constructivism: Comparing critical features from an instructional design perspective. *Performance Improvement Quarterly, 6*(4), 50-72.

Ersoy, H. (2003). *Blending Online Instruction with Traditional in the Programming Language Course: A Case Study.* Unpublished Master's Thesis, Middle East Technical University. Turkey

Flavell, J. H. (1979). Metacognition and cognitive monitoring: A new area of psychological inquiry. *American Psychologist, 34*, 906-911.

Gardner, H. (1999). *The disciplined mind: what all students should understand.* New York, NY: Simon and Schuster.

Garnham, C. and Kaleta, R. (2002). Introduction to Hybrid Courses. *Teaching with Technology Today, 8* (6). Retrieved October 26, 2003, from, http://www.uwsa.edu/ttt/articles/garnham.htm

Gray, L. (1999) Preparing Principals and Superintendents - Students and the instructor in struggle to balance the traditional classroom approach and a Web-delivered approach. Retrieved March 15, 2002, from, http://naweb.unb.ca/99/proceedings/graylee/

Gunter, G.A., 2001. Making A Difference: Using Emerging Technologies and Teaching Strategies to Restructure an Undergraduate Technology Course for Pre-service Teachers. *Educational Media International, 38* (1), pp. 13-20.

Gülbahar, Y. (2002). Assessment of Web-Based Courses: A Discussion and Analysis of Learners' Individiual Differences and Teaching-Learning Process. Unpublished Doctoral Thesis, Middle East Technical University. Turkey

Hall, R.H., Watkins, S.E., Davis, R., Belarbi, A., & Chandrashekhara, K. (2001). Design and assessment of web-based learning environments: The smart engineering project and the instructional software development center at U.M.R. in L.R.Vandervert, L.V. Shavinina, & R.A. Cornell (Eds.) Cybereducation: *The future of long distance learning.* (pp. 137 – 156). New York: Mary Ann Liebert, Inc. Publishers. Retrieved March 16, 2002, from http://campus.umr.edu/lite/publications/cybered_chapter_design_hall_2001.pdf

Hannafin, M., Land, S. & Oliver, K. (1999). Open learning environments: Foundations, methods, and models. In C. M. Reigeluth (Ed.), *Instructional design theories and models: A new paradigm of instructional theory (Vol. II)*, New Jersey: Lawrence Erlbaum Associates, (pp. 115-142).

Harasim, L., Hiltz, S.R., Teles, L., and Turoff, M. (1995). *Learning Networks: A Field Guide to Teaching and Learning Online*. Cambridge, MA: MIT Press.

Hannum, W. (2001): Web-based traigning: advantages and limitations. In Khan, B, H. (Ed), *Web-Based Instruction* (pp 47-58) Englewood Cliffs: Educational Technology Publications

Heller-Ross, H. 1996. Librarian and faculty partnerships for distance education. MC Journal. *The Journal of Academic Media Librarianship 41* (1): 1–8. Retrieved March 16, 2002, from, http://wings.buffalo.edu/publications/mcjrnl/v4n1/platt

Hill, J. R. Distance Learning Environments Via the World Wide Web. In B. H. Khan (Ed.), *Web-Based Instruction* (Englewood Cliffs, NJ: Educational Technology Publications, 1997) (pp. 75-80).

Iiyoshi, T. (1999). *Cognitive processing using cognitive tools in open-ended hypermedia learning environments: A case study.* Unpublished doctoral dissertation. Florida State University.

Inman, Elliott; Kerwin, Michael; Mayes, Larry. (1999). Instructor and student attitudes toward distance learning. *Community College Journal of Research and Practice. 23*: 581-591

İnan, F.A. (2003). *A design and development of an online learning support system for pre-service teachers: A discussion of attitudes and utilization.* Unpublished Master's Thesis, Middle East Technical University. Turkey

Jacob, S .H. (1984). *Foundations for Piagetian education*. Landham, MD: University Press of America.

Jonassen, D.H., Campbell, J.P., and Davidson, M.E. (1994). Learning with media: Restructuring the debate. *Educational Technology Research and Development, 42*(2), 31-39.

Jonassen, D. H. (1996). *Computers in the classroom: Mindtools for critical thinking.* Englewood Cliffs, NJ: Prentice-Hall

Jonassen, D. H., & Reeves, T. C. (1996). Learning with technology: Using computers as cognitive tools. In D. H. Jonassen (Ed.), *Handbook of research for educational communications and technology* (pp. 693-719). New York: Macmillan

Jonassen, D. H. (1999). Designing consructivist learning environments. In C. M. Reigeluth (Ed.) *Instructional design theories and models: A new paradigm of instructional theory (Vol. II)*, New Jersey: Lawrence Erlbaum Associates, (pp. 215-239).

Jonassen, D. H. (2000). *Computers as Mindtools for schools: Engaging critical thinking. Second Edition.* NJ: Merrill

Jones, V. and Jo. J. H. (1998) *Interactive multimedia based on learning theories to enhance tertiary education.* Conference Proceedings ICCIMA'98, Australia.

Jones, V. and Jo, J.H. (1999) The Evaluation of Student Performance and Perception in Web-based Instruction in Regard to Age and Gender. *Conference Proceedings ASCILITE'99*, Brisbane, Australia. Retrieved from, http://www.ascilite.org.au/conferences/brisbane99/papers/jonesjo.pdf

Jones, V., Cranitch, G. and Jo, J.H. (2001) HyWeb: A Hybrid-Web System for Delivery and Enhancement of Web-Based and Traditional Teaching.*Conference Proceedings AusWeb 01*, 7th Australian World Wide Web Conference, Coffs Harbour, Australia, April 2001. Retrieved May 20, 2003, from, http://ausweb.scu.edu.au/aw01/papers/refereed/jones/

Kerka, S. (1996). *Distance Learning, the Internet and the World Wide Web.* ERIC Digest (ED295214). ERIC Clearinghouse on Adult, Career, and Vocational Education, Columbus, OH.

King, P. and D. Hildreth. 2001. Internet Courses: Are They Worth the Effort. *Journal of College Science Teaching. 31*(2);112-115.

Klemm, W. R. (1998), Eight Ways to Get Students More Engaged in Online Conferences. *T.H.E. Journal, 26*, (1), 62-64 Retrieved June 12, 2000, from http://www.thejournal.com/magazine/vault/A1997.cfm

Kowalski, J. 1998, *The Benefits of Information Technology*. ERIC Digest, August , ERIC Clearinghouse on Information and Technology, Syracuse University. Retrieved June 12 2002, from http://ericir.syr.edu/ithome/digests/edoir9804.html

Kozma, R.B. (1994). Will media influence learning? Reframing the debate. *Educational Technology Research and Development, 42*(2), 7-19.

Land, S. M., & Hannafin, M. J. (2000). Student-centered learning environments. In D. Jonassen & S. M. Land (Eds.), *Theoretical foundations of learning environments* (pp. 1-23). Mahwah, NJ: Lawrence Erlbaum Associates.

Landau, V. (2002) *Developing an Effective Online Course*, McGraw-Hill. Retrieved March 15, 2004 from, http://www.roundworldmedia.com/cvc/print10_25.pdf

León de la Barra, G.E., León de la Barra, M.B. & Urbina, A.M. (1999) On Special "Hybrid" Courses in Mathematics. *Proceedings of Frontier in Education Conference*, San Juan, Puerto Rico. Retrieved on March 20, 2002 from, www.ifip.or.at/con2000/iceut2000/iceut06-04.pdf

Lewis, L., Snow, K., Farris, E., & Westat. (1999). *Distance Education at Postsecondary Institutions: 1997-1998*. National Center for Education Statistics. Retrieved March 15, 2002, from http://nces.ed.gov/pubs2000/2000013.pdf.

Lee, J. & Park, O. (2003). Adaptive Instructional Systems. *Handbook of Research for Educational Communications and Technology* (pp. 651-660). Retrieved on March, 25, 2003 from, http://coe.sdsu.edu/eet/Articles/cmi/Park,%202003.pdf

Lilja, D.J. (2001). Comparing Instructional Delivery Methods for Teaching Computer Systems Performance Analysis. *IEEE Transactions on Education, 44*(1, 35-40.

Maddux, C. D., & Cummings, R. (2000). Developing web pages as supplements to traditional courses. In B. Abbey (Ed.), *Instructional and cognitive impacts of web-based education*, (pp. 147-155) . Hershey, PA: Idea Group Publishing.

Matejka, D. and Maguire, M. (2001). A responsive conceptual framework for effective on-line delivery. In L. Richardson and J. Lidstone (Eds), *Flexible Learning for a Flexible Society*, (pp. 493-505). Proceedings of ASET-HERDSA 2000 Conference, Toowoomba, Qld, 2-5 July 2000. ASET and HERDSA. Retrieved March, 26, 2003 from, http://www.aset.org.au/confs/aset-herdsa2000/procs/matejka.html

Marchionini, G. (1988). Hypermedia and learning: Freedom and chaos. *Educational Technology, 28*(11), 8-12.

Marques, O., Woodbury, J., Hsu, S., Charitos, S., (1998). Design and Development of a Hybrid Instruction Model for a New Teaching Paradigm. *Proceedings of Frontier in Education Conference*, November 1998, Tempe, Arizona Retrieved on March 20, 2002 from, http://fie.engrng.pitt.edu/fie98/papers/1229.pdf

Mayer, R. H. (1999). Designing instruction for constructivist learning. In C. M. Reigeluth (ed.), *Instructional design theories and models: A new paradigm of instructional theory (vol. II)*. Mahwah, NJ: Lawrence Erlbaum Associates.

McMahon, M. (1997) Social Constructivism and the World Wide Web – A Paradigm for Learning, *Proceedings of ASCILITE'97*, Perth, Australia.

McManus, T. F. (1996). Delivering Instruction on the World Wide Web. In Litchfield, A. (Ed.) *Teaching and Learning*. Retrieved June, 20, 2003 from, http://www.pdc.unsw.edu.au/interests/ets/ets.teaching.learning.html

Merrill, M.D. (1994). *Instructional Design Theory*. Englewood Cliffs, New Jersey: Educational Technology Publications.

Miles, M. B. & Huberman, A. M. (1994). *Qualitative Data Analysis: An expended source book*. Thousand Oaks: Sage Publications.

Miller, S. M. and Miller, K. L. (1999). Using instructional theory to facilitate communications in web-based courses. *Educational Technology and Society, 2*(3). Retrieved March 20, 2002, from, http://ifets.ieee.org/periodical/vol_3_99/miller.html

Montgomery, S. M. (1995) Addressing diverse learning styles through the use of multimedia, Retrieved March 20, 2002 from, http://FrE.www.ecn.purdue.edu/FrE/asee/fie95/3a2/3a22/3a22.htm

Moore, Michael G. and Kearsley, Greg. (1996). *Distance Education: A Systems View*. Belmont, California: Wadsworth Publishing Company.

Moreno, R. & Mayer, R. E. (1999). Cognitive principles of multimedia learning: The role of modality and contiguity effects. *Journal of Educational Psychology, 91*, 1-11.

Murphy, P. (2003). *The hybrid strategy: Blending face-to-face with virtual instruction to improve large section courses*. University of California Regents. Teaching, Learning, and Technology Center. Retrieved March 30, 2004, from http://www.uctltc.org/news/2002/12/feature_print.html

Oliver, R., Herrington, J. & Omari, A. (1996). Creating Effective Instructional Materials for the World Wide Web, In R. Debreceny & A. Ellis (Eds) *Proceedings of AusWeb 96: The Second Australian World Wide Web Conference*, (pp 485-492). Lismore, NSW: Southern Cross University Press. Retrieved from, http://elrond.scam.ecu.edu.au/oliver/docs/96/AUSWEB1d.pdf

Oren, T. (1990). Cognitive load in Hypermedia: Designing for the exploratory learner. In S. Ambron & K. Hooper (Eds.), *Learning with Interactive Multimedia: Developing and Using Multimedia Tools in Education*. Redmond, WA: Microsoft.

Oytun, E. (2003). *Learners' Perceptions of A Web Enhanced Course*. Unpublished Master's Thesis, Middle East Technical University. Turkey

Özçelik, E. (2002). *The Use of Cognitive Tools In Web-Based Learning Environments: A Case Study*. Unpublished Master's Thesis, Middle East Technical University. Turkey

Parrot, S. (1995). Future Learning: Distance Education in Community Colleges, Eric Digest. JC-95-02.

Passerini, K. & Granger, M.J. (2000). A developmental model for distance learning using the Internet. *Computers & Education, 34*, 1-15

Pea, R.D. (1985). Beyond amplification: using the computer to reorganize mental functioning. *Educational Psychologist 20* (4), 167-82

Pernici, B. and Casati, F. (1997). The Design of Distance Education Applications on the World Wide Web. In Khan, B, H. (Ed), *Web-Based Instruction* (pp 245-254) Englewood Cliffs: Educational Technology Publications.

Persin R. (2002). Web-assisted Instruction in Physics: An Enhancement to Block Scheduling. *American Secondary Education 30*(3) 2002.

Phipps, R., and Merisotis, J. (1999). *What's the Difference? A Review of Contemporary Research on the Effectiveness of Distance Learning in Higher Education*. Institute for Higher Education Policy. Retrieved March 15, 2002, from the World Wide Web: http://www.ihep.org.

Pilgrim C. J., and Creek M. J. (1997) On-line Education - A University Strategy, *Proceedings of ASCILITE'97*, Perth, Australia. Retrieved March 15, 2002 form http://www.curtin.edu.au/conference/ASCILITE97/papers/Ring/ Ring.html

Rahkila, M. and Karjalainen M. (1999). *Evaluation of Learning in Computer Based Education Using Log Systems*. 29th ASEE/IEEE Frontiers in Education Conference Retrieved March 15, 2002, from http://fie.engrng.pitt.edu/fie99/papers/1232.pdf

Reigeluth, C., (1999). *Instructional-Design Theories and Models, Volume II. A New Paradigm of Instructional Theory.* Mahwah, New Jersey and London, Lawrence Erlbaum.

Relan A., Gillina, B.B. (1997). Effective dimensions of interactive learning on the world wide Web. In Kahn, B. H. (Ed.), *Web-Based Instruction* (pp. 59-65), Englewood Cliffs: NJ, Educational Technology Publications.

Russell, T.L. (1999). *The no significant difference phenomenon.* Chapel Hill, Office of Instructional Telecommunications, North Carolina State University. Retrieved March 20, 2002, from, http://teleeducation.nb.ca/nosignificantdifference.html

Reeves, T. C. and Reeves, P. M. (1997). Effective dimensions of interactive learning on the world wide Web. In Kahn, B. H. (Ed.), *Web-Based Instruction* (pp. 59-65), Englewood Cliffs: NJ, Educational Technology Publications.

Romiszowski, A.J. (1997). Web-based distance learning and teaching: Revolutionary invention or reaction to necessity. In B.H. Khan (ed.), *Web-Based Instruction*. Englewood Cliffs, NJ: Educational Technology Publications.

Romiszowski, A. J., & Mason, R. (1997). Computer-mediated communication. In D. Jonassen (Ed.), *Handbook of Research for Educational Communications and Technology* (pp. 438-456). New York: Scholastic Press.

Romiszowski, A. J., & Mason, R. (2001). Research on Computer Mediated Communication. Chapter for D.Jonassen (Ed.). *Handbook of Research on Educational Communication and Technology*. New York: Macmillan.

Rowland, G. (1995). Instructional Design and Creativity: A Response to the Criticized. *Educational Technology, 35* (5), 17-22.

Schrage, M. (1991). *Shared minds: The new technologies of collaboration.* New York, NY: Random House.

Skinner, B.F. (1968). *The Technology of Teaching.* New York: Appleton-Century-Crofts.

Saba, F. (1997). *Introduction to Distance Education in Defining Concepts in Distance Education*. Magna Publications, Inc., Madison, WI.

Saba, F, Ed. (August, 1999). *Distance Education Report*, 3 (8).

Sanders, D. W. & Morrison-Shetlar, A. I. (2001). Student attitudes toward Web-enhanced instruction in an introductory biology course. *Journal of Research on Computing in Education, Vol. 33* Issue 3I, 251-263. Retrieved from, http://www.iste.org/jrte/33/3/abstracts/sanders.cfm

Sands, P. (2002) *Inside Outside, Upside Downside: Strategies for Connecting Online and Face-to-Face Instruction in Hybrid Courses.* Teaching with Technology Today. University of Wisconsin-Milwaukee. 8.6. Retrieved July 20, 2003, from http://www.uwsa.edu/ttt/articles/sands2.htm

Sankaran, S., & Bui, T. (2001). Impact of learning strategies and motivation on performance: A study in web-based instruction. *Journal of Instructional Psychology, 28*(3), p. 191.

Simpson, O. (2000) *Supporting Students in Open and Distance Learning*. London, Kogan Page.

Truel, A. T. (2001). Student Attitudes toward and evaluation of Internet-assisted Inatruction. *Delta Phi Epsilon Journal, 43*(1), 40-49.

Tuckman, B. W. (2002). Evaluating ADAPT: A hybrid instructional model combining web-based and classroom concepts. *Computers & Education, 39*, 261-269. Retrived May 20, 2003, from, http://all.successcenter.ohio-state.edu/references/evaluating_ADAPT.htm

University of Illinois (1999), *Teaching at an internet distance: the pedagogy of online teaching and learning, report of a 1998–1999*. University of Illinois faculty seminar. Retrieved from, http://www.vpaa.uillinois.edu/reports_retreats/tid.asp

Updegrove, K. (1995) *Teaching on the Internet*. Retrieved March 16, 2002, from, http://dolphin.upenn.edu/~kimu/teaching.htm

Vrasidas, C., & McIsaac, M. S. (1999). Factors influencing interaction in an online course. *American Journal of Distance Education, 13* (3), 22-36.

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes.* Cambridge, MA.: Harvard University Press.

Weiner, B. (1990). History of motivational research in education. *Journal of Educational Psychology, 82*(4), 616-622.

Welsh, T. M. & Reeves, P. M. (1997). An Event-Oriented Model for Web-Based Instruction. In Khan, B, H. (Ed), *Web-Based Instruction* (pp 159-166) Englewood Cliffs: Educational Technology Publications.

Wild, M. and Omari, A. (1996) A working model for designing learning environments. *Conference Proceedings AusWeb96*, Australia.

Willis, Barry. (1993). *Distance Education: A Practical Guide*. Educational Technology Publications. Englewood Cliffs, NJ.

Yıldırım, Z. (1999), *Comparison of Hypermedia and traditional Instruction in terms of Their effect on Declarative, Conditional and Procedural Knowledge Acquisition, Retention and Attitudes*. Unpublished Doctoral Thesis, Middle East Technical University. Turkey

APPENDIX A

CEIT 314 Computer Networks & Communications Syllabus

Course Information
The course introduces the underlying concepts and principles of computer networks. It presents the different components of a network and how these components fit together. The course emphasizes the design and implementation of network software that transforms raw hardware into a richly functional communication system. Real net works (such as the Internet, ATM, Ethernet, Token Ring) will be used as examples to reinforce the concepts and demonstrate various protocols.

Catalogue Description
CEIT 314: Computer Networks & Communications (2-2) Getting familiar with TCP/IP and OSI Reference Models. Understanding routing and internetworking as a fundamental requirement for working on and with networks and internet. Packet flow through internet, packet switched technologies, and protocol data units across the layers of OSI reference model is the focus of this course. The functions of routers in different WAN technologies, the protocols governing the rules of data flow through WANs will be examined.

Course Goals
At the end of the course the students will be able to; • Define the basic concepts of computer and communication networks. • Describe how computer networks work. • Define concepts for Token Ring, FDDI, Ethernet family Networks and Internet. • Solve simple problems of their future networks without needing any outside help • Describe and define the OSI layers and the TCP/IP protocol suite. • Differentiate between the functions and operations of networking devices required to build a Local Area Network. • Describe networking signals and what can happen to them on physical media. • Design physical and logical networking topologies. • Plan and draw structured cabling for network installation. • Classify the various types of IP addresses. • Define the Upper Layer Protocols of the OSI Layers.

Course Outline
1. **Computing Basics** a. Hardware, software, network settings b. Binary math c. Units of information and bandwidth 2. **The OSI Model** a. OSI Layers

b. TCP/IP

3. **Local Area Networks (LANs)**
    a. Networking signals and Encapsulation
    b. LAN Devices
4. **Layer 1; Media, Connections, Collisions**
    a. Resistance, voltage, and continuity
    b. Basic networking media
5. **Layer 2; Concepts and Technologies**
    a. LAN Technologies
    b. Ethernet, Token Ring, FDDI
    c. Elements of a Frame
6. **Design, Documentation and Structured cabling**
    a. Hexadecimal math
    b. MDFs and IDFs in Ethernet
    c. Structured cabling installation
    d. Install, terminate, test, and troubleshoot CAT 5 UTP cabling runs
7. **TCP/IP; IP Addressing**
    a. Various types of IP addresses
    b. Creating subnets
8. **Layer 3; Routing and Addressing**
    a. Packet diagrams
    b. Routing basics
9. **Protocols**
    a. Routing Protocols
    b. Distance Vector Routing, RIP
10. **Layers 4, 5; Transport and Session**
    a. IP, TCP, and UDP
    b. TCP Port Numbers
11. **Layers 6, 7 Presentation and Application**
    a. Formatting, encryption, and compression
12. **Troubleshooting Network Problems**

Textbook
• "Computer Networks A Top-Down Approach Featuring the Internet" by James F. Kurose, Keith W. Ross, Addison Wesley, 2001, ISBN: 0-201-47711-4 • "Computer Networks" by Andrew S. Tanenbaum, Third Edition, Prentice Hall, 1996, ISBN: 0-13-394248-1 • "Cisco Networking Academy Program: First-Year Companion Guide" by Cisco Systems, Inc., Revised Printing, Cisco Press, ISBN: 0-58713-003-3

Reference Books
• Local Area Networks: A Client/Server Approach. John Wiley & Sons, Inc., ISBN: 0-471-14162-3 • Local Area Networks, by David A. Stampler, Second Ed.Addison Wesley, 1998, ISBN 0-8053-7729-8 • Stallings, W., "Data and Computer Communications", 4th Ed., Prentice Hall International Ed., 1994, ISBN 0-13-326828-4 • Data Communications, Computer Networks and Open Systems, Fred Halsall, Addison-Wesley, 1992 (Third Edition)

Evaluation and Grading	Percentage %
Midterms	2*15
Final	1*30
Attendance / Participation	10
Labs and Homework	20
Quiz	10

APPENDIX B

ACHIEVEMENT TEST

Name Surname:
Student No:

Direction: This multiple choice test is developed to measure your knowledge in "Computer Networks and Communication". Read the questions carefully, encircle the correct choice letter. Please check only one choice for each question.

1. What is the decimal number 151 in binary?

A. 10010110 B. 10010111 C. 10101011 D. 10010011

2. Which factor reduces throughput?

A. increased number of users B. decreased number of users

C. increased size of hard drive D. decreased size of hard drive

3. Which of the following best defines an object on a web page that, when clicked, transfers you to a new web page?

A. network redirector B. hyperlink C. web browser D. ASCII

4. What is an example of an application that requires both a client and server component in order to function?

A. web browser B. Microsoft Word C. ASCII D. PICT

5. What is the function of the session layer?

A. concerned with data structures and the negotiation of data transfer syntax

B. provides reliable transit of data across the physical layer

C. provides connectivity and path selection between two end systems

D. manages data exchange between presentation layer entities

6. Which best describes the function of the presentation layer?

A. responsible for reliable network communication between end nodes

B. concerned with data structures and negotiation data transfer syntax

C. provides connectivity and path selection between two end systems

D. manages data exchange between layer entities

7. Which process does the OSI model describe?

A. how to protect networks from unwanted intrusions such as hackers and viruses

B. how a network uses transmission devices provided by common carriers to create a steady and reproducible signal

C. how information or data moves from one computer through a network to another computer

D. how to maintain physical and software links between networks

8. Which protocol is designed to download or upload files on the Internet?

A. SNMP B. Telnet C. FTP D. HTTP

9. When creating a network from just two PCs, what kind of cable would be used to directly connect them?

A. fiber optic cable B. standard UTP cable

C. UTP rollover cable D. UTP crossover cable

10. If 4 hosts are connected to a hub how many IP addresses are required for these 5 devices?

One B. two C. four D. five

11. What is another name for a multi-port repeater?

A. Bridge B. Host C. Hub D. sequencer

12. At which layer of the OSI model is the NIC located?

A. Layer 2 B. Layer 3 C. Layer 4 D. Layer 5

13. In electrical terms, what does AC mean?

A. alternating current B. attenuating current

C. amplitude current D. amplified current

14. What is the opposition to the movement of electrons as they move through materials?

A. Current B. Resistance C. Ohms D. voltage

15. What is the primary cause of crosstalk?

A. cable wires that are too large in diameter B. too much noise in a cable's data signal

C. electrical motors and lighting D. electrical noise from other wires in a cable

16. Which term describes the conversion of binary data into a form that can travel on a physical communications link?

A. Encoding B. decoding C. encrypting D. decrypting

17. What is the unit of measure for resistance?

A. Volt B. ohm C. amp D. joule

18. Which is a characteristic of a collision domain?

A. all computers on a single shared access media

B. all computers sharing a single IP address

C. all computers sharing a single MAC address

D. all computers within a WAN

19. What is the term used for separating collision domains with bridges, switches, and routers?

A. switching domains B. extending domains

C. segmentation D. fragmentation

20. Which best describes an extended star topology?

A. LAN topology in which each of the end nodes of the core topology are acting as the center of its own star topology

B. LAN topology in which transmissions from network stations propagate the length of a single coaxial cable and are received by all other stations

C. LAN topology in which end points on a network are connected to a common central switch by point-to-point links

D. LAN topology where central points on a network are connected to a common central switch by linear links

21. What is one advantage of using fiber optic cabling in networks?

A. Cheap

B. easy to install

C. not susceptible to electromagnetic interference

D. it is available either with or without an outer shield

22. Convert the decimal number 127 to Hex.

A. 2B B. 7F C. EF D. 1A

23. What is the decimal value of the hex number ABE?

A. 2750 B. 5027 C. 2570 D. 7250

24. What is the Organizational Unique Identifier (OUI)?

A. all hex digits of a MAC address

B. the 1st 6 hex digits of a MAC address

C. the last 6 hex digits of a MAC address

D. the prefix to all network device model numbers

25. Which organization's LAN standards include 802.3 and 802.5?

A. EIA. B. IEEE. C. TIA. D. UL.

26. What is a function of a MAC address?

A. provides a unique identity scheme

B. provides a hierarchical addressing

C. provides a collision free domain

D. provides increased network stability

27. Which fiber mode characteristic is recommended for inter-building connectivity?

A. single-mode B. multi-mode C. intra-mode D. inter-mode

28. What can be done if the area of the LAN is more than 200 meters in diameter?

A. a repeater could be installed to extend the network

B. another server could be used to extend the network

C. special NICs can be purchased to extend the network

D. all of the above

29. What device addresses the problem of too much traffic on a network by dividing the network into segments and filtering traffic based on the MAC address?

A. Bridge B. port C. hub D. transceiver

30. Which of the following statements are true of routers?

A. They are passive.

B. They operate only at the data link layer.

C. They base forwarding decisions on Layer 2 addresses.

D. They base forwarding decisions on Layer 3 protocol addresses.

31. What device builds a MAC address table?

A. passive hub B. bridge C. active hub D. transceiver

32. Which type of networking media is now installed most often for backbone cabling?

A. 100 ohm unshielded twisted pair cable

B. 150 ohm shielded twisted pair cable

C. 62.5/125 micron fiber-optic cable

D. 50 ohm coaxial cable

33. What best describes the difference between alternating and direct current?

A. DC helps computers to work more efficiently, whereas AC can cause noise.

B. AC flows at a constant value, whereas DC rises and falls.

C. DC shifts ions from pole to pole, whereas AC ions run in one direction.

D. DC flows at a constant value, whereas AC rises and falls.

34. When running cable from the wiring closet to wall jacks, where is the cable itself labeled?

A. at each tie B. at each end C. at the jack end D. at the panel end

35. Which of the following is a source that can produce interference on UTP cable?

A. fluorescent lights B. fiber-optic cabling C. Bridges D.coaxial cabling

36. How many pins are on each of the ports of a patch panel?

A. 4 pins B. 8 pins C. 11 pins D. 45 pins

37. What should be used to mount cable to a wall?

A. tie wraps B. electrical tape C. staples D. paperclips

38. What kind of jack must be used for making a connection to a Category 5 unshielded twisted pair cable in a horizontal cabling scheme?

A. RJ-45 B. BNC C. UTP 55 D. EIA 45

39. What is decimal number 164 in binary?

A. 10100100 B. 10010010 C. 11000100 D. 10101010

40. Which of the following is the approximate number of hosts supported in a Class B unsubnetted network?

A. 254 B. 2024 C. 65 thousand D. 16 million

41. Which part of a network layer address does the router use during path determination?

A. the host address B. the router address

C. the server address D. the network address

42. Which of the following would be the decimal value of the binary IP address 11001101.11111111.10101010.11001101?

A. 205.255.170.205 B. 109.255.170.109

C. 205.127.200.205 D. 109.127.200.109

43. What is the maximum number of bits that can be borrowed from the host portion of a Class C network to create subnets?

A. 2 B. 4 C. 6 D. 8

44. In a connection-oriented system, what happens before any user data is transferred?

A. a connection is established with the recipient's local router

B. a connection is established between the sender and receiver

C. a connection is established with the sender's local router

D. the destination is not contacted before any actual data is sent

45. Which type of routing protocol is RIP?

A. distance vector B. link state C. hybrid D. spanning tree

46. What do bridges and switches use to make data forwarding decisions?

A. logical addresses B. physical addresses

C. network addresses D. IP addresses

47. Which OSI layer protocol does IP rely upon to determine whether packets have been lost and to request retransmission?

A. Application B. Presentation C. Session D. Transport

48. When sending data to a host on a different network, the source host encapsulates data so that it contains what destination address in the IP header?

A. IP address of the router B. MAC address of the router

C. MAC address of the destination device D. IP address of the destination host

49. Which simple protocol exchanges datagrams, without acknowledgements or guaranteed delivery?

A. TCP B. ASP C. TCP/IP D. UDP

50. Which ports are reserved by TCP and UDP for public applications?

A. numbers from 255 to 1023 B. numbers below 255

C. numbers above 1023 D. numbers from 0 to 1023

51. Which term refers to the amount of data that can be transmitted before receiving an acknowledgement?

A. window size B. closed connection

C. two way handshake C. expectational acknowledgement

52. Which of the following is a main function of the presentation layer?

A. dialogue control B. managing applications

C. windowing D. data compression

53. What is ASCII and EBCDIC used to format?

A. Graphics B. text C. digitized music D. video

54. What are most applications that work in a networked environment classified as?

A. file storage applications B. network redirector applications

C. client-server applications D. dialogue control applications

55. Which describes Layer 3 path determination in the OSI model?

A. enables switches to find the best path to a host

B. enables a switch to choose the next hop

C. determines how a packet is forwarded on the same subnetwork

D. enables a router to choose the next hop

56. Which IP address from network 219.129.32.0 is a broadcast address if 3 bits have been borrowed from the network portion?

A. 219.129.32.5 B. 219.129.32.63 C. 219.129.32.97 D. 219.129.32.167

57. Which protocol can find the MAC address of a computer given its IP address?

A. RARP B. DHCP C. ARP D. Proxy RARP

58. What is specified by the network number in an IP address?

A. the network to which the host belongs

B. the identity of the computer on the network

C. the node that is being addressed

D. the network broadcast identity of subnetwork

59. How many bits are in the network and subnet portion of a class B network with a subnet mask of 255.255.240.0?

A. 18 B. 19 C. 20 D. 21

60. Why is a static route the preferred method for reaching stub networks?

A. static routing requires less overhead

B. static routing requires more overhead on the network

C. this allows routers to adjust to changes in the network

D. the routes are learned automatically

APPENDIX C

ATTITUDE FORM FOR COMPUTER NETWORKS AND COMMUNICATION TOPICS

Direction: Below, you will find statements about the attitudes towards "Computer Networks and Communication Topics". For each statement put an (X) sign on the choice reflecting your opinion.

	Strongly Disagree	**Disagree**	**No Opinion**	**Agree**	**Strongly Agree**
1. I like computer network topics.	( )	( )	( )	( )	( )
2. I fear exams about computer networks.	( )	( )	( )	( )	( )
3. I like to discuss about computer networks issues.	( )	( )	( )	( )	( )
4. Information about computer networks are boring.	( )	( )	( )	( )	( )
5. Computer networks topics are helpful for cognitive development.	( )	( )	( )	( )	( )
6. Computer networks topics make me feel uncomfortable.	( )	( )	( )	( )	( )
7. There should be more classes related to computer networks.	( )	( )	( )	( )	( )
8. Computer networks topics are easy to learn.	( )	( )	( )	( )	( )
9. Computer networks topics are not likable.	( )	( )	( )	( )	( )
10. Computer networks topics do not bring about cognitive development.	( )	( )	( )	( )	( )
11. Computer networking topics have no impact on critical thinking ability.	( )	( )	( )	( )	( )
12. Computer networks topics are exciting.	( )	( )	( )	( )	( )
13. I fear computer networks topics.	( )	( )	( )	( )	( )
14. If it would be possible, I wouldn't learn about computer networks.	( )	( )	( )	( )	( )
15. I like to study for computer networks topics.	( )	( )	( )	( )	( )
16. Everyone should be familiar with computer network topics like Internet resources.	( )	( )	( )	( )	( )
17. I get bored while studying computer networks topics.	( )	( )	( )	( )	( )

18. I would like to learn advanced topics about computer networks.	( )	( )	( )	( )	( )
19. I don't even want to hear anything about computer networks.	( )	( )	( )	( )	( )
20. Computer networks topics are confusing.	( )	( )	( )	( )	( )
21. Computer networks topics should be learned by everyone.	( )	( )	( )	( )	( )
22. I don't enjoy computer networks topics.	( )	( )	( )	( )	( )
23. I'm not interested in listening to computer networks topics.	( )	( )	( )	( )	( )
24. It would be better if computer networks classes are not offered.	( )	( )	( )	( )	( )
25. Computer networks topics are amazing.	( )	( )	( )	( )	( )
26. Communicating with others over a computer network can help me to be more effective in doing my job in the future.	( )	( )	( )	( )	( )
27. I am confident about my ability to do well in courses related to computer networks.	( )	( )	( )	( )	( )
28. All university students should be required to take courses on computer networks.	( )	( )	( )	( )	( )
29. I don't think that knowledge about computer networks will be useful in my career.	( )	( )	( )	( )	( )
30. Computer networks topics are not exciting.	( )	( )	( )	( )	( )
31. Knowledge on computer networks is not required for everyday life.	( )	( )	( )	( )	( )
32. Computer network topics increase the critical thinking ability.	( )	( )	( )	( )	( )
33. The thought of using computer networks frightens me.	( )	( )	( )	( )	( )
34. I can not recognize how computer networks topics can be helpful in my future life.	( )	( )	( )	( )	( )
35. I feel comfortable about my skills to work with computer networks.	( )	( )	( )	( )	( )
36. I look forward to using computer networks to perform tasks related to my field of study.	( )	( )	( )	( )	( )
37. Computer networks can take over tedious and time consuming tasks effectively.	( )	( )	( )	( )	( )

APPENDIX D

COURSE FEEDBACK FORM

Direction: On a scale of **1 (strongly disagree)** to **5 (strongly agree**) please respond to each statement. Encircle the one that represents your idea.

1. The instructor was adequately prepared to teach this course.	1 2 3 4 5
2. Analogies and real-life experiences of the instructor added value to the course.	1 2 3 4 5
3. Presentations were clear and easy to understand.	1 2 3 4 5
4. Answers to questions were provided in a timely manner.	1 2 3 4 5
5. Participation was enhanced through effective use of questions.	1 2 3 4 5
6. The class meetings were interesting and enjoyable.	1 2 3 4 5
7. Grouping strategies were utilized effectively.	1 2 3 4 5
8. I felt comfortable approaching the instructor with questions/ideas.	1 2 3 4 5
9. The order of course topics aided my learning.	1 2 3 4 5
10. The course schedule allowed me to understand the topics.	1 2 3 4 5
11. The activities and group works helped me to understand the topics.	1 2 3 4 5
12. The assignments helped me evaluate my knowledge of the lesson.	1 2 3 4 5
14. Overall, the course materials were of high quality.	1 2 3 4 5

For the second (Hybrid Instruction) section only

13. Cognitive tools (Navigation, highlight, bookmark, etc.) aided my learning.	1 2 3 4 5
14. Overall, the course materials were of high quality.	1 2 3 4 5

OTHER COMMENTS

APPENDIX E

GÖRÜŞME SORULARI

Web Destekli Öğrenme ortamlarının etkililiğini yönelik bir araştırma yapıyorum ve CEIT314 dersi hakkındaki görüşlerini öğrenmek istiyorum. Bu görüşmede verdiğin bilgiler sadece araştırma amaçlı kullanılacak, ders notunuzu kesinlikle etkilemeyecek ve kişisel bilgileriniz de gizli tutulacaktır. Görüşme süresi yaklaşık bir saat olacak. İzninizle görüşmeyi kaydetmek istiyorum. Verdiğiniz bilgiler için şimdiden teşekkür ederim.

1. Bireysel öğrenme alışkanlıkların (kendi kendine öğrenme, bireysel çalışma, v.s.) bu dersi almanı etkiledi mi? Etkilediyse nasıl etkiledi?
(Source of Motivation, Metacognitive Support)
2. Bu dersle ilgili beklentilerin nelerdir?
- Beklentilerinin hangileri karşılandı. Karşılanmayanlar sence neden karşılanmadı.
(Source of motivation)
3. Eski bilgi ve becerilerini bu derste edindiğin bilgi ve becerilerle ilişkilendirebildin mi?
(Pedagogical Philosophy, Learning Theory, Metacognitive support)
4. Bu derste başarılı olmanı engelleyebilecek öğeler var mıydı, varsa bunlar nelerdir?
(Metacognitive Support,)
5. Ders süresince öğretim elemanı nasıl bir rol üstlendi. Öğrenci olarak senin rolün neydi?
(Teacher Role, Learning Theory)
6. Dersle ilgili bilgi ve becerileri kazanmak (öğrenmek) için neler yaptın, ne tür etkinliklere katıldın?
(Task Orientation)

7. Dersin yüz yüze (sınıf ortamında) olan bölümü içeriği öğrenmene katkıda bulundu mu? Bulunduysa nasıl anlatır mısın?

(Collaborative Learning Strategies, Learning Theory)

8. Ders için hazırlanan Web sitesi içerisinde istediğin konuya rahatça ulaşabiliyor muydun? Nasıl?

9. Öğretim elemanının hangi davranış ve yaklaşımları öğrenmeni olumlu veya olumsuz yönde etkiledi?

(Teacher Role, Metacognitive Support, Source of Motivation)

10. Dersi vermek için kullanılan Web destekli öğretim biçiminin hangi özellikleri (çalışma grupları, mesaj kutusu, ödevler, quizler, ek kaynak duyuruları) içeriği öğrenmene katkıda bulundu? Nasıl anlatır mısın?

(Structural Flexibility, Collaborative Learning Strategies, Pedagogical Philosophy, Learning theory)

- Ders saatinde yapılan çalışma gruplarının öğrenmene etkisi oldu mu? Nasıl?
- Ders saatinde yapılan sınavların (quizlerin) öğrenmene etkisi oldu mu? Nasıl?
- Haftalık ödevlerin öğrenmene etkisi oldu mu? Nasıl?
- Web sayfasında sunulan Mesaj kutusunun öğrenmene etkisi oldu mu? Nasıl?
- Web sayfasında sunulan ek kaynakların öğrenmene etkisi oldu mu? Nasıl?

11. Ders içeriğine Web üzerinden erişimin sana faydaları veya zararları oldu mu? Olduysa bunlar nelerdir açıklar mısın?

(Structural Flexibility, Metacognitive Support)

12. Ders içeriğinin haftalar bazında sunulmasının sana göre faydaları ve sınırlılıkları nelerdir?

(Structural Flexibility, Learning Theory)

13. Web sayfasıdaki araçlardan (Navigation, highlight, bookmark, notebook, pagenote, glossary, search, history) hangilerini kullandın?

- Kullandığın araçlar içeriği öğrenmene katkıda bulundu mu? Nasıl?
- Hiç kullanmadığın araçlar oldu mu? Hangileri?

(Structural Flexibility, Goal Orientation)

14. Dönem boyunca karşılaştığın problemler nelerdir? (öğretmene erişim, ders materyallerine erişim, ders materyallerini okuma, ödevler, vb.) Bu problemler daha sonra giderildi mi?

(Source of Motivation, Learning Theory)

15. Dersin beğendiğin özellikleri nelerdir? Nedenini açıklar mısın?
(Learning Theory, Task Orientation, Source of Motivation, Collaborative Learning Strategies)
16. Web destekli bir ders almak öğrenme alışkanlıklarında ve dersi anlamanda bir değişiklik yaptı mı? Yaptıysa nasıl bir değişiklik yaptı?
(Goal Orientation, Metacognitive support)
17. Dersin Web sayfasındaki bilgileri yazıcıdan yazdırıp mı çalıştın yoksa bilgisayardan mı çalıştın?
(Pedagogical Philosophy, Learning Theory)
18. Ders içeriğini öğrenmek için dersin web sayfasındaki içerik, ek kaynaklar ve okumalardan başka kaynak kullandın mı? Kullandıysan bunlar neler?
(Structural Flexibility, Pedagogical Philosophy, Learning Theory)
19. İlerde tekrar Web destekli öğretim biçiminde verilen bir ders almayı düşünür müsün? Nedenini açıklarmısın?
(Source of Motivation)
20. Arkadaşlarına bu dersi (veriliş biçimi değişmeden) almalarını önerir misin? Nedenini açıklarmısın?
(Source of Motivation)
21. Ders süresince Web'i nasıl kullandığını kısaca anlatır mısın?
(All)
22. Bundan sonraki yaşantında karşılaşacağın bilgisayar ağları ile ilgili işlerde bu derste öğrendiklerini kullanabilir misin? (Task Orientation, Goal Orientation)
23. Web'de verilen örnek durumlar, alıştırmalar, görsel materyaller bilgileri gerçek hayatla ilişkilendirmende faydalı oldu mu? (Task Orientation)
24. Sence Web destekli öğretimin geleceği nasıl?

APPENDIX F

INTERVIEW QUESTIONS & DIMENSIONS

Pedagogical Philosophy

3. Eski bilgi ve becerilerini bu derste edindiğin bilgi ve becerilerle ilişkilendirebildin mi?

10. Dersi vermek için kullanılan Web destekli öğretim biçiminin hangi özellikleri (çalışma grupları, mesaj kutusu, ödevler, quizler, ek kaynak duyuruları) içeriği öğrenmene katkıda bulundu? Nasıl anlatır mısın?

17. Dersin Web sayfasındaki bilgileri yazıcıdan yazdırıp mı çalıştınız yoksa bilgisayardan mı çalıştınız?

18. Ders içeriğini öğrenmek için dersin web sayfasındaki içerik, ek kaynaklar ve okumalardan başka kaynak kullandın mı? Kullandıysan bunlar neler?

21. Ders süresince Web'i nasıl kullandığını kısaca anlatır mısın?

Learning Theory

3. Eski bilgi ve becerilerini bu derste edindiğin bilgi ve becerilerle ilişkilendirebildinmi?

5. Ders süresince öğretim elemanı nasıl bir rol üstlendi. Öğrenci olarak senin rolün neydi?

7. Dersin yüz yüze (sınıf ortamında) olan bölümü içeriği öğrenmene katkıda bulundu mu? Bulunduysa nasıl anlatır mısın?

10. Dersi vermek için kullanılan Web destekli öğretim biçiminin hangi özellikleri (çalışma grupları, mesaj kutusu, ödevler, quizler, ek kaynak duyuruları) içeriği öğrenmene katkıda bulundu? Nasıl anlatır mısın?

12. Ders içeriğinin haftalar bazında sunulmasının sana göre faydaları ve sınırlılıkları nelerdir?

14. Dönem boyunca karşılaştığın problemler nelerdir? (öğretmene erişim, ders materyallerine erişim, ders materyallerini okuma, ödevler, vb.)

15. Dersin beğendiğin özellikleri nelerdir? Nedenini açıklar mısın?

17. Dersin Web sayfasındaki bilgileri yazıcıdan yazdırıp mı çalıştın yoksa bilgisayardan mı çalıştın?

18. Ders içeriğini öğrenmek için dersin web sayfasındaki içerikten, verilen ek kaynaklardan ve okumalardan başka kaynak kullandın mı? Kullandıysan bunlar neler?

19. Ders süresince Web'i nasıl kullandığını kısaca anlatır mısın?

13. Web sayfasıdaki araçlardan (Navigation, highlight, bookmark, notebook, pagenote, glossary, search, history) hangilerini kullandın?
- Kullandığın araçlar içeriği öğrenmene katkıda bulundu mu? Nasıl?
- Hiç kullanmadığın araçlar oldu mu? Hangileri?

Goal Orientation

13. Web sayfasıdaki araçlardan (Navigation, highlight, bookmark, notebook, pagenote, glossary, search, history) hangilerini kullandın?
- Kullandığın araçlar içeriği öğrenmene katkıda bulundu mu? Nasıl?
- Hiç kullanmadığın araçlar oldu mu? Hangileri?
21. Ders süresince Web'i nasıl kullandığını kısaca anlatır mısın?
22.Bundan sonraki yaşantında karşılaşacağın bilgisayar ağları ile ilgili işlerde bu derste öğrendiklerini kullanabilir misin?

Task Orientation

6. Dersle ilgili bilgi ve becerileri kazanmak (öğrenmek) için neler yaptın, ne tür etkinliklere katıldın?
15. Dersin beğendiğin özellikleri nelerdir? Nedenini açıklar mısın?
21. Ders süresince Web'i nasıl kullandığını kısaca anlatır mısın?
23. Web'de verilen örnek durumlar, alıştırmalar, görsel materyaller bilgileri gerçek hayatla ilişkilendirmende faydalı oldu mu?

Source of Motivation

1. Bireysel öğrenme alışkanlıkların (kendi kendine öğrenme, bireysel çalışma, v.s.) bu dersi almanı etkiledi mi? Etkilediyse nasıl etkiledi?
2. Bu dersle ilgili beklentilerin nelerdir?
- Beklentilerinin hangileri karşılandı. Karşılanmayanlar sence neden karşılanmadı.
9. Öğretim elemanının hangi davranış ve yaklaşımları öğrenmeni olumlu veya olumsuz yönde etkiledi?
14. Dönem boyunca karşılaştığın problemler nelerdir? (öğretmene erişim, ders materyallerine erişim, ders materyallerini okuma, ödevler, vb.) Bu problemler daha sonra giderildimi?
15. Arkadaşlarına bu dersi (veriliş biçimi değişmeden) almalarını önerir misin? Nedenini açıklarmısın?
16. Ders süresince Web'i nasıl kullandığını kısaca anlatır mısın?

Teacher Role

5. Ders süresince öğretim elemanı nasıl bir rol üstlendi. Öğrenci olarak senin rolün neydi?

9. Öğretim elemanının hangi davranış ve yaklaşımları öğrenmeni olumlu veya olumsuz yönde etkiledi?

21. Ders süresince Web'i nasıl kullandığını kısaca anlatır mısın?

Metacognitive Support

1. Bireysel öğrenme alışkanlıkların (kendi kendine öğrenme, bireysel çalışma, v.s.) bu dersi almanı etkiledi mi? Etkilediyse nasıl etkiledi?

3. Eski bilgi ve becerilerini bu derste edindiğin bilgi ve becerilerle ilişkilendirebildin mi?

4. Bu derste başarılı olmanı engelleyebilecek öğeler var mıydı, varsa bunlar nelerdir?

9. Öğretim elemanının hangi davranış ve yaklaşımları öğrenmeni olumlu veya olumsuz yönde etkiledi?

11. Ders içeriğine Web üzerinden erişimin sana faydaları veya zararları oldu mu? Olduysa bunlar nelerdir açıklar mısın?

16. Web destekli bir ders almak öğrenme alışkanlıklarında ve dersi anlamanda bir değişiklik yaptı mı? Yaptıysa nasıl bir değişiklik yaptı?

21. Ders süresince Web'i nasıl kullandığını kısaca anlatır mısın?

Collaborative Learning Strategies

7. Dersin yüz yüze (sınıf ortamında) olan bölümü içeriği öğrenmene katkıda bulundu mu? Bulunduysa nasıl anlatır mısın?

10. Dersi vermek için kullanılan Web destekli öğretim biçiminin hangi özellikleri (çalışma grupları, mesaj kutusu, ödevler, quizler, ek kaynak duyuruları) içeriği öğrenmene katkıda bulundu? Nasıl anlatır mısın?

15. Dersin beğendiğin özellikleri nelerdir? Nedenini açıklar mısın?

21. Ders süresince Web'i nasıl kullandığını kısaca anlatır mısın?

Structural Flexibility

8. Ders için hazırlanan Web sitesi içerisinde istediğin konuya rahatça ulaşabiliyor muydun? Nasıl?

10. Dersi vermek için kullanılan Web destekli öğretim biçiminin hangi özellikleri (çalışma grupları, mesaj kutusu, ödevler, quizler, ek kaynak duyuruları) içeriği öğrenmene katkıda bulundu? Nasıl anlatır mısın?

11. Ders içeriğine Web üzerinden erişimin sana faydaları veya zararları oldu mu? Olduysa bunlar nelerdir açıklar mısın?

12. Ders içeriğinin haftalar bazında sunulmasının sana göre faydaları ve sınırlılıkları nelerdir?

13. Web sayfasıdaki araçlardan (Navigation, highlight, bookmark, notebook, pagenote, glossary, search, history) hangilerini kullandın?

- Kullandığın araçlar içeriği öğrenmene katkıda bulundu mu? Nasıl?

- Hiç kullanmadığın araçlar oldu mu? Hangileri?

18. Ders içeriğini öğrenmek için dersin web sayfasındaki içerikten, verilen ek kaynaklardan ve okumalardan başka kaynak kullandın mı? Kullandıysan bunlar neler?

21. Ders süresince Web'i nasıl kullandığını kısaca anlatır mısın?

VITA

Ömer Delialioğlu was born in Ankara on March 9, 1970. He received his B. S. degree in Physics Education from the Middle East Technical University in 1993. He received his M. Sc. degree in Science Education from the Middle East Technical University in 1996. He worked in the Continuing Education Center at the Middle East Technical University as educational coordinator and instructional technologist from 1994 to 1998. He took part in many computer and computer networks related adult training programs as instructor. In 1998 he started his job as specialist in the Department of Computer Education and Instructional Technologies at the Middle East Technical University. His main areas of interest are computer networks, authoring languages, hybrid/blended instruction, web-based instruction, instructional design, and the use of instructional technologies in teaching and learning.