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Students' Perceptions on Effective Dimensions of Interactive Learning in a Blended Learning Environment

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ABSTRACT

This study investigates students' perceptions of the "effective dimensions of interactive learning" in a hybrid course. A case-study design was used, and 25 students enrolled in "Computer Networks and Communication," a course at a public university in Turkey, formed the sample of this study. The study lasted for 14 weeks. At the end of the study, interviews were conducted to gather data on the "effective dimensions of interactive learning". Additionally, computer logs of the students were kept and analyzed to triangulate the interview data. The findings of the study showed that the way instructivist and constructivist elements are blended, the need for metacognitive support, authentic learning activities, collaboration, type and source of motivation, individualized learning, and access to the Internet played important roles in students' learning in the hybrid course.

Keywords

Blended learning, Hybrid instruction, Effective dimensions of interactive learning

Introduction

There are different opinions on the effect of technology in education. One of the earliest arguments questioning technology's role in learning comes from Clark (1983, 1994). He argues that media (technology) is nothing but a vehicle that delivers instruction, and that technology would not affect student learning. He pointed at the method of instruction as the most important consideration for this aim. Other researchers, such as Russell (1999), Jonassen, Campbell, and Davidson (1994), and Ehrmann (1999), agreed with Clark that focusing purely on the technology would be wrong and that learning should be the center of interest.

Previous research studies show that integrating technology into instruction can definitely improve access to information. However, if the question is "whether technology improves learning," previous research studies indicate that the answer seems to be "no" (Ehrmann, 1999). Russell's (1999) work has similar results. Three hundred distance education studies showed that the learning outcomes from distance education courses were not significantly different from those of traditional courses, indicating "The No Significant Difference Phenomenon."

The inherent problems of online instruction, including the pressure of limited resources (such as time, money, hardware, and software) and the pedagogical problems of purely online or traditional instruction, have led to a new idea: Why not mix the benefits of online courses with the benefits of face-to-face courses? Many instructors supplement their courses with simulations, online exercises, and immediate online feedback, creating richer learning environments through multimedia and hypermedia. The systematic and strategic integration of these tools into courses to meet pedagogical goals introduce a new way of approaching instruction. This new strategy has many names: blended learning, hybrid instruction, mediated learning, web-enhanced instruction or web-assisted instruction.

"Blended learning" and "hybrid instruction" are terms commonly used to label courses that combine face–to-face classroom instruction with online instruction. Blended learning environments aim to combine attributes of online instruction, such as efficiency, sufficiency, and freedom to access information anytime with minimal effort, with attributes of traditional classroom instruction, such as enabling students to work with the new information presented, as well as interact with peers and the teacher in the classroom. For the current study, the terms blended learning and hybrid instruction are used interchangeably and are interpreted as the effort to integrate the social aspect of face-to-face environment with information-access methods of a web-based environment. Although there are differences in the practice of blended learning and hybrid instruction, the idea behind both is to redesign the instruction to maximize the advantages of both face-to-face and online modes of instruction.

However, the literature does not provide much evidence on whether or not this type of instruction is more effective than purely traditional face-to-face courses or purely online courses. Garnham & Kaleta (2002) investigated the hybrid courses of 17 instructors from five different campuses of a state university. The findings revealed that there were no common or accepted standard approaches and teaching methods among the offered hybrid courses. In a parallel study at the same university, Sands (2002) proposed general guidelines for instructors who planned to combine online teaching elements within their courses. No follow-up research on these two studies looked at whether or not these proposals created common standards or increased the effectiveness of these courses. In an earlier study, Marques, Woodbury, Hsu, and Charitos (1998) investigated how well a blended learning environment in another university worked for students' learning with respect to students' experiences. The study indicated 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 called "well suited" to the progressive development and implementation of a learning-centered model of instruction. The literature also shows that students' course satisfaction was high in hybrid courses (Gray, 1999; Black, 2002). Several other studies found that students preferred a "mixed" course structure , and that hybrid courses affected students' learning positively (Gunter, 2001; Sanders & Morrison-Shetlar, 2001; Yildirim, 2005). All of these studies provide valuable information in designing blended learning environments, and most of them indicate positive attributes of these environments.

There are no accepted standards for blended learning, and different institutions implement blended learning in different ways. The analysis of such an environment needs to include all of the important attributes in an instructional setting. A model covering the most important dimensions of learning in a blended learning environment is needed. Some models were proposed to ensure effective learning in online learning environments. Models developed by Reeves (2002), Reeves and Reeves (1997), Caladine (1999), and Welsh and Reeves (1997) provide important guidelines for the instructional designers. The model developed by Reeves and Reeves (1997) defines the effective dimensions of interactive learning in the World Wide Web (WWW). The dimensions included in the model were driven from research and theory in instructional technology, cognitive science and adult education. In addition, the model focuses on the pedagogical aspects of online learning (Reeves & Reeves, 1997) rather than on the media and technology components of Web based instruction WBI,. The model is used to understand where the instructional practices are located on continua with contrasting values at two ends for important learning dimensions (supplied in Table 1). The model of Reeves & Reeves (1997) was modified by Reeves in 2002 and developed into a general model for evaluating what really matters in computer-based education. The new model, with 14 dimensions, was referred to as a "systematic evaluation of computer-based education (CBE) in all its various forms (including integrated learning systems, interactive multimedia, interactive learning environments, and microworlds)" (Reeves, 2002, p. 1). Since its dimensions are more generic, the older version of the model was selected as a framework for the current study to understand student perceptions on the important dimensions of a blended learning environment. Out of 10 dimensions in the model, nine, namely: pedagogical philosophy, learning theory, goal orientation, task orientation, source of motivation, teacher role, metacognitive support, collaborative learning strategies and structural flexibility were included in this study.

Even though there is an increase in the number of blended learning environments, and the existing literature generally showed positive attributes of these instructional practices, the field lacks detailed and empirical studies on the effectiveness of the learning process in these environments. Therefore, to see the whole picture and determine the contributing factors to learning in blended learning environments, there is a need to examine hybrid courses from different dimensions and contribute to related literature in this respect. Hence, the aim of this study is to investigate the effective dimensions of interactive learning in a blended learning environment relative to students' perceptions. To investigate this issue, the dimensions of interactive learning in Reeves and Reeves' model (1997) were used as a conceptual framework. The research question that guided this study was: What are students' perceptions about the blended learning environment in terms of effective domains of interactive learning at the end of the study in regard to

- pedagogical philosophy employed,
- the learning theories that formed a base for the hybrid course,
- goal orientation,
- task orientation,
- source of motivation,
- instructor's role,
- metacognitive support,
- collaborative learning strategies, and
- structural flexibility.

Table 1. Effective Dimensions of Interactive Learning on the WWW

Pedagogical Philosophy		
Instructivism	⟷	***Constructivism***
Knowledge flows from instructor to the student		Knowledge is 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***
Instruction with focus on a expected behavior		Simulation with more than one solution to a problem
Task Orientation		
Academic	⟷	***Authentic***
Traditional academic exercises have to be done		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 the facilitator of instruction, guiding students
Metacognitive Support		
Unsupported	⟷	***Integrated***
No support for monitoring progress and adjusting to individual learner's needs		Supporting learners by helping them 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
Cultural Sensitivity		
Insensitive	⟷	***Respectful***
Cultural sensitivities are not taken into consideration while designing 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

Method

Design of the Study

A case-study design was used in this study. Effective dimensions of interactive learning in a hybrid course were examined through in-depth interviews with the participants and through the log system, which kept records of students' web-component usage. While qualitative data gathered from the interviews was used to investigate students' perceptions, quantitative data in the form of frequency count and activity durations from the log-system was used to triangulate and support the findings.

Participants

The study included a total of 25 university students enrolled in the "Computer Networks and Communications" elective course at Middle East Technical University in Turkey. The course was designed and offered as a hybrid course. Prior to the study, all students were required to take the course "Introduction to Information Technologies and Applications," which covers computer-literacy topics. The students were from various departments at the university. The study lasted 14 weeks, and during this period, the students met once a week for one hour in class, but essential parts of the course were done online.

Procedures of the Study

A hybrid model of instruction was designed and developed to deliver the content of the "Computer Networks and Communications" 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.

At the beginning of the semester, students were provided with orientation on how to participate in the online part of the course. This orientation covered topics such as how to use the site, website addresses, navigation structures, use of cognitive tools, security policies, and choosing usernames and passwords.

Students were informed about what was expected from them while using the online part of the course. Every student in the hybrid course had to visit the course website and be active online for at least one hour each week. Students' website usage was logged by the log system, and each week, the duration and activities of each student were checked. The students could not just open the page and leave, since the system logged them out after a five-minute inactive time. In the one-hour classroom meeting, students were informed about their online participation.

When students met once a week for one hour in the class, no lecturing was done. Instead, with the guidance of the instructor, class time was used for group and individual activities, educational games, discussion of homework and assignments, questions and answers about the subject, and discussions on term projects.

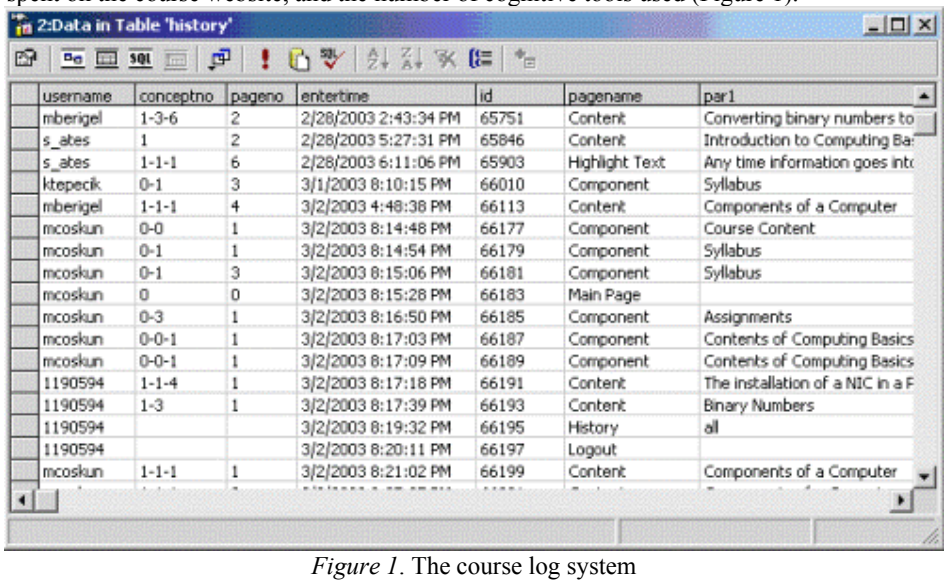
Data Collection

An interview guide was used to collect data on the students' perceptions of the effective dimensions of interactive learning in regard to the hybrid course. Additionally, the log system was used to track the students' activities in the course website to triangulate the interview data.

The interview guide included 24 questions on the effective dimensions of interactive learning: "pedagogical philosophy, learning theory, goal orientation, task orientation, source of motivation, teacher role, metacognitive support, collaborative learning, and structural flexibility" (Reeves and Reeves, 1997). At the beginning of the semester, the interview guide was piloted with two students who took the same course the previous year. Because of time constraints and difficulties in understanding, some of the questions were eliminated and some revisions were done a second time. Two measurement-and-evaluation experts examined the final schedule, and it was found valid for this study.

The students in the hybrid course were interviewed individually at the end of the semester. Each interview lasted about 40–60 minutes. The interviews were tape-recorded with the students' consent.

For triangulation purposes, the log system was used to collect data on students' use of the course website. For each user, the log system recorded the students' online habits, including the time spent on a specific chapter, the total time spent on the course website, and the number of cognitive tools used (Figure 1).



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 int
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 F
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 1. The course log system

Data Analysis

Qualitative and quantitative data analysis strategies were performed in the study. The interview data was transcribed, and content analysis was performed to find out meaningful phenomena in regard to students' perceptions of "effective dimensions of interactive learning" (Reeves and Reeves, 1997). Students' responses were interpreted and categorized into the dimensions provided in the Reeves & Reeves (1997) model. For the data in each dimension, data reduction, data display, and conclusion-drawing processes were done (Miles & Huberman, 1994). In data reduction, the interview results were categorized and simplified. In data display, the categorized and simplified results were organized for conclusion drawing. Finally, conclusions were drawn, and then the interpretation and discussion of the results were offered.

The actions that the students performed on the course website were tracked through the log system. The log system kept logs of each student in terms of username, the topics visited, time spent on each topic, login-logout time, history of visited pages, and history of the cognitive tools used. For each user, the quantitative data gathered through the log system were analyzed in regard to the total number of pages visited, duration of time spent on each topic, total number of tool actions, and usage frequency of each cognitive tool.. The frequency and duration for each student were compared with the interview data for triangulation.

The Hybrid Course

The "Computer Networks and Communications" course was designed and developed as a hybrid course for the purpose of this study. The hybrid course required self-paced learning time since the course content was online, creating a significant reduction in classroom lecture time. In designing the hybrid course, formal and informal data gathered from the students who already took the course were examined. In order to determine the content and visual elements of the course website, the desired outcomes of the course in terms of goals and objectives were specified, and content, exercises, and assessment instruments to be included were documented. Because of internal validity concerns, the majority of the visual elements and the content were adapted, with permission, from a commercially well-known information source. As the third step, the graphical user interface of the website was designed. As the last step of creating the website, the content and the visual materials were coded. The website of the course was developed using Active Server Pages (ASP), Microsoft SQL Server 7.0, Dynamic HyperText Markup Language (DHTML), and Cascading Style Sheets (CSS), and it included course content, syllabus, announcements, assignments, forum comments and the cognitive tools Highlight, Bookmark, Notebook, Pagenote, Search, Glossary, History, Sitemap and Note to Remember (Figure 2).

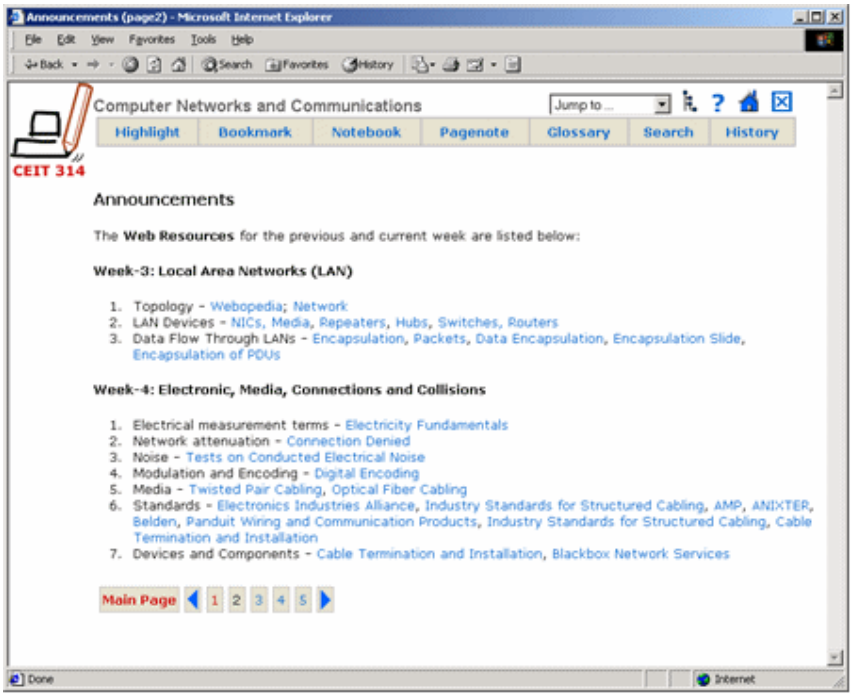


Figure 2. The course website

The website included objectivist/instructivist and constructivist elements. Objectivist structure in terms of content presentation structure in the website was supported by constructivist elements such as cognitive tools and in classroom meetings that included group work, games, discussions, and projects.

The differences in learning and teaching activities between the hybrid course and a traditional course were shown by Caladine's (1999) model, which he called "A Model for Learning and Teaching Activities" (MOLTA). The elements of the hybrid course in regard to MOLTA are summarized in Table 2.

Table 2. The Elements of the Hybrid Course

MOLTA Elements	Hybrid Course (one hour of classroom meeting each week)
Delivery of Material	Website, on-line materials
Interaction with materials	Multimedia, web browsing, web cognitive tools, homework, quizzes, classroom activities
Interaction with the teacher	Web announcements, forum, phone, face-to-face interaction, consultation
Interaction between students	Web forum, e-mail, group work, class discussions, projects
Intra-action	Class discussions, group work, web forum

Results

The students' perceptions of the blended learning environment are important to understanding their preferences in regard to effective dimensions of interactive learning in the hybrid course parallel to Reeves and Reeves' (1997) model.

Pedagogical philosophy and learning theories

The two contrasting values in pedagogical philosophy are instructivism and constructivism. Closely related to these pedagogical philosophies are the learning theories behaviorism and cognitivism. The interview results indicate that while the overall design of the hybrid course is closer to instructivist philosophy, the online part of the course, group work, and classroom discussions and activities are closer to constructivist epistemology (Table 3). The findings showed that the materials and the activities based on both instructivist and constructivist philosophies were found to be beneficial for learning by the students.

Table 3. Students' Perceptions of the Features Based on the Pedagogical Philosophy and Learning Theory of the Hybrid Course

Features/ Components of the Hybrid Course	**Students' Perceptions**	**Pedagogical Philosophy**	**Learning Theory**
Design of the Course (Whole Course)	Successful in relating previous knowledge to newly acquired knowledge.	Instructivist & Constructivist	Behaviorist & Cognitivist
Predetermined Objectives (Whole Course)	Helpful in that they indicated what was expected.	Instructivist	Behaviorist
Learning Habits of Students (Whole Course)	Preferred lecturing and face-to-face communication.	Instructivist	Behaviorist
Time Management (Whole Course)	Nice to come to the class for only one hour. Overall, it was too demanding.	Constructivist	Cognitivist
Quizzes (Face-to-face)	Useful for self-assessment.	Instructivist	Behaviorist
Group Work (Face-to-face)	Helpful to learn from others and reflect on what others knew.	Constructivist	Cognitivist
Announcements & Additional Links (Web)	Learning from different sources was beneficial.	Constructivist	Cognitivist
Assignments & Homework (Web)	Supportive of course content.	Constructivist	Cognitivist

Course Content (Web)	Heavy course load and too much to read. Structured, step by step	Instructivist	Behaviorist
Message Board (Web)	Useful for exchanging web resources.	Constructivist	Cognitivist
Website Usage (Web)	Preferred to study at home on weekends and before class meetings.	Constructivist	Cognitivist
Cognitive Tools (Web)	Useful for organizing learning. Enabled searching and quick and easy access to information.	Constructivist	Cognitivist

Most of the students mentioned that they found the cognitive tools provided in the course website beneficial. One of the students said, "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 students were asked if they could relate new knowledge with their prior knowledge. Most students (N=21) indicated that they could do this to one extent. Only four out 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. Some students (N=11) mentioned, 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 explained that they had a good background in the computer networks subjects and that they could build everything they learned from the hybrid course on their previous knowledge. The findings of the study showed that the hybrid course was successful in relating previous knowledge to the newly acquired knowledge if the students had previous knowledge.

The course features that support students' learning in the hybrid course were ranked by the students as:
1. Homework and assignments provided through the website (N=24)
2. Announcements and additional links supplied through the website (N=16)
3. Quizzes given in the classroom (N=15)
4. Group works and classroom discussions conducted in the classroom (N=11)
5. Message Board (Forum) in the course website (N=8)

Goal orientation and task orientation

The findings of the study showed that majority of the students found the goal orientation of the hybrid course more sharply focused than general. This was so because course topics were divided according to measurable objectives. Students were satisfied with these pre-determined goals and objectives. Most of them stated that by 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 website 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 website to understand the topic as much as I could. I also knew that we would have activities on these topics in the classroom."

Majority of the students mentioned that they could integrate the focused and general goal orientation strategies while learning. The classroom meetings were based on unfocused goal orientation. One student said, "Every week, we did 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 instructor for detailed information or for an information source." Some students indicated that the general goal orientation strategies in the projects, assignments and group works helped them acquire the hands on real-life skills of what they read in the course website.

To understand how the students made use of the sharply focused structure of the course contents, we asked them how they used the website throughout the semester. Most students (N=16) first accessed the course content pages when they logged into the course website. After that, the students viewed the assignments and additional links. Lastly they examined 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, then visited the course content, assignments, announcements, and Message Board, as indicated by the 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 was required of them throughout the course, then they investigated the additional links, and last, they asked questions or looked for questions asked by others.

Motivation

The findings of the study showed that motivation and reward are very important for students' learning in the hybrid course. The analysis of the interview data showed that students had both intrinsic and extrinsic motivation. The analysis of the data also pointed towards intrinsic motivation as the key element for the success in the hybrid course.

One indication for intrinsic motivation was "enjoying" the course. Students indicated that even though they enjoyed some learning activities, they did not enjoy reading the content from the website. They enjoyed the real-life experiences, such as installing a cable, configuring a computer or a network device, and making a cabling design for a given building floor plan. They also enjoyed reading and applying real network protocols and addressing schemes like IP. One of the students commented regarding motivation and metacognition, "I always wondered why we configured the computers with IP address and a subnet mask. Now I understand why and how we use them."

Students who indicated a "joy" of learning the topics covered in the course were those with metacognitive abilities that allowed them to understand "what they learned" and "why and how they learned." For example, a student said: "I expected that this course would change my way of understanding the computer-network topic. My expectation became true. Now I look at many things differently. For example, when I enter a computer lab I can determine where the line is going from, where the switch is located, good or bad ways of installation."

The features of the hybrid course the students liked the most:

The content of the hybrid course (N=22): Most of the students found the computer-network subjects interesting. Students stated that they liked to learn about the computer-network subjects, because these subjects would be useful in their professional life. Almost all students said that they would benefit from the course content in the future.

The hybrid structure of the course (N=15): The majority of the students indicated their enjoyment 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 being neither fully web based nor fully traditional.

The learning/instructional activities done in the classroom (N=15): The majority stated that they prefer doing activities rather than sitting silently and listening to the instructor. They indicated that they enjoyed practicing on the information they read on the website.

The cognitive tools in the course website (N=14): According to student comments, the cognitive tools gave the course website a professional feel, making it different from standard, electronic page-turning websites. One student commented, "The tools in the website were very usable. I used them for accessing information quickly and easily."

The course website (N=12): Half of the students found the website very user-friendly, appealing in terms of graphics, and well organized for accessing information. The students liked the navigation structure and the information-presentation structure.

When the students' interview results on their likes and dislikes are compared, we could see that the students had internal and external motives throughout the course. One common view of students was that the classroom meetings, which included face-to-face communication with the instructor and peers, was a source of motivation. Students indicated that they found interaction with the instructor especially motivating. Regarding the face-to-face component of the course, while some students said that they understood the topics better through interaction with the instructor and their friends, others indicated they liked to talk with others on the course content. Analysis of the interview data pointed towards intrinsic motivation as the key element for success in the hybrid course.

Instructor's role

Students perceived the role of the instructor as a guide in their learning, and a facilitator of the classroom activities. They indicated that they could communicate with the instructor in a friendly manner. The students perceived their role as "active" and the course as student-centered. The student interviews showed that the instructor was an important source of motivation for them. They viewed the instructor as the person who:

- outlined the important points of the course content (information source)
- motivated the students to come to class and read the content (motivation source)
- controlled their assignments, homework, and projects (authority figure, feedback provider)
- helped them in doing their assignments, projects and classroom activities (facilitator)

The findings showed that the instructor's role was closer to constructivist orientation. The instructor provided learning environments open to interaction and communication, and was a facilitator.

Metacognitive support

Students' perceptions of 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, and searching and accessing information easily and quickly provided metacognitive support for the students in the hybrid course. The cognitive tools enabled students to customize the course website 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 provided on the course content pages. The most preferred cognitive tools according to the students' interviews were 1) Glossary, 2) Highlight, and 3) History. The log system showed that the most frequently used tools were 1) Highlight, 2) Glossary and 3) History. As stated by the students, cognitive tools helped them in structuring their knowledge and "knowing what they know." Table 4 presents students' use of cognitive tools, and their activity count in the log system.

Table 4. Students' use of cognitive tools

The Cognitive Tool	Number of students stating that they made use of it	Activity count in the Log-system
Glossary	23	438
Highlight	21	1728
History	20	194
Sitemap	18	156
Search	17	123
Bookmark	15	140
Pagenote	13	80
Notebook	10	75

Students indicated that the Glossary and Highlight were the most "helpful" tools in studying for the course. Students' activities in the log system showed similar results. The most frequently used cognitive tool by the students was the Highlight and then the Glossary. Most of the students stated that they used the cognitive tools to underline (highlight) texts, to lookup abbreviations, and to find a specific topic within the content.

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 website was integrated in terms of metacognitive support. The important finding of the study was that metacognitive skills of the students in the hybrid course vary in accordance with their achievement goal orientations in the hybrid course. Students are expected to understand their responsibilities and manage their learning by themselves in hybrid courses. In the current study, the metacognition and time management skills of the students were supported through cognitive tools in the website and with a log-system. The interview results and findings of the log system were consistent indicating that students were supported in controlling and regulating their learning in the hybrid course.

Collaborative learning strategies

The face-to-face component of the hybrid course was where most of the collaborative learning strategies were integrated. Students worked in groups, played educational games, and participated in classroom discussions. The

Message Board feature of the course website 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 affected their learning in a positive way. Students were further asked which of the classroom activities they benefited from most while learning. Students' answers indicated that they benefited most from 1) asking questions about the class discussion to their peers and the instructor, 2) working in groups, 3) playing educational games, and 4) listening to classroom discussions. Students indicated that the Message Board was useful but not as effective in student collaboration as expected. While students perceived the website of the course as more unsupported, they perceived the classroom learning activities as supported in regard to collaborative learning strategies.

Structural flexibility

The interview results indicated that the structural flexibility of the hybrid course and especially the website of the course were open rather than fixed. The majority indicated that they could access information anytime they wanted and there was no restriction regarding time or place since the website was accessible seven days a week, 24 hours a day. With the integration of the cognitive tools, they could easily search, access, and organize knowledge. Through these tools, they could access the same information from different links. Most of the students stated that the course website was user-friendly and that the graphical and navigation features such as buttons, icons, and links were clear, easy to understand, and distinguishable. Access to any information within the course content could be achieved multiple ways. The hierarchical presentation of the content added to the structural flexibility of the course.

Closely related to structural flexibility of the hybrid course was the usability of the course website. Usability refers to the factors that make the experience for the learner simpler and stress free. The usability factors were especially important for the course website, which was a dynamic website prone to technical problems. The download time was also important, since most of the students stated that they prefer to connect to the Internet via modem from home. Students' perceptions about the amount of text in one page and the no-scrolling feature were generally positive. There were only few students who would prefer scrolling on web pages. The graphics were selected with care, and student perceptions showed that the graphics were helpful in understanding abstract concepts. Students stated that they would have liked more simulations and multimedia available on the website. On the other hand, they also wanted to download the pages as quickly as possible because they connected via modem from home and had to pay for the Internet connection time.

Conclusion and discussion

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). In the design of the hybrid course, the aim was to produce the best practice by means of key concepts of instructional design, and different parts of each theory were used according to "what," "where," and "how" questions. Our studies indicate that the students found the pedagogical philosophy of the hybrid course to be a mixture of instructivist and constructivist elements. This structure is also recommended by Passerini and Granger (2000) as the ideal paradigm of online-course design. Moreover, as stated by Moreno and Mayer (1999), there is no need for discovery learning to have constructivist learning. Constructing meaning can also be achieved by a well-designed and organized directed learning. This is parallel with what the students indicated related to the pedagogical philosophy. Most of the students found the course was well designed for the aim of hybrid instruction. Students declared that their primary source of information was the course the website, which was closer to objectivist theory. They also indicated that they used other components of the hybrid course for supporting their learning (such as classroom activities and cognitive tools) which were closer to cognitivist learning theory and constructivist philosophy.

The cognitive tools in the course website were successful implementations of the cognitivisit learning theory and constructivist philosophy. The findings indicated that cognitive tools enabled students to process a large amount of information and helped students search for, access, and organize information, important for learning in open-learning environments according to Land and Hannafin (2000). Our study indicated that students needed learning-support tools such as the cognitive tools in the course website in order to interact and become involved in cognitive activities (Clarebout, Elen, Johnson & Shaw, 2002). Learning-support tools provide an overt means

through which individuals engage and manipulate both resources and their own ideas (Hannafin, Land, & Oliver, 1999), and structure or assist in the problem-solving process (Clarebout, Elen, Johnson & Shaw, 2002).

The discussion about how much of the course should be online was an issue for the hybrid course in this study. As proposed by Garnham & Kaleta (2002), the amount of online information should be limited. Our findings showed that the information provided online in the hybrid course was "overloaded" and too much. Special attention is needed in both selecting the content and determing the amount of time needed to cover that content in the hybrid course.

Findings point to motivation as an important factor in student achievement. Research evidence indicates that motivation is not only a determinant for students' achievement but that it also has to be activated for each task (Weiner, 1990). The findings of the current study point 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). They acknowledged that intrinsically motivated students engage in the task more intensively and show better performance than extrinsically motivated students. However, some studies showed opposite results for traditional classroom settings (Frase, Patrick, & Schumer, 1970, cited in Lee & Park, 2003). 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" (Lee & Park, 2003, p. 657). Lepper's findings provided evidence that "extrinsic motivators diminish one's interest in learning because the goal becomes the reward rather then their learning" (1985, cited in Alessi and Trollip, 2001, p. 26). Keller argues that the "instructional designer must be proficient at motivation design as well as instructional strategy and content design" (Keller & Suzuki, 1988, cited in Alessi and Trollip, 2001, p. 25). This is especially important in blended-learning environments because the results indicate that extrinsically motivated students in particular tend to lose their motivation. The course website alone was not enough to hold students' motivation high. Students wanted to see their peers, talk to them, share their knowledge and skills, and use their theoretical knowledge in real cases. These activities were effective to motivate students in the hybrid course.

Berge (2000) listed the change in roles of the instructor in constructivist courses as: "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". Parallel to this list, some of the changes mentioned by the students indicate that the instructor's role was close to the constructivist epistemology. The students stated that this role supported their achievement, satisfaction, and motivation in the hybrid course.

Previous research studies show that in web-based learning environments, students are expected to access, organize, and analyze information (Jonassen & Grabinger, 1990, cited in Liyoshi, 1999; Newmark 1989, cited in Liyoshi, 1999). The new role of the students puts high cognitive demands on them. The cognitive load has the potential to cause problems in cognitively ill-equipped learners, making them feel "disorientated," and causing "cognitive overload" in such learning environments (Marchionini, 1988; Oren, 1990). As a solution to these problems, the need for metacognitive support was mentioned by Jonassen (1996). Metacognitive support was provided through the cognitive tools in the hybrid course website, and found to be successful in overcoming the students' disorientation and cognitive overload. In addition to decreasing the cognitive load, these tools were implemented to support students' metacognition while they learned from the hybrid-course website. As indicated by Land and Hannafin (2000), they were important factors for learning in open-learning environments, which were described as environments in which students need to process a large amount of information. Cognitive tools are required in these environments to provide help to the students in searching, accessing, and organizing information. Liyoshi, Hannafin, and Wang (2005) implied that even though student-centered learning environments have drawn attention, such systems put an extraordinary cognitive burden on the learner. They suggest that cognitive tools can help learners in such learning environments.

The students' preference for collaboration, especially in classroom meetings, points towards the social aspect of collaboration. In his social learning theory, Bandura (1975) emphasizes modeling of behaviors, attitudes, and emotional reactions while doing purposive, goal-directed activities in a collaborative group. Students' behaviors, attitudes, and emotions affected others while working in groups, discussing a concept, or playing educational games. A similar notion was outlined by Vygotsky (1978) by claiming that social interaction is fundamental in cognitive development. The collaborative classroom environment in the blended learning environment provided opportunities for the social interaction of students.

The usability and simplicity of design was given a special attention in the creation of the course website. Nielsen (2000, cited in Hall et al., 2001) advocates that web design should not include graphics and sounds unless they are absolutely essential. The design of the website of the hybrid course was inline with the literature (Hall et al., 2001) to assure delivery of information simply and quickly without any unnecessary audio and visual elements. The students' perceptions were inline with the stated literature in that the majority found the website easy to use. Additionally, rather than studying from the course Web site, students stated that they wanted to download the pages to their computers as quickly as possible because they connected from their homes via modem and had to pay for the Internet connection time. With the implementation and wide use of new Wide Area Network technologies such as ADSL, this problem can be solved in the near future.

Implications

The design, development, and implementation processes for a blended learning environment are different from those in a purely traditional, face-to-face lecturing course or a purely web-based course. From the results of this study, the following suggestions are made for the development and implementation of hybrid instruction:

- Don't hybridize only the technologies; hybridize the pedagogical philosophies, theories, and instructional-design methodologies.
- Give special attention to student motivation in hybrid courses.
- Provide tools for metacognitive support.
- Use multimedia in the web component to enhance learning
- Encourage and provide facilities for student-student and student-instructor communication.
- Provide students with online self-assessment tools.
- Provide print materials.

Even though the above suggestions are made based on the findings of this study, one needs to be cautious in generalizing these findings in other contexts. The content of the "computer networks and communication" subject is technical, procedural, and well-structured. Other subjects, especially ill-structured subjects, may require different design in a blended learning environment. Therefore, additional research studies that examine effective dimensions of interactive learning in a blended learning environment with different learners and in different subject area are needed.

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