STUDENT PERCEPTIONS ON A WEB-ENHANCED INTRODUCTORY CHEMISTRY COURSE: A CASE STUDY

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ABSTRACT

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This study analyzed student perceptions about Web-enhanced instruction in an Introductory Chemistry course given in two semesters. The opinions, experiences, and expectations of the students about the course Web site, Web-based supportive course materials, the PowerPoint presentations used in the lectures and self-paced learning, and online quizzes were discussed.

The participants were 143 students from a section of the course. Data were obtained from group interviews, questionnaires, and observations.

Focus group interviews were conducted towards the end of the first semester. The interviews were subjected to a content analysis. The results yielded from the interviews were used as a base for the construction of the

questionnaire, that is, the Evaluation of Web-Enhanced Instruction in General Chemistry Course Questionnaire. Using the questionnaire, frequency distributions for demographic data about the students, and the statements evaluating different aspects of the course were obtained. In addition, two quiz sessions were observed.

The analysis of both qualitative and quantitative data showed that the students were satisfied with the course Web site and used its services as far as it is regularly updated. The most appealing component in the Web site was stated to be the animations within the interactive materials. They also believe that they had better use interactive materials and PowerPoint presentations as supportive materials.

However, the findings indicated that some factors such as large lecture hall environment, students' being passive during the lectures, lack of attention, and lack interactivity resulted in the students not wanting the lectures to be given via the PowerPoint presentations. Finally, about the online quizzes, the students stated that if the quizzes had been delivered via the Internet, they should have taken it anywhere and anytime, asynchronously.

Keywords: Web-enhanced instruction, student perceptions, supportive materials, PowerPoint presentations, online assessment.

ÖZ

WEB-DESTEKLİ BİR GENEL KİMYA DERSİ HAKKINDA ÖĞRENCİLERİN ALGILARI: BİR DURUM ÇALIŞMASI

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Bu çalışma, öğrencilerin Web ile zenginleştirilmiş bir Genel Kimya dersi hakkındaki algılarını analiz etmektedir. Çalışmada, derse devam etmiş olan öğrencilerin dersin Web sitesi, Web-tabanlı ders materyalleri, PowerPoint gösterilerinin derste ve bireysel çalışmada kullanımı, ve çevrimiçi kısa sınavlar hakkındaki fikir, deneyim ve beklentilerini tartışılmaktadır.

Bu çalışmanın katılımcıları Genel Kimya dersini alan 143 kişidir. Veriler grup görüşmeleri, anket ve gözlem yöntemleri ile toplanmıştır.

Grup görüşmeleri birinci dönemin sonuna doğru yapılmıştır. Görüşmelerin analizi sonucunda elde edilen bulgular ışığında Web ile Zenginleştirilmiş Genel Kimya Dersini Değerlendirme Anketi hazırlanmıştır. Bu

anket ikinci dönem sonunda öğrencilere verilmiştir. Anketin uygulanması sonucunda, öğrencilerin demografik bilgilerinin ve dersin değişik yönlerini değerlendiren ifadelerin frekans dağılımları elde edilmiştir.

Çalışmanın sonucunda öğrencilerin dersin Web sitesinin bulunmasından hoşnut oldukları ve Web sitesinde bulunan ve güncellenen servisleri kullandıkları anlaşılmıştır. Bunu yanısıra öğrenciler Web sitesinde destekleyici materyal olarak bulunan etkileşimli materyaller içindeki animasyonların öğrenciye hitab eden ve en yararlı yenilik olduğunu vurgulamışlardır.

Buna karşın, dersin amfi ortamında işlenmesi, derste pasif kalmaları, derse dikkatlerini toplayamamaları, ve etkileşimin azalması gibi nedenlerden dolayı öğrencilerin PowerPoint gösterileri ile ders işlenmesinden hoşnut olmadıkları ortaya çıkmıştır. Çevrimiçi sınav konusunda ise, öğrenciler kısa sınavlar bu şekilde verilmeye devam ettiği takdirde, sözkonusu sınavları istedikleri yer ve zamanda almalarının daha anlamlı olacağını bildirmişlerdir.

Anahtar Kelimeler: Web-Destekli Öğretim, Öğrenci algıları, Destekleyici materyaller, PowerPoint gösterileri, Çevrimiçi değerlendirme.

To My Parents, Zeliha and Hasan Hüseyin Yıldırım

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INTRODUCTION

1.1 Background of the Study

New emerging technologies are leading to major structural changes in the management and organization of teaching. These have the potential to enrich not only existing classrooms, but equally important, to allow institutions to reach out to new target groups such as lifelong learners, people in the work force, and the physically disabled (Bates, 2000). There are different rationales for using technology in higher education. Many educational institutions are experiencing the integration of new technologies in their instructional services. Bates (2000) stated the following reasons given by institutions for using technology:

- To improve instruction,
- To provide students with the everyday information technology skills they will need in their work and life,
- To widen access to education and training,
- To respond to the technical imperative,
- To reduce the costs of education,
- To improve the cost-effectiveness of education. (p. 16)

Use of technology in education has been investigated for many years. Technology is used for administrative and instructional purposes in education. It has many advantages such as accessing student information and materials anywhere and anytime. E-mail, presentation software, videoconferencing, the

World Wide Web, Multimedia, and CD-ROM are some of the major technologies recently introduced to instruction.

These new technologies are used either for providing classroom aid or distributed learning. Using presentation software to show illustrations and examples better, to reduce the instructors' role of transmitter of information, using statistical programs for calculations, or inviting a guest expert to the classroom by means of a videoconference may be some examples of using technology for classroom aid. On the other hand, distributed learning can be seen as a continuum (Bates 2000). At one end of the continuum, technology is used to supplement a somewhat reduced face-to-face teaching load, with the significant elements of the learning conducted through the technology by the learners on their own. At the other end of the continuum, learners study completely off campus.

Especially, Web-based approaches are coming into the educational institutions' vision. This is not just because of the technological advancements but also due to changing demands of the society (Bates, 2000).

It will be meaningful to indicate the rationale for using learning technologies such as Web in education from the universities' point of view, and from the students' point of view. Instruction will improve as it becomes more flexible, relevant, and interactive; and course materials will evolve along with the supporting technology (Kandies, Stern, 2000). Web-enhanced courses facilitate students to become more active learners as they take responsibility as co-discoverers of knowledge (Kandies, Stern, 2000).

The use of new technologies, especially the Web, involves a changing pedagogical paradigm (Kendies and Stern, 2000). The first change is from time-based learning to a lifelong learning model. Class attendance is far less important than learning a set of skills and concepts such as information acquisition, processing and evaluation. The new paradigm might be called "networked

learning" as opposed to classroom-centered instruction or achievement-based education.

Keenan (1996) stated that a teacher must first decide how extensively an instructor wishes to incorporate the Internet resources for his/her instruction. To make the decision simpler, she offered three models as examples of the increasing level of importance that Internet resources may take on in a course, these are Traditional Model, Transitional Model, and Distance Model. She indicated that teachers may wish to employ any variation or combination of these, to suit their own needs, noting that the models are evolutionary in design. After successfully adapting a Traditional course, they may want to move on to a Transitional course before they try a Distance course.

The first is the Traditional Model which maintains all of the elements of the basic classroom: fixed meeting time and place, traditional classroom (no computers), and the Internet is an additional resource for students to access on special trips to the campus computer lab, or in their own time. The Traditional model introduces the Internet to the class and directs them to explore it further as an alternate source of information for a specific assignment or a set of assignments. Smaller subsets of the Internet such as electronic mail, listservs, newsgroups, or bulletin board services, may alternatively provide instructors in the Traditional Model with a more manageable set of information than the World Wide Web. Ideally, the Traditional model incorporates several units of instruction on these technologies as appropriate complements to course materials.

The second is the Transitional Model which maintains the traditional elements of fixed meeting time and place, but that place may include regularly scheduled visits to the campus computer lab or an entirely computerized classroom. This model may also allow the instructor to eliminate space constraints by using electronic mail or chat software for asynchronous or synchronous exchanges, thus allowing students at remote sites to participate in

the class. The Transitional model introduces and continues to explore Internet concepts during class time, and incorporates the Internet not only as a supplemental resource, but as an alternate delivery mode for instruction and collaboration. Instructors in the Transitional model may post course materials to a syllaweb or to a class listserv, and may also allow students to submit assignments over electronic mail or to collaborate with each other through synchronous conferencing software.

The last one is the Distance Model which transcends traditional class boundaries by placing all materials, assignments, and resources on-line. Students do not meet in traditional class sessions; instead they exchange ideas and information entirely over the Internet, with possible exceptions for orientation sessions, office hours, or supervised examinations. The Distance model introduces, explores, and relies upon Internet concepts for its success throughout the semester.

Distance Model allows the students self-paced instruction and individualized attention through electronic mail, listservs, newsgroups, and synchronous conferencing, either on a local area network or in a Multi-User Domain. Distance instructors may also use Real-time video transfer over the Internet, which is quickly becoming more accessible to teachers and students for distance education, with some system add-ons available for under $100 per user. In conjunction with satellite capabilities, instructors in the Distance Model may exploit the Internet's "learn anytime, anywhere" to its fullest potential. Using these technologies, students may virtually participate in lessons from any geographic location, at any time.

As far as publishing a course Web site for a course is concerned, developing static Web pages has become an end-user activity that can be easily learned due to the many good development software tools on the market (Kendies and Stern, 2000). A basic course Web site could be developed by an instructor from existing materials if the instructor is competent in the use of any

word processor software. The teacher can make all the materials and resources readily available to students at any time of the day or night, make easy adjustments and updates to assignments, add announcements about course activities such as laboratory sessions or quizzes, and therefore manage lesson information flow with less lead-time than a paper environment would provide.

1.2 Purpose of the Study

This case study is designed to utilize the efforts that had already been expended towards applying Web-enhanced instruction in General Chemistry courses by the department of Chemistry and a state research institute. They designed, developed and maintained the course Web site, and developed interactive materials that included animations, which were published on the course web site. PowerPoint presentations were prepared by the instructor, and weekly quizzes were delivered online via a program developed by the state research institute mentioned above.

This study examined two General Chemistry courses, which were offered to the 1st year students of the department of Chemistry and the department of Chemistry Education in a state university in Turkey. The students' experiences and their perceptions about the Web-enhanced General Chemistry course were the main data gathered for the study. At the end of the study, a large and descriptive picture of the Web-enhanced courses, General Chemistry I and II was obtained from the students' point of view.

In such a setting, students' perceptions towards those new implementations needed to be investigated in order to develop better practices. So this study is designed to diagnose students' perceptions toward these new approaches in their General Chemistry courses, and their expectations of better practices.

1.3 Problem Statement

The main research question of this study was "What are students' perceptions pertaining to Web-based applications and activities in an introductory Chemistry Course?"

In this respect, this study aimed to find answers to the following sub-questions:

1) What are students' perceptions pertaining to the course Web site?
2) How do students perceive Web-based materials intended to support their learning?
3) In what ways do the students perceive the PowerPoint presentations during lectures and self-paced learning?
4) How do students perceive online assessment in terms of their achievement?

1.4 Significance of the Study

In educational settings, many new technologies and approaches are offering better instruction as the technology improves in capacity. However, if there is achievement, little is known about what yields this: the effect of media used, the effect of instructional strategies, the effect of some learners' characteristics, or any other factor. In addition, students' habits, background, capabilities and attitudes are also determining factors in whether a new instructional strategy will work or not.

The use of Web-based and Web-enhanced instruction is growing rapidly. There is much information and discussion surrounding the layout of content on the screen and facilitating communication, although little information is available regarding the students' perception and use of online instruction (Kaminski and Rezabek, 2000, ¶ 1). In fact, learners' perceptions are key factors

in determining better ways of delivering instruction. From this point, this study aimed to diagnose students' perceptions who took General Chemistry course I and II, in which Web-enhanced instruction was used, towards Web-enhanced instruction in a general sense. It is crucial to expose whether any media or delivery of instruction is adopted by students for attaining the instructional goals.

The findings of this study provided what were students' perceptions about the course Web site, Web-based supportive materials, lecturing with presentation software, and online assessment, in terms of their experiences, difficulties, positive thoughts and expectations.

If instructors ignore the requirements and difficulties of Web-enhanced instruction, and try to adopt it unconsciously with previous habits and procedures, it will probably result in misuse of the technology and finally in failure. Thus, there is a strong need to understand all the features of Web-enhanced instruction including its strengths, weaknesses, procedures and requirements in its planning and implementation processes for better practices.

1.5 Definition of the Terms

Perception: The extraction of information from sensory stimulation. *Note:* Perception is an active, selective process, influenced by a person's attitude and prior experience. In all forms of communication, perception is the crucial link between incoming stimuli and a response that is meaningful. **2.** the result of perceptual processing; comprehension; understanding. **3.** the direct, intuitive recognition of truth, beauty, value, etc., especially in moral or artistic judgements; insight (http://www.lblp.com/definitions/perception.htm). All of the three meaning given above are meant in many part of this study. But the 1st one has a closer meaning to the researcher's use of this term.

Web: the World Wide Web, which is one of the services of the Internet that is used through browser programs such as Internet Explorer, Netscape Navigator, etc.

Web-Enhanced Instruction: Use of technology to enhance instruction during design, development, implementation, and evaluation phases.

Animation: Computer animations that were prepared with Java programming language or Macromedia Flash program. They are motion pictures illustrating some chemical concepts that are challenging and abstract and that are placed in the supportive instructional materials. The instructor shows these animations in the lectures as well.

Interactive Materials: Supportive materials that contain explanations, definitions, formulas, and animations, for the students to apply to their self-paced study and which are accessed via the hyperlink: "Interactive" in the course Web site. It is sometimes used as supportive interactive materials, also called Web-based interactive supportive materials.

PowerPoint Presentations: Presentations prepared with Microsoft PowerPoint by the instructor. They are used during the lectures and are available in the course Web site with the hyperlink: "Lectures", for the students' individual study.

E-quiz: Weekly quizzes given via the Internet in a computer laboratory on campus, synchronously, in two sessions.

Information Boxes: Boxes that are accessed via hyperlinks within the text placed in the interactive materials. They contain answers to questions within the text, formulas, or additional information.

CHAPTER 2

REVIEW OF LITERATURE

An extensive review of literature was conducted according to the research questions stated below.

The main research question of this study was "What are students' perceptions pertaining to Web-based applications and activities in an introductory Chemistry Course?"

In this respect, this study aimed to find answers to the following sub-questions:

1) What are students' perceptions pertaining to the course Web site?
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4) How do students perceive online assessment in terms of their achievement?

2.1 Use of Technology in Teaching

In considering large classes in large lecture theatres, the main problem is usually analyzed as the lack of interaction and the consequent extreme passivity imposed on the audience. Large numbers usually prevent learners from asking sufficient questions to repair the attunement between the speaker and the audience, both from a pragmatic (there isn't time for any people to ask questions) and a social (it just feels too embarrassing) viewpoint (Drapper, Cargill; Cutts, 2002). So some alternative ways are inevitable to provide students learn better. Technology seems to be a powerful candidate to fulfill this requirement.

Bates (2000) stated that teaching through technology can, under the right circumstances, have the following advantages over traditional classroom teaching:

- Learners are able to access high-quality teaching and learning at any time, any place.
- Information previously available only through a professor or instructor is accessible on demand through computers and the Internet.
- Well-designed multimedia learning materials can be more effective than traditional classroom methods because students can learn more easily and more quickly through illustration, animations, different structuring of materials, and increased control of interaction with learning materials.
- New technologies can be designed to develop and facilitate higher order learning skills, such as problem solving, decision-making, and critical thinking.

- Interaction with teachers can be structured and managed through online communications to provide greater access and flexibility for both students and teachers.

- Computer mediated communication can facilitate team teaching, use of guest faculty from other institutions, and multicultural and international classes (p. 27).

Neuhoff (2000) stated that presentation software can provide students with an opportunity to become actively engaged in classroom demonstrations of computerized experimentation without requiring any programming knowledge on the part of the instructor. Given that many experimental techniques involve computerized presentation of stimuli; this is one area in which multimedia instruction has clear advantages over more traditional pedagogical methods (¶ 14).

Wilmoth, and Wybraniec (1998) also indicated that computer presentations can act as useful tools in courses like social statistics and methods (¶ 1).

Atkins-Sayre et. al. (1998) conducted an exploratory research study which presented students' perceptions of PowerPoint presentations used by college instructors in a basic Fundamentals of Public Speaking course. They collected data to determine the results in four primary areas: general questions about PowerPoint use; the perceived effectiveness of PowerPoint; demographics of the respondents; and student preference for future use. Four hundred and eighty-five (N=485) surveys were collected from participants. Respondents ranged in age from 17-57 years old with a mean age of 24. The results of their study indicated that: (1) 29 percent of the students had been exposed to PowerPoint in other classes, and 33 percent had given presentations using it; (2) students had a higher effect for classes using PowerPoint as a lecture tool; (3) 69 percent of the students perceived PowerPoint as a cognitive aid; and (4) the use

of the technology significantly increased the desire for Hispanic students and English-as-a-second-language students to want to see the technology used in other classes (¶ 1).

About design of the presentations with presentation software, Chalupa, and Sormunen (1996) conducted a study to discover how people learned to prepare presentations with presentation software. Usable surveys were received from 282 (23.5%) subscribers to a computer magazine, of whom 91.5% had taught themselves the use of presentation software. Less than 40% had graphic design training; about half recognized a need for it. Printed documentation was the most common means of support when learning how to prepare presentations.

2.2 Web-Enhanced Instruction

The Web attracts students as a learning mode as it restores the intrinsic value in learning, namely, enjoyment, since a more exploratory style is reinforced (Kendies and Stern, 2000). However, Rice, McBride, and Davis (1998) pointed out that learners need to perceive Web-based instruction as something they can use, find worth the effort to use, and want to use (¶ 41).

Kendies and Stern (2000) pointed out the value added to instruction with the Web as following:

> As in any traditional course, students will continue to attend classes, listen to lectures, ask face-to-face questions, participate in individual and group projects, and do homework. The learning enhancement is the opportunity to conduct research on the Web, e-mail teachers and classmates, submit multimedia projects, practice critical thinking, and learn to "synergize" information in the nonlinear environments of the network.

Nicholas and Laudato (1999) conducted an assessment study to diagnose the impact on students of online materials in university courses. They included

students and faculty members of 20 courses with 1850 student seats. Students reported that they liked online materials and that the online environment contributed to their learning. Students clearly want these enhancements in their courses. Providing outlines of lecture notes prior to a class allows students to organize information before class and spend more time listening in class. Students reported that procedures as simple as providing lecture outlines have a major positive impact on their learning (¶ 45). For the faculty, they concluded that given a well-supported tool that enables them to use the Web for on-campus course enhancement, without requiring extensive technical knowledge, faculty will respond positively by implementing the tool, as in case of a dramatic use a dramatic growth in the use of CourseInfo, a course management program, at their university (Nicholas and Laudato, 1999, ¶ 58).

The Web is a way to give students, teachers, and administrators more flexibility, even in a traditional classroom. Students can access course materials from anywhere via the Internet.

An underlying goal of the Web-enhanced course is to enable students to acquire the conceptual background and online skills needed to achieve Internet competency, and to awaken them to the Internet's incredible potential in education. The first major objective is to instruct students in the broad range of basic Internet services, such as email, listserv, telnet, FTP, and the WWW. The second objective is to challenge students with innovative methods of course development and delivery via electronic means (Kendies and Stern, 2000).

Kendies and Stern (2000) stated that a computer is not a substitute teacher or tutor with boundless patience, but it is a personal access tool in an information-rich environment. Thus, courses must provide the impetus to master the new tools of the trade.

The contemporary student is comfortable with technology and also expects to use it in school. Many of today's students are already using the Web

for entertainment and peer communication. So it can also be used in education (Kendies and Stern, 2000).

According to Branson (1991), in the age of electronic information in which we live, the teacher is no longer at the center. The center is occupied by accumulated knowledge and experience, to which students have direct access. Students learn not only by following the teacher; they learn along with the teacher and by interacting with one another. He stated that students are bound to learn much that the teacher does not know (cited in Menges, 1994, ¶ 3).

Kendies and Stern (2000) listed a range of issues in the form of questions that should be addressed by teachers designing and developing Web-enhanced course:

- What is the guiding philosophy of Web-enhanced course design?
- Can the Web improve instruction and course management?
- What design issues are involved for a course Web environment?
- What additional pedagogical benefits accrue for student and teacher?

However, the use of technology for instruction is not always successful. Kendies and Stern (2000) stated that the ineffective use of technology has not reflected its broad acceptance by today's young people.

Technical Support Need for Interactive Web site

The developments in Web technology play an important role on the increasing advantages of the Web such as providing interactivity. As interactivity capability of the materials on the Web increases, its effectiveness and usage rate also increase. However, developing and maintaining interactive Web pages usually require some expertise on the part of the teacher or on the part of third-party developer/vendor (Kendies and Stern, 2000). Developing Web pages that are highly interactive for a good pedagogical structure is a difficult task for users

who are educators, not technicians. So there is a need for technical support to develop and maintain an interactive Web site.

Materials to be viewed on a computer screen have to be designed with an awareness of interrelation of visual composition and presentation to the students' understanding and motivation. Kendies and Stern (2000) claimed the five principles of graphic user interface design that come into play for a Web environment. These are the use of metaphors, direct user manipulation, consistency, and perceived stability, feedback dialog, and aesthetic integrity. They also pointed out that design must also consider the possibility that visual elements and non-discriminating choices can become a distraction in a learning environment if they do not support the primary objective of a particular educational activity. They advised these questions to be answered: "What will the student absorb? How will the experience built their knowledge base, feed analytical processes, and stimulate creative reflection?"

Students become part of a community of learners/scholars by participating in and contributing to the universal repository of knowledge (Kendies and Stern, 2000). Of course, this model requires more independence and self-motivation, and some students do not consider themselves computer literate and can be intimidated by online materials.

Only putting the course materials on the Web has no pedagogical value. According to Fraser (1998, cited in Kendies and Stern, 2000) the best way to evaluate whether value is added by using a new technology is to assess "the extent to which the material cannot be produced in the older medium".

The technology-incentive model of course delivery is criticized since it decreases the interaction between students and faculty. However, encouraging use of e-mail for "anytime, any place" questions can actually increase interaction, though asynchronously. Especially shy students, who would never raise a hand in class to ask a question or express an opinion, find e-mail an

effective way to "speak-up" and be part of the class discussion (Kendies and Stern, 2000).

Simon suggested that computers can bring about a revolution in education only if their use is accompanied by improvements in our understanding of teaching and learning (1991, cited in Kendies and Stern, 2000).

2.3 Web-Based Supportive Materials

Because of various classroom situations and numerous individual differences, teachers tend to seek non-traditional tools eagerly for improving student learning, especially in science and math. Educators have responded to the need for relevant learning experiences by using the Internet and the Web. The Web has become one of the best sources of information; however, looking for an exact curriculum standard can be exhausting and time consuming.

G. Gunter and R. Gunter (1998) highlighted the changing needs of textbooks for classrooms. They looked at the availability of textbook information on Web sites and they divided the Web support for the textbook into three levels: (1) Textbook information Web sites - including general information about the book, (2) Textbook companion Web sites – offering extensive resources, and information about the books in a teacher-centered manner, and (3) Web-enhanced Textbook sites- offer extensive resources both for teachers and students. They stated that the third level, Web-enhanced textbooks have the most potential to change the way teachers teach and students learn (¶ 16). They proposed that in the near feature, hundreds of Web-enhanced textbooks will emerge to:

- Offer teachers chapter-by-chapter organized and hyperlinked educational resources that are maintained at the publisher's Web site

- Provide relevancy and currency by being continually updated by the publisher and evaluated by educators
- Save students and teachers time by laying out information in an easy-to-navigate style
- Offer students information and discovery learning avenues on thousands of topics (¶ 17).

The concept of discovery learning is very crucial for students and teachers. Students often do not understand some topics well enough by merely reading textbooks. G. Gunter and R. Gunter (1998) proposed that students could interact with the textbook's Web site to gain a more in-depth understanding and complete practice tests to evaluate their knowledge and better prepare for classroom examinations (¶ 18).

2.4 Animations

A review of relevant literature on computer animation was not encouraging both in terms of the number of previous studies conducted, and of outcomes reported. Only few studies have been done on the specific instructional effects of animation, although computer-based instruction has been studied in some depth. Results of the studies that have been undertaken are inconclusive regarding the benefits of instruction in this way (Rieber, 1990a, cited in Nicholls et. al., 1996, ¶ 4).

"If a picture is worth thousand words, what is an animation worth? A thousand pictures? A million words? The fact is, animation is able to convey a vast amount of information in a very short period of time and can be a powerful method of reinforcing concepts and topics first introduced to students through text, discussion and other media." said Doyle (2001, ¶ 4). He also claimed that

animations can enhance understanding by depicting real objects slowed down as in a beam of while light passing through a prism and emerging from the other side as the separate wavelengths of the spectrum- or by depicting actions that have been sped up, such as the melting of arctic ice caps. Besides these, he proposed that, in his study with seventh graders, when the students were given topics to explore and then asked to create their own animations, they became deeply engage in creating original and compelling solutions to problems, so their motivation to learn increased (Doyle, 2001, ¶ 4).

In a study involving determination of average speed, Beak and Layne (1988, cited in Nicholls et. al., 1996, ¶ 5) found that a lesson including animated graphics lead to higher scores on a post-test than lessons with either still graphics or text only. However, in an earlier study of student estimates of answers to various algebra word problems, including determination of average speed, Reed (1985, cited in Nicholls et. al., 1996, ¶ 5) found no difference between groups seeing a moving simulation and groups provided with textual clues in place of the simulation. Beak and Layne explained this inconsistency by arguing that graphics used in conjunction with a textual explanation of the graphics are more effective than when simply replacing text (Nicholls et. al., 1996). Beak and Layne also stated that insignificant results may have resulted from the possibility that the graphics used in those studies were too difficult for subjects to comprehend or did not focus sufficiently on lesson objectives (Nicholls et. al., 1996, ¶ 5).

Typical studies of animation have involved concepts of rules that can be illustrated through motion such as Rieber's studies (1989, 1990b, Nicholls et. al., 1996) presenting Newton's laws of motion, or Reeds' (1985) Nicholls et. al., 1996) and Beak and Layne's (1988, Nicholls et. al., 1996) studies involving lessons of average speed. Others have used animation to present lessons where motion is not applicable.

A precise, narrow focus is generally a strength in experimental design. However, it may be that in some of the studies described, the animation played too circumscribed a role in the overall lesson, or perhaps the nature of the lessons limited the extent to which animated support could be developed (Nicholls et. al., 1996).

In their study, following Rieber's description of attention-gaining, presentation, and practice as the three potential functions of animation, Nicholls et. al.(1996) found that animations were effective in a number of areas as a supplement to existing instruction, i.e. practice (¶ 45).

2.5 Online Assessment

Online assessment has become a favorite component of Web-based instruction, and course management systems as well. Charman and Elmes (1998) and Sly and Rennie (1999) provide some evidence that students perform better when computer-based assessment is used, especially for frequent formative testing. In addition, The benefits of computer-based assessment, both for staff and students, are well documented. They include rapid formative feedback to students, reduced marking load for staff, and a closer match between the assessment and learning environments (Brown et al., 1999).

However, Ricketts and Wilks (2001) stated that issues relating to student performance should be carefully considered when computer-based assessment is introduced. In particular, they suggested that the mode of presentation of assessments can significantly influence student performance, and that appropriate screen design is perhaps the most important factor in online assessment.

2.6 Specific Research Studies

Harms, Krahn, and Kurz (1998) developed a multimedia learning environment, namely Slice (self-directed learning in an interactive computer environment). Slice integrated textual material, animation, simulation, and video (from laser disks) and provided, in its extended version, links to a computer algebra system. Slice operated under Windows using Toolbook. They developed one prototype unit 'oscillatory motion'. The topics cover part of the first-year introductory physics course for all engineering disciplines: simple, damped and driven oscillations. Slice is intended to develop and foster self-learning abilities as an essential prerequisite for lifelong learning and continuing education.

Two main teaching/learning modes have been investigated: a standard 'lecture' - in a modified format- presented in the physics lecture hall with strong emphasis on the Slice material to motivate students (students could use Slice in the PC pool from the server) and a 'lecture' in the PC pool: guided teaching units (90 minutes each) in the PC pool were supplemented by lectures in the physics lecture hall to show live experiments and video disks.

For evaluation of Slice, the students answered a set of questionnaires concerning the lecture, computer use (user interface and physics content of the books), time budget, course booklet and learning progress. The questionnaires were supplemented by interviews in small student groups.

The main results of the evaluation were summarized as follows. (1) The students had few problems with the user interface (icons, buttons, etc.). (2) The PC pool was too small and therefore overcrowded during the sessions, causing, in addition, a high noise level. Interaction with the 'lecturer/mentor' was reduced by the physical set-up of the PC pool in traditional rows facing the blackboard (It should be mentioned that a redesign of the 'lecture room' as a 'physics studio' was successfully introduced in the Cuple project at Rensselaer). (3) A post-test versus pre-test comparison revealed less progress in learning than anticipated by the authors. The main problem for the students was coping with the given

freedom of self-guided learning and self-pacing. From secondary schooling the students seem to be 'educated' to prefer a teacher-centered teaching mode rather than the self-dependent learning mode possible in the multimedia approach. It seems to be difficult to change these habits in first-year students (Harms, Krahn, and Kurz, 1998, ¶ 21).

Another similar study was conducted by Sanders and Morrisson-Shetler (2001). They examined student attitudes toward the introduction of a Web component into a general biology course for undergraduate nonmajors at a midsized rural university. The Web component primarily allowed asynchronous learning outside the classroom and increased student-to-student interaction. Students could use the Web site to Web access chapter outlines, grades, critical-thinking and problem-solving questions, self-grading quizzes, and the course syllabus.

It was found that the Web component had a highly positive effect on student learning, problem-solving skills, and critical-thinking skills. The effects of the Web-enhancement tool were assessed using essays, short answer and multiple choice questions, and in-class discussion. The attitude of females in the course toward Web-based learning was found to be significantly more positive than that of males. Furthermore, females in the class were found to use the Web more often than males. Student use of the Web was found to be independent of age, race/ethnicity, year in school, computer experience, and learning style. The fact that there was no relationship between attitude and learning style indicated that the materials posted were suitable for all types of learners.

Most students used the Web to take quizzes, post to the bulletin board, access their grades, and download chapter outlines and critical-thinking and problem-solving questions. All of these facilities allowed for asynchronous learning. The chat room was the least used Web component, possibly because it required the students to log on at specific times (synchronous learning). However, the majority of the students did access the logs of each of the chat

sessions that were posted on the Web. Findings from this study suggest that instructors should use the Web for the posting of course syllabi, grades, quizzes, questions, and materials that encourage student-to-student and student-to-faculty interaction. The materials posted to the Web should address the different learning styles of the students and be diverse and interesting enough to encourage student participation.

2.7 METU Case: Course Web Site and Materials for General Chemistry Course I and II

"General Chemistry I, and General Chemistry II" courses were offered as must courses successively, in the Fall and Spring semesters of 2001, at Middle East Technical University (METU). These courses aimed to provide the students with a basic understanding of the fundamental principles and theories of Chemistry. The section that consisted of first grade students of Chemistry and Chemistry Education was used in this study. For this section, the lectures were given mostly by using PowerPoint presentations, the course Web site that contains the presentations used in the lectures and interactive materials was introduced, and the quizzes were delivered via the Internet.

The course Web site and the interactive materials were designed and developed by a commission whose members were a number of professors from the department of Chemistry, and researchers and programmers from a state research institute.

The course Web site had some components for students to access supportive materials and to facilitate instructor-student interaction. Each student could access the Web site with his/her own password. The components in the Web site were: My Profile, Grades, Dates/Places, Quiz, Assessment, Syllabus, Lectures, Laboratory, Interactive, Problems, Ask a question, and Contacts. Figure 2-1 shows a sample screen from the Web site.

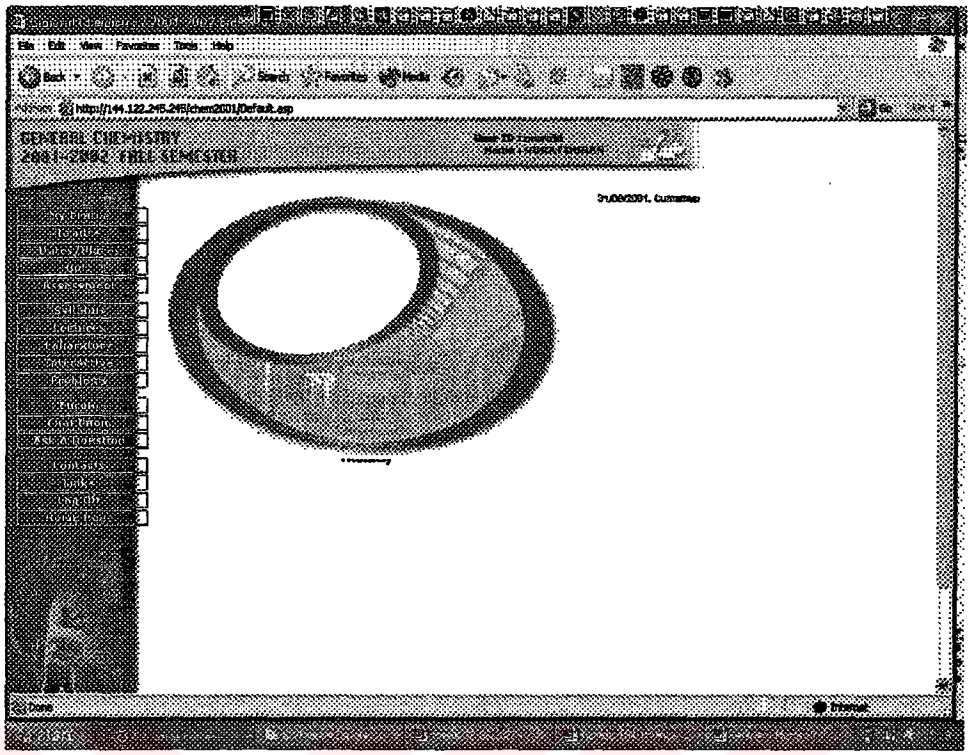


Figure 2-1
Sample screen from the course Web site

"My Profile" is a component that makes it possible for students to enter their own personal data and demographics. This enables the instructor to learn the profiles of his/her students. Figure 2-2 shows a sample screen from My Profiles.

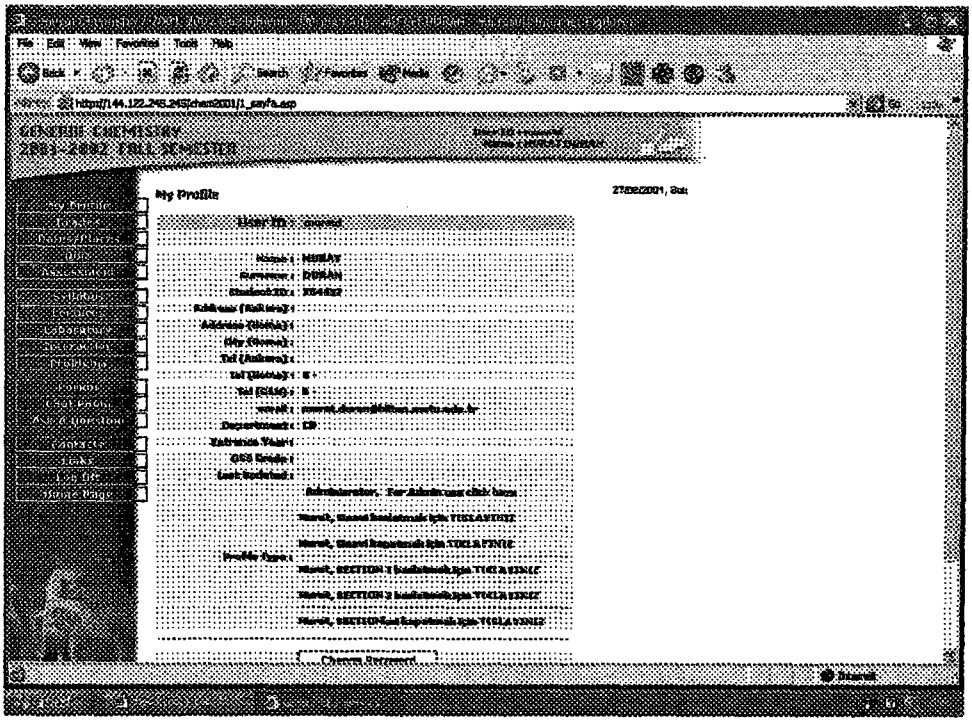


Figure 2-2
Sample screen from My Profile

In the "Grades" part, students can see all of their grades from the General Chemistry course so far, such as quizzes and midterms. This component helps students monitor their own progress and learn their grades confidentially.

The "Dates/Places" component helps students learn the assignments, time and places of quizzes and exams before the events. It is a kind of bulletin board used by the instructor to announce important events regarding the course.

"Quiz" is a part that only becomes active in the quiz times. The students log on to the system, and open the quizzes in the laboratory at the same time. The quizzes consist of multiple-choice questions. So the students select their answers and send the answers online just by clicking a send button. The class takes the quizzes in two groups with two sessions successively.

"Assessment" is a component in which some questionnaires about to the course were given to the students.

"Syllabus" is a part in which the course content and sequence are given briefly.

"Lectures" is the component that contains the PowerPoint presentations used in the lectures. These presentations were published on the Web site so that the students could follow which subjects were covered or emphasized in the lectures for a unit or a chapter. There are 12 presentations for each semester. Some sample screens from the presentations are given in Figures 2-3 and 2-4.

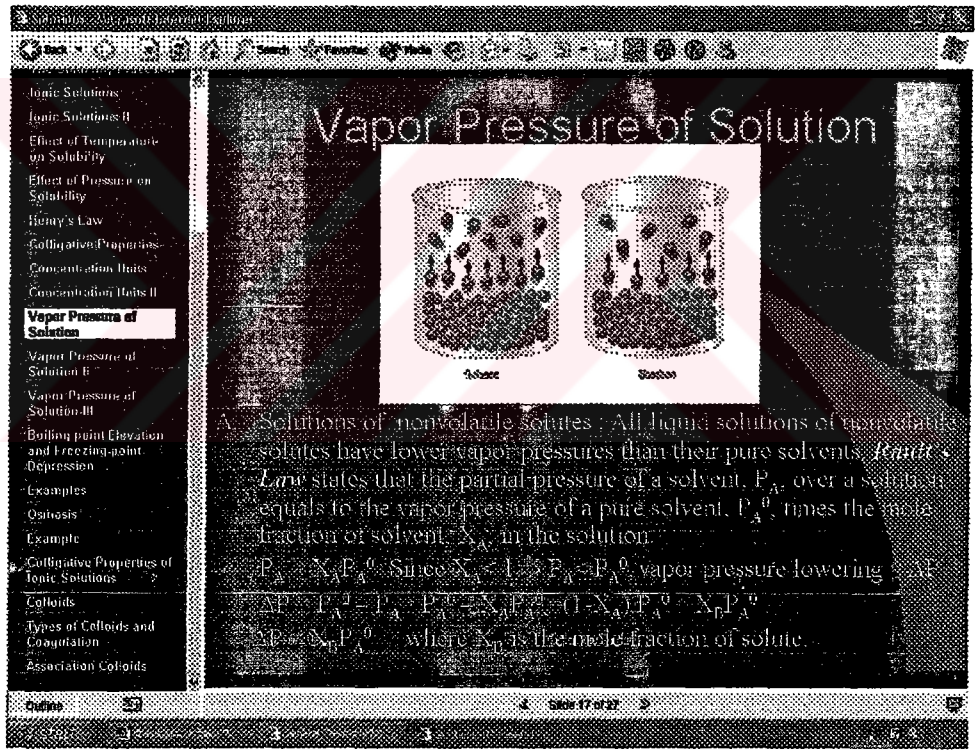


Figure 2-3
Sample screen from PowerPoint presentations

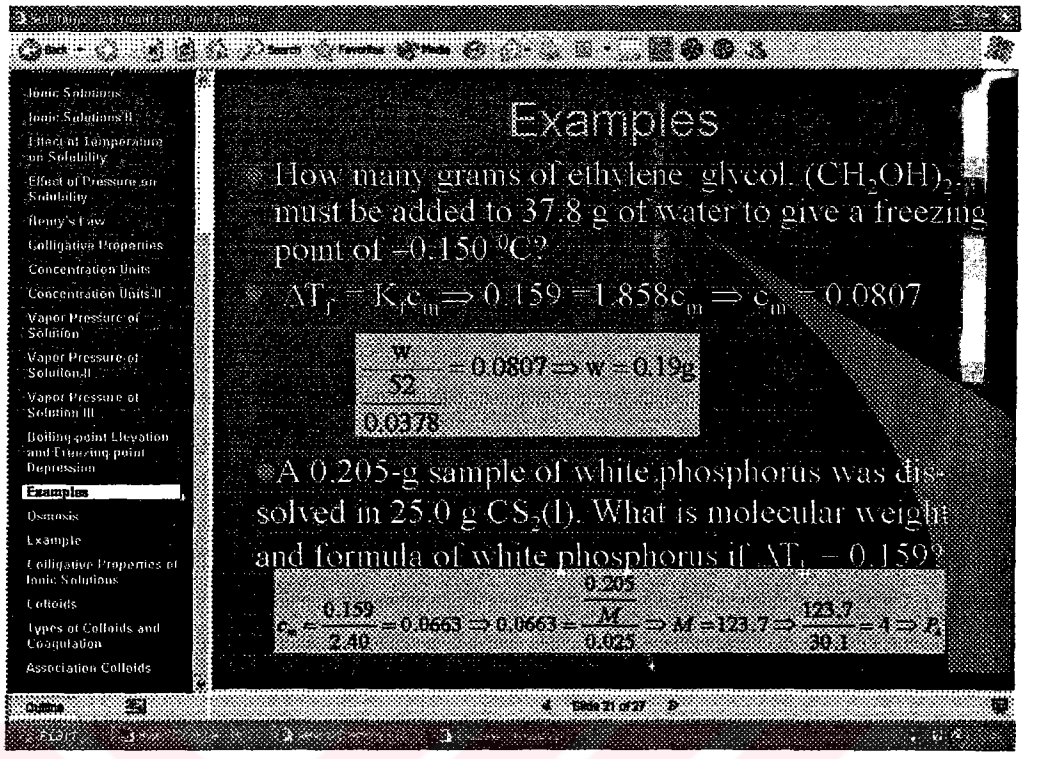


Figure 2-4
Sample screen from PowerPoint presentations

In the "Laboratory" part, the list of laboratory experiments that will be done is given. In addition, two experiment simulations take are given in this component.

"Interactive" is a hyperlink that provides access to the interactive materials a sample screen of which is shown in Figure 2-5. The main objective of these materials is to help students learn abstract chemical concepts, especially by means of animations. Students use them when they study the course, and the instructor sometimes applies the animations within these materials during the lectures.

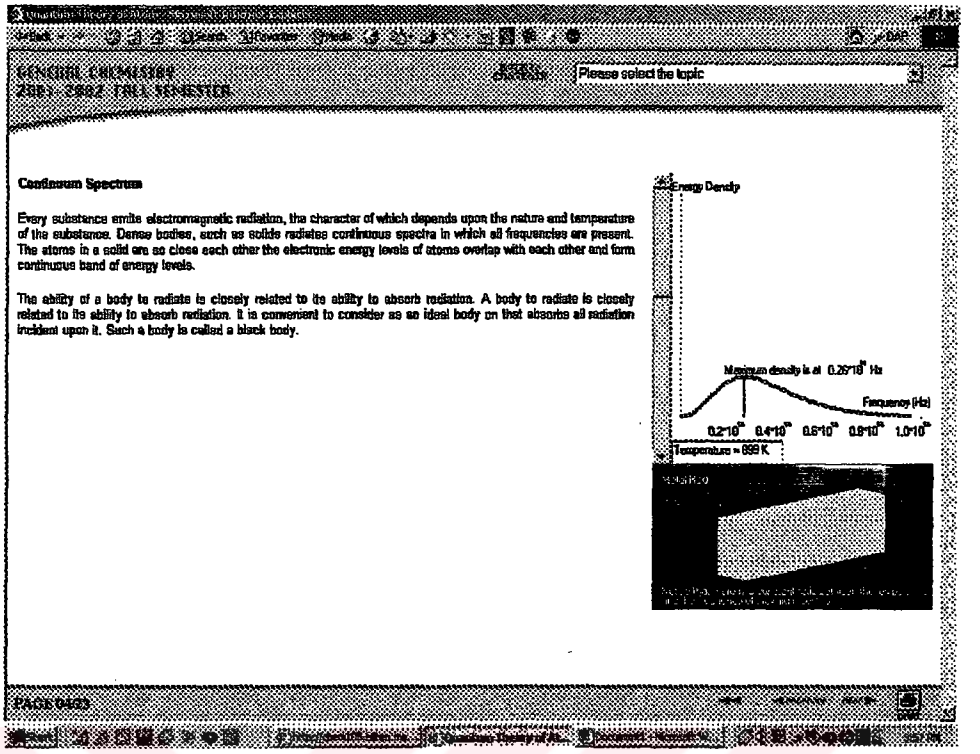


Figure 2-5
Sample screen from interactive materials

The "Problems" part contains some assignments for each chapter from the textbook and their solutions. Figure 2-6 shows a sample screen from the Problems part. The students are supposed to note the assignment problems, try to solve them and check the answers in this component. It is thought of as a fast feedback mechanism for the students. Figure 2-7 shows a sample screen from the solutions of problems in this component.

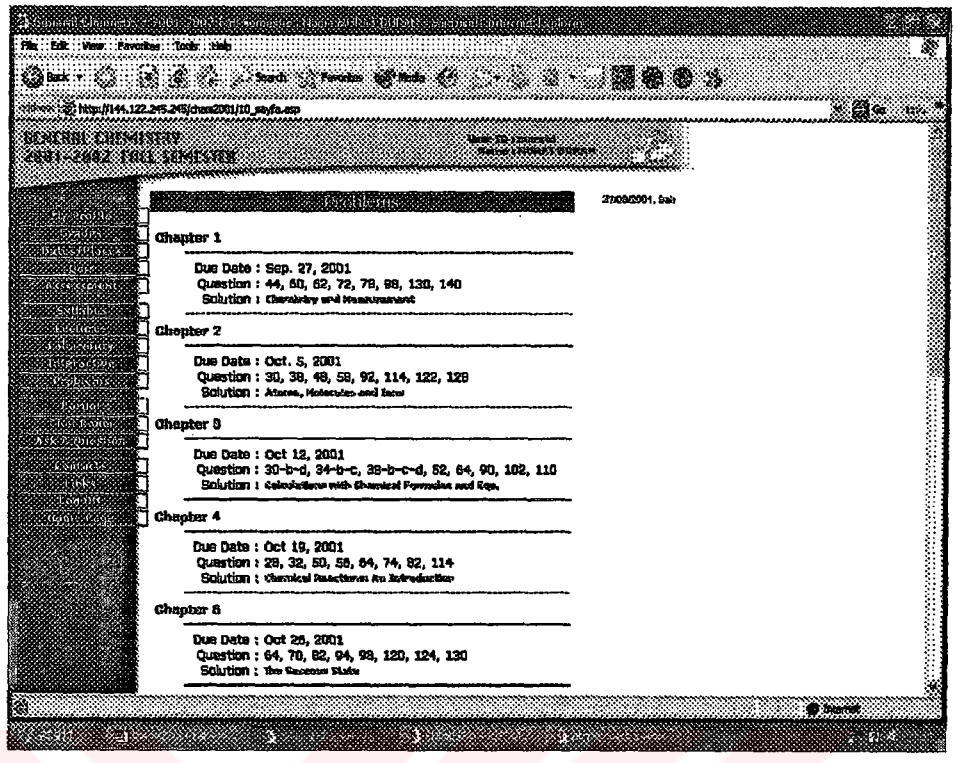
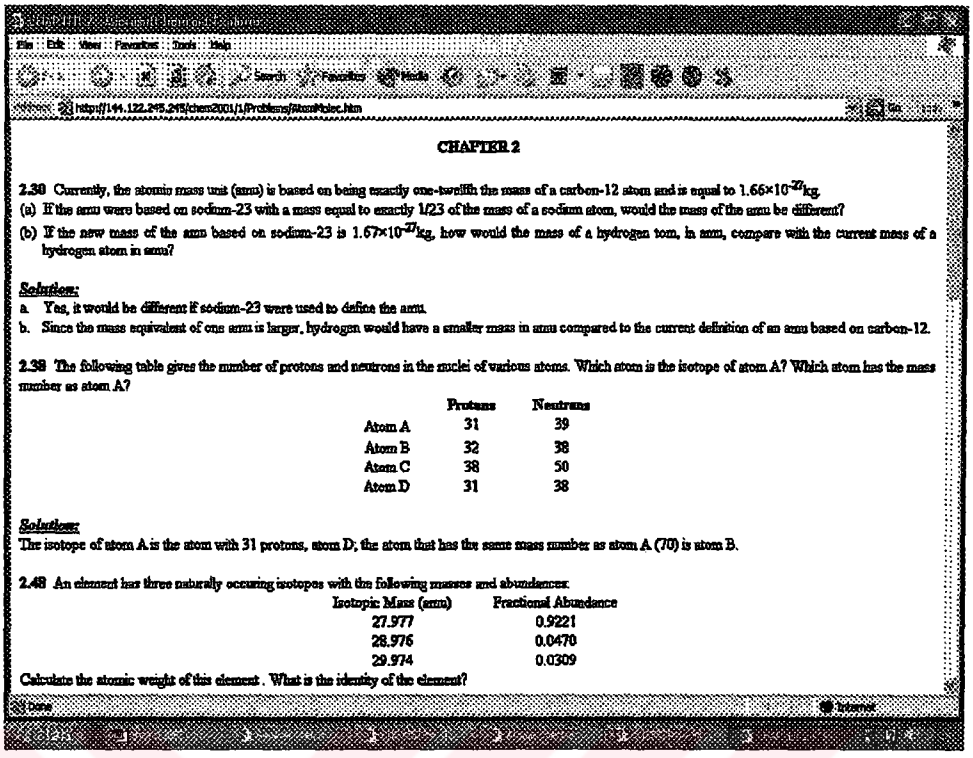


Figure 2-6
Sample screen from Problems



CHAPTER 2

2.30 Currently, the atomic mass unit (amu) is based on being exactly one-twelfth the mass of a carbon-12 atom and is equal to 1.66×10^{-27}kg.
(a) If the amu were based on sodium-23 with a mass equal to exactly 1/23 of the mass of a sodium atom, would the mass of the amu be different?
(b) If the new mass of the amu based on sodium-23 is 1.67×10^{-27}kg, how would the mass of a hydrogen tom, in amu, compare with the current mass of a hydrogen atom in amu?

Solution:
a. Yes, it would be different if sodium-23 were used to define the amu.
b. Since the mass equivalent of one amu is larger, hydrogen would have a smaller mass in amu compared to the current definition of an amu based on carbon-12.

2.38 The following table gives the number of protons and neutrons in the nuclei of various atoms. Which atom is the isotope of atom A? Which atom has the mass number as atom A?

	Protons	Neutrons
Atom A	31	39
Atom B	32	38
Atom C	38	50
Atom D	31	38

Solution:
The isotope of atom A is the atom with 31 protons, atom D; the atom that has the same mass number as atom A (70) is atom B.

2.48 An element has three naturally occurring isotopes with the following masses and abundances:

Isotopic Mass (amu)	Fractional Abundance
27.977	0.9221
28.976	0.0470
29.974	0.0309

Calculate the atomic weight of this element. What is the identity of the element?

Figure 2-7
Sample screen from Problem solutions

"Ask a question" is the other feedback mechanism in the course Web site. The students have the opportunity to ask their questions about missing points; that is, regarding missing concepts in their minds related to the course, assignments, quizzes, materials or the Web site.

"Contacts" is the last part in the course Web site. The e-mail address, room number and office phone number of the instructor and course assistants are found here.

CHAPTER 3

METHOD

This chapter presents the overall design of the study, participants, the case, data collection instruments, data collection procedures, data analysis procedures, and limitations of the study.

The main research question of this study was "What are students' perceptions pertaining to Web-based applications and activities in an introductory Chemistry Course?"

In this respect, this study aimed to find answers to the following sub-questions:

1) What are students' perceptions pertaining to the course Web site?

2) How do students perceive Web-based materials intended to support their learning?

3) In what ways do the students perceive the PowerPoint presentations during lectures and self-paced learning?

4) How do students perceive online assessment in terms of their achievement?

3.1 Overall Design of the Study

The purpose of this study was to investigate the perceptions of the students about the Web site of a General Chemistry course, the supportive materials in this Web site, and the PowerPoint presentations used in the lectures or self-paced learning. Mainly qualitative methods were used. The major advantage of qualitative study is that it allows the researcher to study an individual instance of a phenomenon in great depth (Borg, Gall, and Gall, 1993). The main purpose of the study was to get a complete and in-depth understanding of students' perceptions about Web-enhanced instruction through their experiences and expectations in an introductory Chemistry course.

This study is a case study because it focused on a section of a class. Case studies become particularly useful where there is a need to understand some particular problem or situation in great depth, and where one can identify cases rich in information- rich in the sense that great deal can be learned from a few exemplar of the phenomenon in question (Patton, 1987). However, where a single researcher is gathering all the information, selection has to be made. The researcher selects the area for study and decides which material to present in the final report. It is difficult to crosscheck information, so there is always the danger of distortion (Bell, 1999).

Students' perceptions about the new approaches to instruction need to be investigated for better practices in education. In fact, many evaluation studies for educational programs and materials address the learners of those programs or the users of those materials as the main data source.

As the first step of the study, the researcher conducted an extensive literature review on such topics as Web-enhanced instruction, use of presentation programs in education, Web-based supportive materials, and online assessment, which was presented in Chapter 2. The literature review made it possible for the researcher to identify the advantages and disadvantages of Web-enhanced instruction; use of presentation programs, Web-based supportive materials and

online assessment. Afterwards, the researcher prepared data collection instruments to be used for investigating students' perceptions about the new implementations of a Web-enhanced General Chemistry course.

This study focused on 143 students (76 males, 67 females) who took General Chemistry courses I and II. They took General Chemistry I in the Fall semester and General II course in the Spring semester within the 2001-2002 academic year, consecutively. As far as the participants of the study are concerned, from the section that is mentioned above, 20 students participated in the focus-group interviews, and 91 students took the questionnaire.

In the next step of the study, towards the end of the fist semester, the focus-group interviews were conducted. There were five focus group interviews, one of which was the pilot study. Later, group interviews with students were held to reveal students' perceptions about (1) the course Web site, (2) the interactive materials in the course Web site, (3) use of PowerPoint presentations in the classroom and for individual study, and (4) online quizzes.

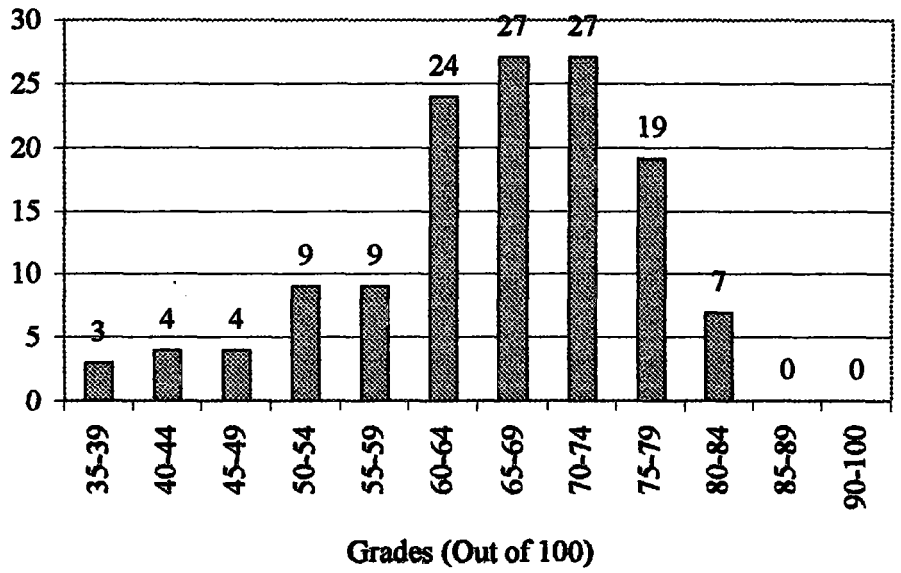
The data collected through focus group interviews were subjected to a content analysis. The data were labeled by using descriptive codes to simplify the thickness and complexity of data. The codes were collected under manageable themes. The themes that were formed by the researcher helped to identify students' perceptions about the course Web site, Web based supportive materials, use of PowerPoint presentations in the classroom and for self-paced learning, and online quizzes.

Finally, a questionnaire was prepared by the researcher in the light of the findings of the interviews to reveal the perceptions of the whole class about the critical issues drawn from the interview results. This instrument was developed in order for the researcher to validate the results of the interviews.

3.2 Participants of the Study

The participants of this study were from one of the sections of General Chemistry I and II in the 2001 Fall semester. In that section, there were 143 students from the department of Chemistry and Chemistry Education. The students were freshmen. The cumulative GPA of the students was in the range of 0,60-4,00 out of 4 with a mean score of 2,27 (N=70). For General Chemistry I, the mean score was 65,7/ 100 (N =135), and for General Chemistry II it was 59/ 100 (N= 136). The frequency distribution of grades for the General Chemistry I and II were illustrated in Figure 3-1.

All the students in this section had participated in IS 100 ("Introduction to Information Technologies and Applications"), which is the computer literacy course in METU. The general objective of IS 100 is to introduce all concepts and applications in their preparatory school or freshman year, to prepare them to use these skills during their undergraduate studies in their respective disciplines, and in their future professional lives. The catalog information about the course is "Introduction to computers in computer hardware and software, word processors, spreadsheets, computer networks and Internet browsers". The material is taught totally in laboratory". The course was offered in a hybrid format, which both employed face-to-face and online instruction. A significant part of the course learning was online, so classroom seat-time was reduced.



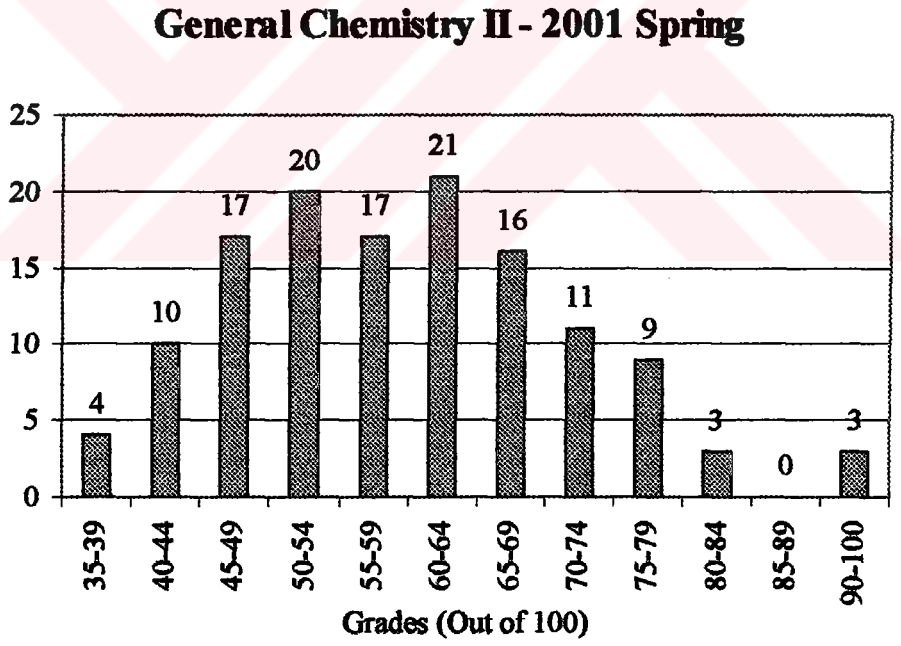


Figure 3-1
Frequency Distribution of Grades for General Chemistry I and II

The convenience sampling approach was used in this study for the focus group interviews and the questionnaires. Although the ideal situation might be to select the individual or setting of most interest to the researcher, the user logs showed that the students did not use the Web site and the materials on it at the expected rate, so the researcher did not have the opportunity to categorize the students according to their usage frequency, or any other criteria. Those students who volunteered for the interviews and the questionnaire therefore formed the participants of this study.

In November 2001, 20 students were selected as participators of the five focus-group interviews, one of which was the pilot study.

In June 2002, the questionnaires were administered to the whole class. At the end, 91 students' responses were taken into consideration (51 male, 40 female).

3.3 Data Collection Instruments

This study, which aimed to investigate students' perceptions about a Web-enhanced course, included both qualitative and quantitative data collection methods. In data collection, the process of involving more than one data source and more than one method enhances validity in research, and provides triangulation in data collection (Merriam, 1992). To ensure triangulation, three instruments were used to collect data: (1) Interview Guide, (2) The Evaluation of Web Enhanced Instruction in General Chemistry, and (3) The Quiz Observation Form.

Interview Guide

The interview guide, which was used in the focus group interviews, was used to collect in-depth data from the students on their perceptions of the course Web site, the interactive materials in the Web site, the PowerPoint presentations as supplementary materials, the use of PowerPoint presentations in the lectures and online assessment. It was a semi-structured interview and prepared in Turkish by the researcher based on the research questions and related theoretical literature. It had five sections.

The first section aimed to gather information about the opinions, experiences and expectations of students about the course Web site in a general sense. Questions about the strengths and weaknesses of the Web site, and problems encountered with the Web site were asked. In addition, perceptions about the components of the Web site were investigated in this section.

In the second part, students' perceptions about the PowerPoint presentations as supplementary materials were investigated. The students were also asked to identify the most attractive and the most boring aspects of the presentations. In addition there were questions about the aim of the presentations and how they were utilized. Finally, the expectations of the students about the presentations were investigated in this section.

The third section was about the supportive interactive materials. The goals of this section are to determine students' perceptions on the use of interactive materials in individual study, and how to increase the effectiveness of the interactive materials. In addition, students' opinions about the animations in these materials were separately elicited. The selected animations that were shown during the interviews were presented in Appendix C.

The fourth part was about the use of PowerPoint presentations in the General Chemistry lectures. The difficulties about, and positive aspects of the course from the students' point of view were investigated. Their expectations were investigated in this section as well.

The last section was about online assessment. The difficulties, best aspects, and expectations about e-quizzes were ascertained in this section. The structure of the interview guide for all the parts can be seen in Figure 3-2.

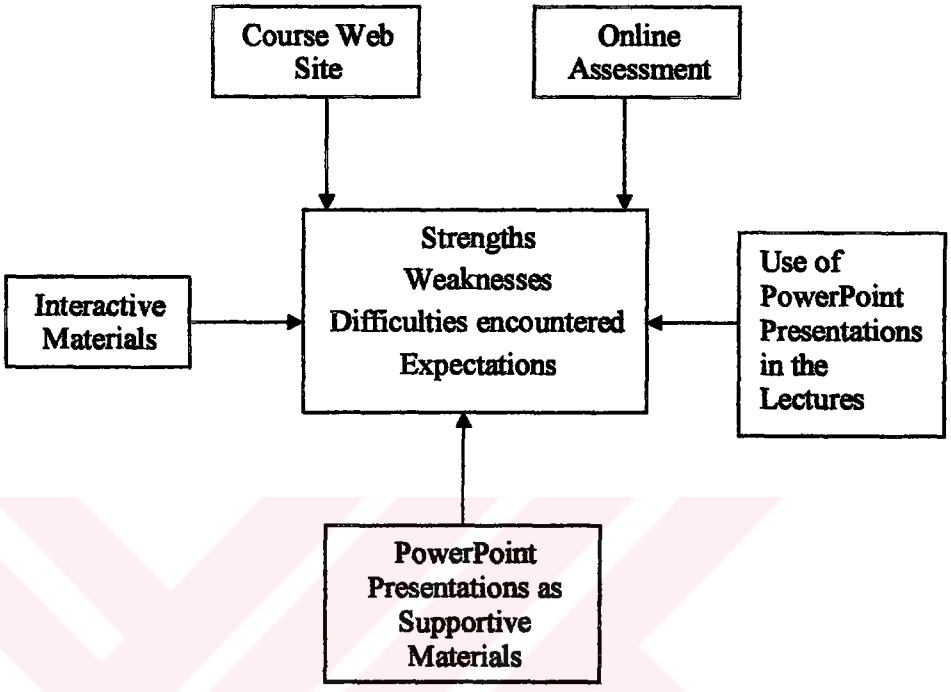


Figure 3-2
The structure of the interview guide

The researcher asked three colleagues to check the questions in terms of clarity before conducting a pilot study for the interview guide. The questions, which were found to be unnecessary, unclear or ambiguous, were revised. The interview was then piloted by the first group of the interviewees in order to see which questions were understood well, which needed revising, and accordingly gave the final form. Finally, some questions were modified, some of them were excluded, and some new ones were added. The interview guide is presented in Appendix A.

This questionnaire was developed by the researcher. The results of the focus group interviews were the base for developing the items. It is presented in Appendix B. It consisted of three sections.

The first section aimed to gather information about the students' demographic data such as their age, department, and cumulative grade point averages. Besides demographic data, their computer competency level, attendance rate in the General Chemistry courses, reasons for low attendance, the place of access to the Web site as well as the frequency of use of the course Web site were ascertained in this section.

The second section consists of 34 statements that will profile the perceptions of the students about the course Web site, interactive supportive materials, PowerPoint presentations, method of instruction and online assessment. These items could also be seen as an evaluation of the new approach to the method of the instruction from the students' point of view. In this part, the 2nd, 6th, 24th, and 31st items are negatively constructed.

The last section was aimed to diagnose the expectations of the students about the course Web site, interactive supportive materials, PowerPoint presentations, method of instruction and online assessment. For further improvements in the course, understanding the students' expectations is crucial. It consists of 15 statements. All of the statements are positive items.

In the items of the second and the third sections, a 5-point scale type format that ranges from "strongly agree" to "strongly disagree" was used. The reliability analyses for these two sections (49 items in total) yielded the coefficient Alpha of .93 (N=57).

The questionnaire was submitted to three experts who had experience in instrument development to ensure its accuracy and validity. The instrument was also pilot-tested with five graduate students. With this pilot study, the clarity of the statements and the time necessary to complete the questionnaire was evaluated. The pilot–study participants informed the researcher about unclear statements and made some suggestions. Afterwards, necessary modifications were made according to the feedback before the questionnaire was administered.

The Quiz Observation From

Two of quizzes were observed by the researcher. To observe in a systemic way, the researcher designed a quiz observation form which is presented in Appendix D.

For observations, the important factors that affected students' performance in the lab environment were listed and put in the observation checklist. The observation begins with the group entering the lab and finishes when they have all left the lab. The whole process, including student-student interaction and student-teacher interaction, was observed.

3.4 Data Collection Techniques

In order to collect data for this study interviewing and questionnaire were used. It was decided to interview the students. An important reason in the selection of this technique was that depth interviewing investigates beneath the surface, looking for detail and providing a holistic understanding of the interviewee's point of view (Patton, 1987). Collecting data in a holistic approach was crucial, since the researcher is not a part of the subject matter, is unfamiliar with the students' current profile and had a few observations about the implementation of the new approaches in the course. In fact, the aim of the interviewing is to enter the other persons' perspective (Patton, 1987).

In the study interview guide approach was used. In this approach, the researcher uses an interview guide to make sure that all relevant topics are covered. The interviewer remains free to build a conversation within a particular subject area, to word questions spontaneously, and to establish a conversational style, but with the focus on particular predetermined subjects (Patton, 1987). The interviewees express themselves without any direction from the researcher by means of open-ended questions.

There are some advantages to the interview guide approach as stated below:

> It makes it sure the interviewer has carefully decided how best to use the limited time available in an interview situation. The interview guide helps make interviewing different people more systematic and comprehensive way by delimiting the issues to be discussed in the interview. The interview guide approach is especially helpful in conducting group interviews. A guide keeps the interaction focus, but allows individual perspectives and experiences to emerge (Patton, 1987, p. 111).

The weaknesses of this approach are stated below:

> Important and salient topics may be inadvertently omitted. Interviewer flexibility in sequencing and wording questions can result in substantially different responses, thus, reducing the comparability of responses (Patton, 1987, p. 117).

In this study, the interviews were conducted as focus group interviews. Focus group interviewing is described by Rossman and Rallis (1998) as the following:

> The interviewer creates an open environment, asking questions that focus closely one specific topic to encourage discussion and the expression of differing opinions and points of view. The interaction of the participants is the critical characteristic of this type of interviewing. This technique assumes that an individual's attitudes and beliefs do not form in a vacuum: people often need to listen to the others' opinions and understandings to clarify their own (p. 143)

The interaction among the students in the interviews provided the researcher with a deeper understanding of the classroom dynamics and the effect of new implementations on students. In addition, group dynamics change the extension and deepness of the responses to the answers, so a reach set of data could be obtained with group interviewing (Yıldırım, Şimşek, 1999).

"The Evaluation of Web Enhanced Instruction in General Chemistry" questionnaires were administered to the whole class to check to what extent the class agreed with the participants of the focus group interviews; in other words, to increase the validity of the findings obtained from the group interviews. In this way, collecting the data using two different techniques ensured triangulation.

3.5 Data Collection Procedures

The students attended the lectures during the first semester. Attendance was not obligatory. They took quizzes regularly. They used the course Web site to take their assignments, to follow the lectures that they had missed, to learn their grades, and to study interactive supportive materials. In other words, they experienced the new implementations of the course.

One month before the end of the first semester, voluntary students were selected as focus-group participants. The interviews were conducted at the end of that semester, since the interactive materials were used towards its end. By that time the researcher had made a literature review and prepared the interview guide. The researcher also participated in two lectures and observed two quizzes. The Quiz Observation Form was presented in Appendix D.

There were five groups. The first group was evaluated as a pilot study of the interview guide and led the guide to be revised. However, since two out of four participants seemed to be key informants, the data obtained from the pilot

study were mostly used in the analysis process. The interview schedule of the focus groups is given in Table 3-1.

Table 3-1
Interview Schedule of Focus Groups

Group Number	Number of participators	Interview Date
Group 1 (Pilot Study)	4	27 November 2001
Group 2	3	25 December 2001
Group 3	4	25 December 2001
Group 4	5	27 December 2001
Group 5	4	27 December 2001

The focus group interviews were conducted in a computer laboratory. Students were interviewed in groups of 3, 4 or 5. It took 50 to 70 minutes for the researcher to conduct an interview. Before the interviews, the researcher informed the interviewees about the purpose of the interview, where the data would be used, the interview time and the fact that the content would be kept confidential. The interviews were recorded with the permission of the participants in order not to miss any data. Some sample screens from the course Web site, interactive materials, and PowerPoint presentations were presented via a computer to remind the participants of the topic of inquiry. Since the native language of the interviewees is Turkish, the interview guide was prepared in Turkish and the interviews were conducted in Turkish. This provided richer data than that could be obtained using English because the participants expressed themselves more smoothly.

"The Evaluation of Web Enhanced Instruction in General Chemistry" questionnaire was administered at the end of the second semester. This

questionnaire was designed as a validation of the findings of the focus group interviews.

3.6 Data Analysis Procedures

Qualitative data analysis begins with searching and arranging the interview transcripts or materials collected by the researcher in order to get the whole picture of the available data. Afterwards, the process continues by organizing them, breaking them into manageable units, synthesizing them, searching for patterns, and discovering important ideas, concepts and themes (Bogdan and Biklen, 1998).

In fact, the analysis of qualitative data is a creative and intellectual process. There is no right way of organizing, analyzing and interpreting qualitative data. However, most qualitative studies are descriptive. The data collected yields words or pictures rather than numbers. The aim of description is to report the entire activity in detail and depth to provide a holistic picture of what has happened in the reported activity or event (Patton, 1987).

One of the most popular strategies when analyzing qualitative data is content analysis. The main purpose of content analysis is to reach the concepts and relations which will express the data collected. The data summarized and interpreted in descriptive analysis are subjected to a deeper procedure. Thus, themes and concepts that are missed during descriptive analysis might be discovered in content analysis (Yıldırım and Şimşek, 1999).

In this study, five focus-group interviews were conducted, one of which is the pilot study. There were 20 participants in total. The data obtained from the questionnaire were subjected to content analysis. The data were labeled with descriptive codes in order to simplify the complexity of the data into manageable units. The patterns were then identified, based on the labels, and collected under

major categories. The major topics and themes helped to identify the concepts and main ideas.

The data analysis process includes the following steps: first the researcher transcribed the interviews word by word from the tapes that were recorded during the interview sessions, using a word processor program. Then the researcher set the right margin as seven cm. so that sufficient space for writing notes was left, and printed the interview notes. Next, the printed data were read twice in order to get the whole picture of the opinions of the interviewees.

After that, meaningful data units were identified and appropriate labels about the data units were written in the right margin by the researcher. The labeling was conducted in Turkish. After that, the main categories and sub-categories were constructed.

From this point, qualitative data analysis was done in two phases. First, the data were indexed by group number (G*), page number (*), and interviewee number (*) in order to find the related data easier in writing the results chapter in a Microsoft Word document. For instance, G1, 5, 3 represents group 1, page 5, and interviewee 3. The data selected to take part as a quotation in the Findings chapter was marked with an asterisk (*) in the coding document. This facilitated the researcher easily to find the quotations in the raw data when writing the Results chapter. Numbered lists with two columns were designed. In the first column, the themes and codes were organized and written. The second column addresses the place of the code in the raw data. For each theme a separate numbered list was generated.

Second, the researcher made a frequency distribution table with all the categories and sub-categories together in an Excel spreadsheet. This table allowed the researcher to see the relationships and meaning among and within categories, or to reorganize and redefine the categories and sub-categories by means of a whole picture of the data in a table.

As far as the data obtained from "The Evaluation of Web Enhanced Instruction in General Chemistry" questionnaire were concerned, they were entered to the SPSS program according to a special pattern. Frequency distribution and descriptive statistics were conducted to investigate the percentages of students' choices about each item in the questionnaire.

The demographic data provided the researcher with a deeper understanding of the participants' context.

The evaluation of the course part and expectations about the course part were in the form of 5-point-Likert scale consisting of: Strongly Agree, Agree, Neutral, Disagree, and Strongly Disagree. While interpreting the results, percentages of Strongly Agree and Agree were admitted as agree; and that of Strongly Disagree and Disagree were admitted as Disagree.

3.7 Limitations

This study was carried out with a sample of 20 students for the focus group interviews and 91 students for the questionnaire. The students were from the department of Chemistry and Chemistry Education. The students expressed their perceptions about the course Web site, the interactive materials and the online assessments designed and developed by some professors in the department of Chemistry and some staff of a research institute on campus; and about the PowerPoint presentations prepared and used by the instructor.

The results are limited by the characteristics of those materials and implementations. Consequently, they cannot be generalized to all other Web-enhanced courses.

Similarly, the results were also limited by the perceptions of that particular sample and would be different for another Web-enhanced course designed by another committee since this is a small-scale case study.

In this study, the interviews were conducted only with the students. The results of this study are limited to the students' perceptions.

The validity and reliability of this study are limited to the honesty of the participants' responses during data collection procedures.

Participation in the course lectures was not obligatory. So attendance was low. This may have negatively affected the health of the data gathered from the students.

Another limitation concerning the participants was that only voluntary students participated in the study. So convenience sampling had to be adopted.

Lack of diversity, problems of honesty, and time constraints of the students may be other limitations in this study.

CHAPTER 4

RESULTS

In this chapter, in order to find proper answers to the main research problem, that is, "What are students' perceptions pertaining to Web-based applications and activities in an introductory Chemistry Course?", the results of the focus group interviews, the questionnaire and the observation of the quizzes were analyzed. The results were presented based on the six themes arising from the data collected, which are written under the related sub-questions as follows:

1) What are the students' perceptions pertaining to the course Web site?

- The students' perceptions of the course Web site

2) How do students perceive Web-based materials intended to support their learning?

- The students' perceptions of the interactive materials toward their learning

- The students' perceptions of the animations in the Interactive Materials

3) In what ways do the students perceive the PowerPoint presentations during lectures and self-paced learning?

- The students' perceptions of the usage of the PowerPoint presentations during lectures

- The students' perceptions of the PowerPoint presentations for self-paced learning

4) How do students perceive online assessment in terms of their achievement?

- The students' perceptions of online assessment in terms of their achievement

Presentation of Data

The findings of the interviews were presented in verbal form. But the frequencies or percentages of common tendencies were generally stated within the text or in tabular form as in Table 4-2 and 4-3. The number of participants for the focus group interviews was 20 in total.

The results of the questionnaire were presented in tabular form like Table 4-1, and 4-4. In those tables, in each cell representing data, the frequency of students giving that specific answer is given in the first row, and the percentage of them was given in the second row. The number of questionnaires taken into consideration was 91 (N=91). For each item in the questionnaire, the frequencies of "Strongly Agree" and "Agree" were summed and interpreted as "Agree", and similarly, the frequencies of "Strongly Disagree" and "Disagree" were summed and interpreted as "Disagree" while analyzing the questionnaires.

4.1 The Students' Perceptions of the Course Web Site

4.1.1 Learning Environment

Students accessed the course Web site from the computer laboratories on campus and their own computers at home or in their dormitories. The places of connection to the course Web site and the frequency of connection from each kind of place is shown in Table 4-1. It can be said that the students generally connected to the Web site from the computer laboratories on campus. The ones who have computer and an Internet connection sometimes accessed the Web site from home.

Table 4-1
The places of connection and frequency of visits to the course Web site

Place	Always	Often	Sometimes	Rarely	Never	No Answer
Computer Laboratories	9 9,9%	20 22%	25 27,5%	24 26,4%	5 5,5%	8 8,8%
Home	2 2,2%	3 3,3%	15 16,5%	9 9,9%	25 27,5%	37 40,7%
Dorm Room	2 2,2	5 5,5%	4 4,4%	5 5,5	29 31,9	46 50,5%
Internet Cafe	0 0%	3 3,3%	2 2,2%	9 9,9%	30 33%	47 51,6%

When the participants were questioned about the study atmosphere in the laboratories, one of the students stressed that the course Web site access was easy and quick. Another participant pointed out that they had the opportunity to study the materials on the Web site for as long as they wished. Four students stated that if they were really motivated to study, they felt there were no significant problems whatsoever in the laboratory environment. On the contrary, four of the participants proposed that the laboratories were not convenient places

for studying courses. The students indicated that crowded and noisy laboratories negatively affect their concentration and motivation while studying. Eleven students pointed out that the study conditions they had at home were good. However they stated that when at home, they studied the materials on the course Web site infrequently and for shorter durations of time compared to the amount of time they spent studying in campus labs. The major reason for the mismatch in study time lies heavily on the fact that connecting to the Internet at home brings about extra economical bother.

4.1.2 Connection Speed

One out of three students stated that the connection speed was quite high; while two students pointed out that it varied according to the time of the day. Some students stressed that the connection speed of the course Web site was good from places out of campus, too.

4.1.3 Strengths of the Course Web Site

When the best components and features of the course Web site were discussed, the participants stressed being interactive and being easily accessible as the most important features; Interactive supportive materials, Grades, Problems, Lectures, Contacts, Ask a question, and e-quiz were seen as the most important components. The frequencies for the best aspects of the course Web site are presented in Table 4-2.

Table 4-2
The frequencies for the best aspects the course Web site

Component / Feature	Percentage (N=20)
Being interactive	25
Interactive Supportive Materials	25
Grades	15
Problems	10
Lectures (PowerPoint Slides)	10
Contacts	10
Easily accessible from anywhere	10
Ask a question	5
e-quiz	5

One of the students indicated that the best thing in the course Web site was the animations and continued:

> Animations are the best aspect of the course Web site. For instance, there are structures, chemical structures we call "sextet structures" and others like octedral. When you draw these structures on a paper, anything is incomprehensible... what are those structures? Which part is what? We cannot see them, but those structures can be understood when the animations on the computer are applied... They are exactly displayed.

4.1.4 Weaknesses of the Course Web Site

The participants indicated some weak aspects of the course Web site in terms of administration, design and its supportive materials.

As far as the administrative weaknesses stated are concerned, nearly half of the students complained about the frequent change of the course Web site address, especially in the first two months of the first semester. They also added that these changes were not announced on time. In addition, they stated that there was generally a delay in updating the site. One student pointed out that he had

lost trust in the Web site because of it not being updated on time. Besides, some students claimed that students who reside out of the campus and have no computer and Internet access at home would not be able to make sufficient use of the Web site.

When design weaknesses are considered in a general sense, one is about the hyperlinks in the Web site. Students stated that there were some links that were not working properly. Yet another one was the lack of links to other universities/institutions.

The other weak aspects put forth by the students were related to the interactive materials and PowerPoint presentations. Students suffered from the use of these materials as they were clearly disorganized. They think this weakness hindered their utilization of the course materials. The other weakness mentioned was the presence of online materials that could not in any way complement the textbook, or other than simply repeating what it has to say. The frequencies for the weaknesses of the Web site according to the participants are presented in Table 4-3.

Table 4-3
The weaknesses of the course Web site

Component / Feature	Percentage (N=20)
Frequently changed the address of the course Web site	35
Delay in updating	25
Some links not properly working	25
Including insufficient course materials as a resource	10
Including course materials that do not bring much new things besides the textbook has	10
Lack of links to other universities/institutions	10

Table 4-4
Students' opinions about the course Web site

	SA	A	N	D	SD	No answer
33. The hyperlinks, in the course Web site, were working well.	5 5,5%	30 33%	18 19,8%	20 22%	6 6,6%	12 13,2%
34. The Web site was updated regularly.	2 2,2%	24 26,4%	26 28,6%	14 15,4%	13 14,3%	12 13,2%

The data obtained from the questionnaire about the Web site was presented in Table 4-4. While 38,5% of the students agreed on the hyperlinks working well, 28,6 % indicated that the hyperlinks did not work well. For updating matters, though 28,6% of them stated that the Web site was updated regularly, 28,6 % of them had confusions about it and 27% of them disagreed with the existence of regular updates.

4.1.5 Students' Expectations of the Course Web Site

The participants depicted some expectations especially related to the content and administration of the Web site.

Most of the students had doubts about the extent to which the course Web site was interest-arousing for them. In order for the Web site to be more attractive, two students suggested that current information regarding Chemistry could be part of the course Web site. As shown in Table 4-5, 67% of the students would like to see information about today's Chemistry in the course Web site. One of them also proposed a change in structure in that the Web site could be manipulated to address student needs with some more experiment simulation software and Chemistry education games. 63% of them would like some experiment programs and educational games about Chemistry in the course Web site, as presented in Table 4-5.

They would like the supportive materials on the Web site to be of a more extensive nature. Publishing the final exam questions and answers of the previous years on the course Web site was another desire of some participants. Similarly, it is found that 78% of the students expected previous midterm/final questions and answers to take part in the course Web site, as presented in Table 4-5.

On maintenance and administrational issues, the students had two expectations. First, they wanted the course Web site to be updated at least once a week. Second, they would like an alternative delivery option to be available for the supportive materials on the course Web site. For instance, they proposed interactive materials and problems in the site to be sold on CD-ROMs. When they were asked whether they would like the materials in the course Web site and problem solutions to be available as lecture notes or CD-ROM or not, 45,1% of them agreed while 18,7% of them disagreed, as shown in Table 4-5.

Table 4-5
Expectations about the course Web site

	SA	A	N	D	SD	No answer
11. I wish there was information about today's Chemistry in the course Web site.	39 42,9%	28 30,8%	6 6,6%	2 2,2%	2 2,2%	14 15,4%
12. I would like some experiment programs and educational games about Chemistry to exist in the course Web site.	31 34,1%	27 29,7%	14 15,4%	2 2,2%	2 2,2%	15 16,5%
13. I would like the materials in the course Web site and problem solutions to be available as lecture notes or CD-ROM.	21 23,1%	20 22%	17 18,7	10 11%	7 7,7%	16 17,6%
14. I expect previous midterm/final questions and answers to be part of the course Web site.	59 64,8%	12 13,2%	2 2,2%	2 2,2%	2 2,2%	14 15,4%

4.1.6 The Components of the Course Web Site

The students' perceptions about the components of the course Web site were investigated separately, and the results were presented in this section. The students' ratings of the components in terms of their importance were shown in Table 4-6.

Table 4-6
The students' ratings of the components in terms of their importance

	1st	2nd	3th	4th	5th	6th	7th	No Answer
Lectures	26 28,6%	19 20,9%	13 14,3%	7 7,7%	4 4,4%	6 6,6%	6 6,6%	10 11%
Problems	22 24,2%	19 20,9%	11 12,1%	15 16,5%	4 4,4%	6 6,6%	5 5,5%	9 9,9%
Contacts	7 7,7%	11 12,1%	7 7,7%	15 16,5%	18 19,8%	13 14,3%	9 9,9%	11 12,1%
Interactive (Materials)	7 7,7%	11 12,1%	7 7,7%	15 16,5%	18 19,8%	13 14,3%	9 9,9%	11 12,1%
Grades	15 16,5%	16 17,6%	15 16,5%	7 7,7%	7 7,7%	8 8,8%	14 15,4%	9 9,9%
Ask a question	5 5,5%	3 3,3%	14 15,4%	10 11%	12 13,2%	23 25,3%	14 15,4%	10 11%
e-quiz	13 14,3%	11 12,1%	8 8,8%	13 14,3%	8 8,8%	8 8,8%	22 24,2%	8 8,8%

Component 1: My Profile

The students pointed out that this component is very useful for the instructor to access students' personal information and to get to know students better. However, they proposed that this component had no practical use for them. Some students stated that they had no idea why the course Web site had such a component. Several students, however, stated that they liked the fact that the quiz results could be sent to the e-mail accounts that they wrote in their

profiles. On the contrary, one of the students stated that the Web site administrators at the beginning did not use the e-mail address they gave here:

> The results are not posted to the e-mail accounts that we reported here, for example ...I wrote one of my e-mail accounts that was not provided by the university, but the e-mails about the course are not sent to this account. Instead, when any information was sent, they were sent only to accounts that were provided by the university: "Orca". But I had written here the e-mail address I wanted them to use. I think they should have sent the information to this one.

One out of three participants proposed that their photos should be placed in their profiles in order for the instructor to remember them easily. One student suggested that it would be useful for classmates to get to know to one another by viewing peers' personal information online.

Component 2: Dates/Places

Two students claimed that the most useful aspect of this component paid off before each quiz as the time and place of the quiz was announced through this component. However, most of the students stated the weak aspects of this component: expired announcements, late updates, ant the late publication of necessary information.

The students point out the necessity of updating at least once a week. One of the students illustrated the necessity of publishing information on time, as following:

> "Dates/Places" is a good part but it is not functioning well as you see. Although there is the final in a few days time, the second midterm announcement still appears at the moment. When will we learn the information about the final exam? Though there is some time to the final, the second midterm was one month ago. I think the final exam information should have been announced by now. For example, one of the students asked the instructor; he asked when the final would be. The instructor said, "I do not know, go to ... and check it". If the date and place of the final had been announced here, s/he absolutely must have checked here –

> and only here! S/he could have learned it from the Web site. In this sense, this component is sometimes a bit late.... with regard to updating.

Component 3: Grades

Seven students were positive in indicating easy access to their grades. Another student pointed out to the expediency of seeing quiz and exam grades all together. Yet, three students claimed that grades were updated late. One of them pointed out this issue as the following:

> For example, I thought that I could learn my midterm grade from the Web site, since I could not attend the lecture in which the midterm grades were announced. I waited for the grades to be announced in the Grades part. Three weeks later, I asked the instructor, since the grades were still absent in the site. They did not enter them. I had to learn it from the instructor.

The participants expressed their dissatisfaction in only seeing their own grades; thus, having no idea where they stand within the group in terms of their grades. In this respect, they would at least like to see some statistics about the grades of the class such as a mean score. One of them stated:

> I think... I believe that there should be the mean scores, too. There are only the grades. The means of the quizzes do not exist ... the mean of the midterms do not generally exist. We are curious about the grades of the other students, I think, that should be given- The first midterm average had been announced here. But for the second exam, the mean is not written here...

Component 4: Syllabus

While a student emphasized that it is good to see a course content list, three students stated that it was unnecessary. Besides, some students had objections about the content and structure of the syllabus. They proposed that it was not in its proper order, and that the information about which subjects will be covered in which weeks did not exist in this section.

Component 5: Laboratory

Some students claimed that there was no information about the purpose and method of the lab experiments. Nonetheless, another group of students thought that such information was not necessary since they already had a lab book. Furthermore, several students would like to see much more experiment simulation within this component.

Component 6: Ask a question

Three students stated that they found this facility very useful since it provides the comfort of asking questions to the instructor any time asynchronously. Two students also indicated that the communication between student and instructor being confidential was an important advantage of this component. However, three students proposed that communication with the instructor via e-mail asynchronously is not an important utility. They claimed that asking questions to the instructor face-to-face is more effective. One student pointed out that he did not send any messages via this service because of the delay in updating the site, which caused lack of confidence.

Component 7: Contacts

Two participants indicated that the most important advantage of this component was having the e-mails and phone numbers of the instructor and the assistants whenever they were faced with a problem that needed an urgent solution.

As a problem with this component, three students mentioned it's inclusion of out of date information.

Component 8: Problems

Six students thought that the Problems component of the course Web site was quite effective since the problems/questions here were challenging; the problems being the ones whose solutions did not exist in the text book; and the students used it to check whether they had solved the problems correctly or not. One of them indicated the following:

> I think it is quite effective, especially "Problems". I printed out the problems. I solved them at home myself. Because rather than looking at them on the monitor screen, solving them with paper and pencil is better.... I feel that I grasp better in this way... About the content, about commenting... giving problems and then giving their answers is better than only giving problems without any key. This key allows us to check our solutions; whether we can solve them successfully or not, to what extent we solved correctly. .... I think the best component in the site is the problems.

Yet there were some negative aspects of the component reported by the students. One student complained about the midterm questions since they turned out to be much more difficult than the problems on this page. Another student pointed out that the number of problems on the page were far less than adequate. Some students suffered from this component because of the fact that they could not download the solutions of the problems/questions.

Two students expected to see more problems with solutions in this component. One student indicated that there should be questions from other resources besides the course textbook on the page.

Component 9: Forum

Although hyperlinks for a forum and a chat room existed in the homepage of the course Web site, they were not active in either semester. However, the students' opinions about these two communication options were elicited for future implementations.

Since this component is inactive and the students have no experience with Web-based course, most students are unaware of its function, aim, or usage. One student said that he has not sufficiently competent in Chemistry to participate in a discussion in such a forum.

Component 10: Chat Room

Some students were curious about how the Chat room will be used for instructional purposes. One student stated that Chat room would be beneficial when solving Chemistry problems if the number of participants connected at the time becomes high.

Some students had doubts about whether the use of this component will be allowed or not in the laboratories since chatting is forbidden in METU PC laboratories.

Some students said that they wished this component were active at the time because they wanted to communicate with students from other universities and to discuss a number of chemistry concepts. Most of the students agreed that chatting for instructional purposes should be allowed in the laboratories.

4.2 The Students' Perceptions of the Interactive Materials toward Their Learning

4.2.1 Strengths of Interactive Materials

As the strengths of interactive materials are investigated, five students stressed that interactive materials are the most useful part of the course Web site. Almost all students stressed that animations are the most appealing aspect of interactive materials. Half of the students stated that different and interesting

knowledge existed in the material. One of them said that she enjoyed studying it very much.

Two students said that they grasp the concepts better when they both read the content and applied the animations. Besides, three students stated that they could see whether they had learned the concept or not when they study interactive materials. Three students were satisfied with the material since it enabled learning by seeing.

Two participants also pointed out that animations, explanations and examples were well prepared. Some students stated that they were pleased with the materials since they not only contain text, but also visuals such as animations.

Giving extra knowledge, being aimed at investigation, and being available 24 hours a day were the other positive aspects mentioned by the students. One of the students stated:

> ... There are some extra things in the PowerPoint presentations but most of the necessary things do not exist there. We use them for learning extra things, for instance the subject is summarized, but what are the details? I had to study the interactive materials to learn the details of the subjects, to prepare for the exams more...

4.2.2 Content of Interactive Materials

It was stated by seven students that the content of the interactive materials is more difficult than the content covered in the lectures. In addition, five students stated that the interactive materials were insufficient as a supportive resource.

Six students found studying and understanding of interactive materials difficult. Three of them said that they could not understand anything when they tried to study concepts from the interactive materials. As a reason for this situation, six students indicated that studying these materials requires

background information about the concepts. Three of these students also stressed that the PowerPoint presentations and the textbook are simpler and easier to study when compared to the interactive materials. Another student claimed that while they studied any concept from the interactive materials, they got confused if they had not learned that concept beforehand. Some students suffered from the English used in the materials, as the materials were at a higher level than their language abilities. One student pointed out that the animations were clear and comprehensible while the text was not.

As the data obtained from the questionnaire showed in Table 4-7, the students had more positive perceptions on design than on the other aspects. 55% of the students thought that the interactive materials were good regarding design (choice of colors, text and image size, etc.). In addition 36,3% of the students agreed that the navigation was good in these materials.

Table 4-7
Students' opinions about interactive materials

	SA	A	N	D	SD	No answer
12. Interactive materials helped me learn the concepts.	3 3,3%	26 28,6%	22 24,2	21 23,1%	9 9,9%	10 11%
13. I studied the interactive materials willingly.	3 3,3%	17 18,7%	23 25,3%	24 26,4%	13 14,3%	11 12,1%
14. I have learned the concepts, about which I did not have any prior knowledge, easily by studying the interactive materials.	2 2,2%	16 17,6%	26 28,6%	24 26,4%	13 14,3%	10 11%
15. The interactive materials were good regarding design (Choice of colors, text and image size, etc.).	8 8,8%	42 46,2%	17 18,7%	8 8,8%	5 5,5%	11 12,1%
16. The interactive materials allowed me to realize my deficiencies about the concepts that we learned in the lectures.	3 3,3%	18 19,8%	27 29,7%	20 22%	10 11%	13 14,3%
17. The interactive materials were in such a structure that I could reach any sub topics easily whenever I wanted.	4 4,4%	29 31,9%	19 20,9%	19 20,9%	7 7,7%	13 14,3%
18. The interactive materials were comprehensible and fluent.	5 5,5%	21 23,1%	19 20,9%	21 23,1%	11 12,1%	14 15,4%

4.2.3 Design of Interactive Materials

As far as the design issues of the interactive materials are concerned, the participants had some complaints about it, especially about font style, printing, and information boxes.

Six students pointed out that the text in the material had very small fonts and faded colors. Hence, three of the students explained that reading the text in the materials was tiring for the mind and quite straining for the eyes. Some students thought that reading the text with small fonts in the materials made reading difficult and the concepts more complicated. In addition, they said that main headings and subheadings were sometimes indistinguishable. Because of the design problems about text use in the interactive materials, three students claimed that they got bored and did not concentrate on the concept when they tried to read the text and that they did not enjoy reading it.

One of the other design issues about the interactive materials stated by the students was printing. Three students indicated that they could not print the materials in an efficient way. They said that only one third of the paper was used when they print a page. They also claimed that the images and the information boxes accessed with hyperlinks within the text could not be printed –did not show- when a page was printed. They also pointed out that when they wanted to print a whole topic from the material, the printing process took a lot of time since the topic was distributed on separate pages. One of the participants said, "If I print these pages one by one, a little part of page is used for printing. Only the text is printable. Moreover, there are only 2-3 lines of text. So it is not meaningful to print the pages."

Another design problem pointed out by the students was about information boxes including definitions, questions, answers, or formulas regarding content of the materials, which is accessed by clicking on the hyperlinks within the text. Three students indicated that it was not possible to

access the content of some of these information boxes exactly because of the Web site design.

4.2.4 Feedback/Correction

Four students claimed that there were no proper assessment tools such as quizzes within the material to provide them with feedback and correction. One student stated that reading and practicing only sample problems was not sufficient to improve problem-solving skills.

4.2.5 Usage of Interactive Materials

When the question was posed about when and for what purposes the students used the material, six students stated that they had studied the materials for preparing for the exams since the instructor would ask questions from the content of the materials. Two students said that they opened the materials to use the animations. Another student indicated that s/he used the interactive materials when s/he had difficulty in understanding the concepts. Six students claimed that they used the interactive materials in order to grasp the topics better, to gain more information about the concepts, and to learn the details of a concept which was summarized in PowerPoint presentations.

The students had differing tendencies about how they used the materials. Five of the students said that they studied the "Quantum" module more than the other one. On the other hand, three students claimed that they did not use the material, while two students believed that the content of the material is similar to that of the textbook. Three participants preferred to study the materials on hard copies after they had printed them.

4.2.6 Expectations about Interactive Materials

The students expressed their expectations about the content, design, and feedback strategies of the interactive materials.

First of all, they stated that the content of material was clear, comprehensive, within their knowledge level, and organized in a useful way. In addition, as seen in Table 4-8, 67,1% of the students wished the existing interactive materials to be improved and interactive modules for all the concepts to be developed.

Table 4-8
Students' expectations about interactive materials

	SA	A	N	D	SD	No answer
10. I expect concepts to take part more extensively in the interactive materials.	29 31,9%	32 35,2%	13 14,3%	0 0%	2 2,2%	15 16,5%

Other expectations concerning the content of the interactive materials were being presented in a more sensible organization, consisting of the instructor's own lecture notes, including a Turkish version, being made a sound recording, being shorter, and giving the content step by step.

As far as the design considerations are concerned, the students pointed out that the text should be written in a bigger size and the important parts such as definitions should be written with colored fonts. The students wished the text to be bigger in size and readable like the PowerPoint presentations. Some students stated that the text and animations should have been spread on the screen in a more balanced way.

There was an expectation about feedback and correction strategies, which was also not fulfilled. At the end of each topic, students wished to see several problems or questions to solve and wanted the results and correction shown immediately on the screen by the use of interactivity feature of the site.

4.3 The Students' Perceptions of the Animations in the Interactive Materials

Animation is able to convey a vast amount of information in a very short period of time. It can be a powerful method of reinforcing concepts and topics first introduced to students through text, discussion, and other media. Though still in its fledging state, animation holds the promise of allowing visual learners and those with special needs new and powerful ways to comprehend complex media (Doyle, 2001).

As far as students' perceptions about animations in the present study are concerned, stimulating imagination, in other words, concretizing of abstract concepts was stated as the most important advantage of the animations by three of four of the students. Seven students indicated that animations made chemical events concrete, as they were 3D animations. Five students claimed that the animations illustrated chemical events more effectively than the textbook did. Five students pointed out that the most interesting part and aspect addressing them as learners was the animations. In addition, four students especially stressed that animations were the most useful part of the course Web site. 50,6% stated that the animations presented abstract concepts better than the images in the textbook did, as presented in Table 4-10. One student indicated his/her thoughts about the animations as the following:

> Instead of looking at a picture in the textbook, these animations are more effective according to me, ... The animations are very beneficial since often you do not comprehend what is said in textbooks. It is written that "When the iron is heated, it turns to this

color, when the iron is cooled, it turns to that color" in those books. But with these animations, ... you see it, it is really nice...

The students indicated that the animations helped the concepts to fit well into their minds; thus, helped them see the logic behind the formulas presented. One of the students said, "It is very difficult to describe this event verbally; at least it is very difficult to teach it to me in that way. Seeing these events by means of the animations, controlling them is better." They also added that the concepts concretized as if they were doing experimentations, when they applied the animations.

The students indicated that the animations were supportive and provided motivation, gave a general idea about the concepts, provided retention, were effective on learning, and kept them away from rote learning. Table 4-9 shows the advantages of the animations. A student pointed out the benefits of the animations as such:

> People knowing the existence of an atom, the nucleus and electron structures of it with the technology of that time... it is fascinating. I used to wonder how the atoms were divided into parts, how the electrons and protons were deployed and went round the nucleus. How can we perceive these? Can we see why an electron goes round, or how it goes round... I think the animations helped me learn those issues.

Table 4-9
The advantages of animations

Advantages	Percentage (N=20)
Supportive and providing motivation	20
Effective on learning	15
Keep the students away from rote learning	10
Provide retention	5

Table 4-10
Students' opinions about animations

	SA	A	N	D	SD	No answer
20. I easily realized the aims and working of the animations.	4 4,4%	30 33%	20 22%	18 19,8%	5 5,5%	14 15,4%
21. The animations provided me with learning by applying the concepts.	7 6,6%	27 29,7%	17 18,7%	21 23,1%	6 6,6%	13 14,3%
22. The animations presented abstract concepts better than the images in the textbook did.	5 5,5%	41 45,1%	16 17,6%	11 12,1%	4 4,4%	14 15,4%
23. I have felt that I learned the chemical concepts by means of the animations.	7 7,7%	20 22%	22 24,2%	22 24,2%	7 7,7%	13 14,3%
24. From time to time, I had difficulties in opening and applying the animations.	8 8,8%	21 23,1%	15 16,5%	29 31,9%	3 3,3%	15 16,5%
25. I have applied almost all of the animations.	7 7,7%	15 16,5%	17 18,7%	29 31,9%	6 6,6%	17 18,7%
27. I felt as if I had made experiment when I applied the animations.	3 3,3%	15 16,5%	20 22%	26 28,6%	13 14,3%	14 15,4%

4.3.1 Design of the Animations

Five students stated that the animations' colors both attracted their attention and made the animations more understandable. In contrast, two students claimed that the animations' colors made their eyes tired.

Some students stressed that having control over the variables in the animations increased interactivity.

One of five students said that they did not understand the aim, logic of, or concepts illustrated in some animations. As shown in Table 4-10, 37,4% stated that they easily realized the aims and working of the animations. Another student indicated that s/he did not combine the text describing the concept and the

animations in his/her mind. On the contrary, one student stressed that he could understand most of the animations without reading the text.

The students indicated some design problems about the text such as labels, small expressions, variable names around the animations, the structure of animations, and colors of animations. One of five students stated that they were not able to read the texts within animations when the animations were showed in the lecture. One of five students pointed out that they could not open some animations, especially in one module whose animations were prepared with Macromedia Flash. They related this problem to the course Web site. One of the students said that one of the animations that he tried to open led the computer to crash (in an Internet Café). So he decided to not to open the pages with animations in the course Web site any more.

Two students were disappointed about the fact that opening the interactive materials offline at home was impossible. In other words, they had to stay online while they were studying the interactive materials or applying the animations.

4.3.2 Usage of the Animations

One of four students stated that they had applied the animations. The others saw them during the lectures as the instructor applied the animations. As seen in Table 4-10, 38,5% of them indicated that they had applied almost none of the animations.

Some students stated that they applied the animations only for exploration purposes first time round. They also added that they did not understand the concept at once. Students believed that they were not able to utilize the animations without prior knowledge about the concept illustrated by the animations.

One student pointed out that some animations were presenting concepts that were hard to understand compared to his knowledge of subject matter.

4.3.3 Expectations abot Animations

One of four students stated that they would like to see more animations in the interactive materials. In fact, the students wanted to see animations illustrating all the concepts that were difficult to grasp and imagine. One student pointed out that she would like to see animations showing exception cases in Chemistry concepts as well. In addition, as can be seen in Table 4-11, 58,3% of the students would like to see animations for each concept in the materials.

Table 4-11
Students' expectations about animations

	SA	A	N	D	SD	No answer
15. I would like to see explanations or graphics illustrating what is happening when I play with the variables in the animations.	36 39,6%	28 30,8%	8 8,8%	2 2,2%	2 2,2%	15 16,5%
4. I would like to see animations about each concept in the Web site.	19 20,9%	34 37,4%	18 19,8%	3 3,3%	2 2,2%	15 16,5%

The students wanted the animations to be under their control. Certain explanations and/or graphics that described what was going on in the animations were another expectation of the students. 70,4% of the students agreed on this, as can be seen in the Table 4-11. Similarly, one student stressed that cause-effect relationship among variables had to be shown by means of changing text, image, etc. when they applied an animation, in order to understand the concepts more deeply. A student summarized their expectations below:

> ... Sometimes I cannot comprehend a chemical event, and I feel curious about why such an event occurs in the way it does. The animations helped me on that. Existing in a sufficient amount and giving more opportunity to play with the variables would be better though.

4.4 The Students' Perceptions of the Usage of PowerPoint Presentations for Self-Paced Learning

4.4.1 Content of the PowerPoint Presentations

One of four students stated that the PowerPoint presentations were a summary of important parts of the textbook. Three students stressed that the most important advantage of PowerPoint presentations in the course Web site was the fact that it served as a summary of the concepts that the instructor would cover in the lectures. On the contrary, most of the students, 70,4% as seen in Table 4-12, agreed that PowerPoint presentations were not detailed. Similarly, almost half of the students said that these presentations were not an additional resource and included the same text as the textbook. Some students stated that the presentations consisted of only headings and definitions. As a suggestion to solve this problem, the students proposed that instead of PowerPoint presentations, there could be more extensive lecture notes prepared by the instructor. Three students wanted to see comments of the instructor about the concepts that the course covered. A participant indicated his concerns about the content of the presentations as the following:

> For instance, notice that there are 61 slides for this unit in this site. Every unit covers about 30 pages in the textbook. You see a few lines of text, -knowledge in a slide. There are 30 pages in the textbook... To what extent do the presentations cover the knowledge in the textbook? Ok, working on the book may be a burden because there exists a story about the each and every concept, which is a time loss, but presentations are equally unbeneficial since they contain insufficient amount of knowledge when compared.

Three students pointed out that the PowerPoint presentations were materials that could only be applied when the students did not have a textbook with them. However, the students stressed that it was a good advantage and source to follow the content of the courses when the students did not attend any of the lectures. The ease of studying PowerPoint presentations, carrying out a good summary framework before the exams, helping them learn the concepts deeply when studied before the lectures, and removing the necessity of bringing the textbook to campus were the other advantages of PowerPoint presentations as supplementary materials in the course Web site.

Table 4-12
Students' perceptions of the content of PowerPoint presentations

	SA	A	N	D	SD	No answer
2. The PowerPoint presentations were superficial as a supportive course material.	26 28,6%	38 41,8%	10 11%	9 9,9%	2 2,2%	6 6,6%

4.4.2 Weaknesses of the PowerPoint Presentations

One of five students mentioned that studying PowerPoint presentations had no advantage. Because they said that only studying these presentations was not sufficient to master the basic Chemistry concepts. They also indicated that the PowerPoint presentations did not cover the concepts exactly, there were unsolved questions and problem, and they felt difficulties in studying the subjects including heavily numerical processes.

Three students wanted to see more various, more extensive, more challenging, and a better proportion of questions in the presentations.

Another subject that the students suffered from was that the study of presentations required staying online in the Internet and sitting in front of computer. They wished to see alternative delivery of materials, and those materials to be easily printable and downloadable. One of the participators pointed out the download matters as:

> For instance, at home, when we open the computer, we work offline, all of us do this. When we reopen the pages when we are offline, the pages do not appear. If they were seen when we work offline, for instance I would open all the pages, and disconnect the Internet. Then one by one, by examining and learning everything, I could pass through the pages once the pages could stay open when working offline. Yet, I pass the pages in a minute or half a minute, though I need to look at it in three minutes, by skimming when studying online in this condition.

Some students said that it took time to study concepts from PowerPoint materials. Especially they stated that staying in the laboratories was a limited opportunity. One student stated that long presentations were boring in their individual studies or in the classroom.

4.4.3 Usage of the PowerPoint Presentations

Six students stated they had read the PowerPoint presentations while four students said that they had not used these presentations for individual study.

The students stated that they used the PowerPoint presentations in order to glance at a topic, study before quizzes, make a general review, examine the sample problem solutions and different images, and to look over the topics that they did not comprehend in the classroom. In addition, some students stressed that they opened these presentations first for downloading them to their own computers. Table 4-13 shows frequencies for the aims for personal use of PowerPoint presentations.

Some students indicated that they checked whether they learned the topics exactly or not, and some others expressed that they studied the

presentations when they did not attend any lectures. In addition, several students indicated that for the subjects that they grasped in the lectures studying the presentations was advantageous since it had a strengthening effect on learning outcomes.

Table 4-13
Aims for personal use of PowerPoint presentations

Aims	Percentage (N=20)
Glancing at the topic	20
Studying before quizzes	20
Make general review	15
Look over the topics that they did not comprehend in the classroom	15
Examine the sample problem solutions and different images	5

4.4.4 Design of the PowerPoint Presentations

One out of five students stated that the PowerPoint presentations were designed in a comprehensive and useful way. Having easy to understand expressions, being rich in pictures and images, and having colorful background and text to increase comprehensiveness were other positive aspects of the design of the presentations stated. As table 4-14 shows, 57,3% of the students considered the design of the PowerPoint presentations to be fine.

As for the images, some students put forth that the visual elements were more useful than the text, while some other students indicated that the images were the same with the ones in the textbook, and those were sometimes unclear. Another problem mentioned about the images was that they could not be printed on paper.

Table 4-14
Students' opinions on the design of the PowerPoint presentations

	SA	A	N	D	SD	No answer
3. The PowerPoint presentations were good regarding with design (Choose of colors, text and image size, etc.).	10 11%	43 47,3%	19 10,9%	0 0%	5 5,5%	5 5,5%

Table 4-15
Students' expectations of the design of the PowerPoint presentations

1. I wish I could save the PowerPoint presentations and the interactive materials to my floppy disk/computer easily.	25 27,5%	31 34,1%	11 12,1%	4 4,4%	3 3,3%	17 18,7%
2. I wish I could print the PowerPoint presentations and the interactive materials easily.	22 24,2%	34 37,4%	13 14,3%	3 3,3%	4 4,4	15 16,5%

Almost half of the students complained that the PowerPoint presentations could be available once they were online, otherwise not available. Some students tried to download the presentations, some students tried to study offline after opening all the necessary pages, and some of them tried to study them by printing. However, neither downloading any presentations nor printing them with the visuals was possible; thus, students preferred not to use the presentations for individual study. Therefore, they found studying the presentations to be economically cumbersome, and fairly time consuming. The expectation of students on this issue was an opportunity for studying the presentations offline, such as being delivering on CD ROMs. In addition, as can be seen in Table 4-15,

61,6% of them would like the materials in the Web site to be easily downloadable and to be easily printable.

Six students claimed that the presentations had glaring, eye tiring, and hard to read colors. Two students suffered from the fact that the colors of the presentations got their eyes tired when they focused on the material for a long time. At this point, the students wished the background-text-image color settings to be adjusted in a way that it did not hinder reading and make the eyes tired.

PowerPoint presentations opening slowly or not opening at all from time to time was another problem stated by the participants. They also pointed out that the presentations opened more slowly out of the campus. Some students attributed these problems to the quality of the Internet connections.

4.4.5 Feedback/Correction

One student stated that there was no component informing them about whether they comprehended the subject or not.

Some students wished to see some interactive tests for feedback and correction purposes at the end of each presentation.

4.4.6 Textbook vs. PowerPoint Presentations

Almost all students preferred studying the course from the textbook to the presentations, because the textbook presented more detailed information and it did not tire their eyes so much. Some students also stressed that it was a must to study the textbook. Several students stated that there was no need to study the presentations since the course had an extensive textbook.

On the contrary, some students stated that the content of PowerPoint presentations were easier than that of the textbook. One student indicated that s/he preferred the presentations to the textbook for individual study. Four

students indicated that the materials on the course Web site should be used as a supplementary source.

Four students claimed that they read the textbook and did exercises from the textbook when they did not master the topics in the lectures. They believed that there would be no use of studying the presentations, which were also used during the lectures, to learn a topic that they did not grasp well in the classroom. However, two students advocated that they could learn the concepts by studying the presentations. Besides, one student stated that s/he studied the topics that s/he did not learn exactly in the lectures with the presentations.

4.5 The Students' Perceptions of the Usage of the PowerPoint Presentations in the Lectures

An important amount of students had doubts about the use of PowerPoint presentations in the classroom. As seen Table 4-16, only 19,8% of the students enjoyed the instruction made with PowerPoint presentations. The students believed that presentations did not contribute to their learning. When the data collected with the questionnaire was examined again, 14,4% of the class stated that the instructors using PowerPoint presentations in the lectures did not help them learn the concepts, as can be seen in Table 4-16. They indicated that only following those presentations was not sufficient during the lectures. Another issue pointed out was that quizzes and midterms were more challenging although the lectures did not include such hard questions. Because of these reasons, the students said that they did not want to attend the lectures.

Table 4-16
Instructional Use of PowerPoint presentations

	SA	A	N	D	SD	No answer
4. I enjoyed that the lectures were given with PowerPoint presentations.	3 3,3%	15 16,5%	12 13,2%	26 28,6%	29 31,9%	6 6,6%
9. The instructors' using PowerPoint presentations in the lectures helped me learn the concepts.	2 2,2%	12 13,2%	15 16,5%	28 30,8%	26 28,6%	8 8,8%

Most of the students would like the lectures to be presented in a way that the students are accustomed to; in other words, in a traditional manner. Especially, as the setting was not traditional students were not able to take notes during the lectures. Hence, they would like the instructor to give lectures in such a way that they can take notes. One of the students expressed why the attendance rate is low:

> I would like the interactive materials to be extended and conjoined with more sample questions, but I wish the lectures were done in a way that we are used to... the PowerPoint presentations do not satisfy me. They do not satisfy many students in our environment, either. In fact, there is a huge drop in the attendance rate of the students. As far as I know, 140 students are enrolled; in the first day the auditorium was very crowded. Now we go to the lectures and only about 20 students attend the lectures. This is a result of the impossibility of keeping attention on the instruction. Only in the first 45 minutes... after that you cannot keep your attention on the instruction.

Half of the students claimed that they were not used to participating in lessons that were supported with PowerPoint presentations. They could not learn the contents with such instruction. In fact, they said that they were used to see the instructor while he was solving sample problems on the board. As one of them said:

In fact, this is not a system with which we are familiar... computer assisted instruction... how is it carried out? How are the obstacles overcome? ... Basically, the method of lectures is different for us since we are not accustomed to this system. For instance, I have seen such a method of instruction for the first time here. ... I have had computer labs but I have not got any familiarity to such things. I saw this method for the first time here...

Table 4-17
Students' Attendance Rate for the General Chemistry Courses I and II

	Frequency (N=91)
Lower than 25%	35 38,5%
25% - 50%	22 24,2%
50% - 75%	19 20,9%
75% - 100%	13 14,3%
No Answer	2 2,2%

In fact, attendance to the course was not obligatory. It is probably because of this that the attendance rate was low, as the data gathered from the students indicated in Table 4-17. When the reasons for low attendance were asked for in the questionnaire, the students put forth two main reasons: one is that PowerPoint presentations are used in the lectures, the other is that the lectures are in the morning, as can be seen with other reasons in Table 4-18.

There was an objection to the course load. Three students pointed out that the course covered too many concepts. They thought that most of the problems they experienced related to the lectures were as a result of this problem.

Table 4-18
Reasons for Low Attendance

	Frequency (N=91)
Lack of Understanding Subjects	20 22%
Learning better by studying the text book	25 27,5%
Lectures are in the morning	38 41,8%
I cannot take notes well in the lectures	16 17,6%
PowerPoint presentations are used in the lectures	49 53,8%
Lectures do not appeal to me	4 4,4%
Other reasons	4 4,4%

4.5.1 Classroom Environment

There were some problems reported for the classroom environment. Seven students stressed that the PowerPoint presentations were not readable from over a distance in the auditorium. The other stated factors that affect their learning in the classroom environment such as faded text in the presentations, auditorium not being appropriate for computer-supported instruction, imbalance of heat, and lighting problems.

4.5.2 The Role of the Instructor in the Lectures

The students agreed that the instructor added a significant value to the content of slides with his comments. His efforts to make the theme of images in the presentations more clear had an important contribution to their learning. An important amount of the students said that the instructor asked questions about his comments in the exams.

Table 4-19
Students' opinions about the lectures

	SA	A	N	D	SD	No answer
10. There was sufficient teacher-student interaction in the lectures.	4 4,4%	17 18,7%	20 22%	28 30,8%	12 13,2%	10 11%
7. It was helpful that the instructor taught the abstract concepts by showing the pictures and animations in the course Web site.	3 3,3%	33 36,3%	26 28,6%	14 15,4%	6 6,6%	9 9,9%

The students said that the instructor sometimes used the blackboard, but they stressed that he should have used the blackboard more frequently. Six students said that he should at least solve sample problems step by step at the blackboard. A student stated her concerns and expectations below:

> For the next semester, I want the instructor to write and solve sample problems on the blackboard. I wish to see a way of instruction that I can take notes. Besides, according to me, I should apply the materials in the course Web site when I wish. Or for example, if the instructor cannot explain any concept and needs to apply an animation to teach that, it is okay. But, I do not want to read all the text one by one, and the sample problems and their answers to be ready-made in the slides.

Similar to this student's comment, as illustrated in Table 4-20, 68,2% of the students wished the lectures to be done in a way that enables them to take notes. An important amount of the students wished the instructor to lecture more actively and to be the center for instruction. These students proposed that the instruction should not have followed only the PowerPoint presentations, since they found reading the text in the presentations one by one to be boring and useless. In addition, they indicated that student-instructor interaction is very low during the lectures. As illustrated in table 14-19, 44% of the students agreed that the student-instructor interaction in the classroom was inadequate.

Table 4-20
Students' expectations about the lecture method

	SA	A	N	D	SD	No answer
5. I expect the lectures to be done in a way that I can take notes.	45 49,5%	17 18,7%	7 7,7%	4 4,4%	3 3,3%	15 16,5%

The students wished the instructor to use the presentations only for showing images and demonstrating animations to clarify abstract concepts. They stated that the instructor demonstrating concepts via animations in the lectures was very useful and that this new way of teaching is more effective than traditional lecturing. As can be seen in Table 4-19, 39,6% of the students agreed that it was helpful for the instructor to teach abstract concepts by showing the pictures and animations in the course Web site. About this issue, one of the students stated the following:

> For example, the animations... we cannot do some experiments in the classroom. Especially the animations showing waves, the appearance of electrons... We supposed that they had definite orbits. But the instructor said that they did not, or you cannot imagine, but for example, he opened the related animation last day, he demonstrated... There is an object in front of you, you can see it, and then it is easier to create that in your mind. Perceiving by seeing is more effective than only accepting.

They also expected the instructor to comment on the definitions taking part in the presentations and to alter the method of instruction when the students had difficulties to learn the concepts. One of the students pointed out:

> I would like the instructor to be more active, Okay. The materials on the Web are very useful resources, they are supplementary resources. The ones who are curious about a concept and who can not learn or even imagine a concept can apply the materials on the course Web site. But in the classroom, we attend the lectures to interact with the instructor. Concepts should not generally be taught

in only one way. But if you want to teach the concepts in only one way, via the PowerPoint presentations, then the students do not learn. For instance, when I came to the classroom two weeks ago, the instructor presented the concepts with the PowerPoint presentations for two hours. At the end of the lecture, he asked a question about the concept, -we were 30-35 students in the classroom- and nobody could solve the question. Because, they we not learn the concept. The instructor did not alter the way of instruction so that we grasp that concept. The PowerPoint presentations or Problems part in the course Web site is insufficient alone.

4.5.3 Feedback/Correction

The students agreed that the slides were changed so fast that there was no time to ask about the points they did not grasp. They said that they were able to ask their questions to the instructor only in the breaks or after the lectures.

There was a recitation for students who had any questions, but the students wished the instructor to schedule obligatory recitations in which an assistant from the department solved selected problems every week.

Table 4-21
Students' opinions about feedback in the lectures

	SA	A	N	D	SD	No answer
5. I had the opportunity to ask questions to the instructor about the points that I could not understand in the lecture.	7 7,7%	25 27,5%	17 18,7%	22 24,2%	11 12,1%	9 9,9%

Table 4-21 indicates that 35,2% of the students had the opportunity to ask questions about the point that they did not understand while 36,1% of them believed that they could not ask questions to the instructor as much as they desired.

4.5.4 Activity of the Students

The students said that they listened to the instructor and tried to follow the lectures by taking notes. One of the students indicated that she brought the textbook to the classroom in order to underline the point that the instructor stressed.

Half of the students did not find the lectures effective. Besides, PowerPoint presentations existed in the course Web site; therefore, most of the students stated that they did not want to attend the lectures. The students, who pointed out low attention rate to the lectures due to these reasons, and wished that attendance were obligatory.

Half of the students suffered from being passive in the lectures. They stated that their activities were only composed of listening to the instructor and watching the PowerPoint presentations. They stated that since the topics were covered too quickly, they did not have time to comment on and take notes about the sample problems.

Besides the fact that taking meaningful notes was not possible, the students pointed out that they did not set up meaningful relationships with the notes they took and the other course materials such as the textbook, PowerPoint presentations and interactive materials in the course Web site. In fact, their efforts to take notes were not at all beneficial since they could not make use of the notes they had taken.

4.5.5 Attention

When the related questionnaire results were examined in Table 4-22 it is seen that most of the students, 72,6%, could not keep their attention during the instruction. They found the use of PowerPoint presentations to be the major reason of their lack of attention and interest towards the course.

Table 4-22
Students' opinions about their attention in the lectures

	SA	A	N	D	SD	No answer
6. I could not pay careful attention to the instruction during any lectures.	23 25,3%	43 47,3%	6 6,6%	7 7,7%	3 3,3%	9 9,9%

The students said that they became very passive and their motivation was affected by the continual use of PowerPoint presentations negatively. One student stated that s/he gave little attention to the text in the PowerPoint presentations and that s/he tried to listen to the instructor. Besides, some students stated that they did not remember anything in the evening after any lesson. They stated that they sometimes realized which points they had missed in the lectures during their individual study. A student stated an expectation about this issue:

> There are sometimes sound effects within the slides to attract students' attention, especially towards the end of the lectures. The sleeping students wake up suddenly with these effects and begin to follow the lecture, but in five minutes time the lecture will finish.... If we take notes, we will pay more careful attention to the lectures, but I cannot follow the lectures carefully when I do not take notes.

Several students indicated that the instructor had difficulties in gaining attention of the students. They proposed that the students would be more interested and active if the instructor did not use the PowerPoint Presentations.

4.5.6 Sample Problems Solved in the Classroom

The students stated some challenges and expectations about the quality, quantity, and way of solution of the sample problems, which were solved in the classroom.

One out of five students complained that an inadequate amount of exercises were solved in the lectures. Some students stressed that the sample problems were simpler and less extensive when compared to the ones in the examinations. The students wished the instructor to solve more sample problems, which were extensive and more challenging.

Table 4-23
Students' opinions about the effectiveness of sample problems

	SA	A	N	D	SD	No answer
8. I have learnt how to solve the sample problems exactly in the lectures.	1 1,1%	14 15,4%	18 19,8%	33 36,3%	16 17,6%	9 9,9%

Three out of four students had doubts about the effectiveness of the instructor's showing previously solved problems on the PowerPoint presentations. When the related data collected by means of the questionnaire are examined in Table 4-23, it is seen that only 16,5% of the students stated that they had exactly learned to solve sample problems in the lectures. Seven students said that giving the previously solved problems divided in two slides on the screen did not improve their problem-solving skills. Four students stressed that since they did not have the opportunity to join the problem solving process with the instructor as s/he was solving, for instance on the black board step by step, they did not learn the problem solving process exactly. They generally complained about not being able to grasp the solutions since the questions and answers to the questions were ready in the presentations and were quickly passed. Most of the students stated that it would be better if they solved the questions with the instructor at the same time. One of the students said the following about this issue:

The instructor displays the sample problem with a click, then with another click the half of solution is on the wall. I say, "What is that?", "where did this number come from?" Short solutions have been written as a summary in the slides. I say "where did it come from?" With another click, you see the result. And then to another slide with another click. I really do not learn, ... since the process is not written on the board the answers are passed in a short time. While we are asking ourselves "where did that number come from?", "what is that?" the answer is already on the wall. While we try to understand the result, a new slide is opened.

Another student stated similar concerns about this issue:

For example, the question appeared suddenly on the slides... The instructor wanted us to solve it. He supposed that more than sufficient time had passed, but we had just been able to read the question and we have not made any comments about it. Since we had not made any comments on it, we only watch the solution without making any comments. We could not say, "Yes, this came from there; that came from those". We could not comprehend the concepts. Therefore we say that the instructor should go step by step while solving a sample problem. Everything is ready in the slides. He passes from a slide to the next directly; we cannot learn in such a speed. The instructor should solve the problems by making comments.

Table 4-24
Students' expectations about sample problems

	SA	A	N	D	SD	No answer
3. I would like the instructor to solve sample problems step by step on the blackboard.	44 48,4%	24 26,4%	2 2,2%	2 2,2%	4 4,4%	15 16,5%

In conclusion, the students were anxious about the sample problems and its answers being in the presentations. One of the students stated the importance of gaining the problem solving skills as the following: "What is important is to understand how a problem is solved, not to see what the solution is." Similarly,

as seen in Table 4-24, 74,8% of the students would like the instructor to solve sample problems step by step on the blackboard.

4.5.7 Mastery of the Topics

The students claimed that they had difficulties in learning the concepts although they made an effort to follow the lectures. As a reason for this, most of the students pointed to the use of PowerPoint presentations in the lectures. They stated that the concepts passed by without being learnt and internalized well.

They stated that while they were reading slides in the lecture they felt as if the concepts were simple but they realized that they did not remember anything in the evening of that day, as a student indicated below:

> For the last six lectures the blackboard has been used. I have been attending all the lectures....The use of blackboard perhaps occupies 10% of the lecture process since the beginning of the semester. There is no chalk dust... when you think in this way; it is very well to use PowerPoint presentations. But I said that we could not realize even which points we missed in the lectures. It is like this for me... when I open the book and study myself, I realize that I could not learn some crucial points and I was not aware of those points in the lectures. I believe that I listen to the lectures carefully. However, there are still such problems. Perhaps some solutions could be found. At least the sample problems could be solved at the blackboard if the other parts will still be on the PowerPoint presentations.

Some students said that if they came to the classroom without any preparation, the lecture had no use. Similarly, one student stated that if s/he studied the concepts before the lectures, s/he comprehended the concepts better. Some students also indicated that if they had no prior knowledge about the concepts, they sometimes did not realize the goals of that lecture. These students proposed that the best way of learning in the lectures is to take notes from the blackboard. They also claimed that they learned better if a lot of examples were solved in the lecture.

As they were students from department of Chemistry, one out of four students stressed that they had to learn the Chemistry concepts better than the students of other departments did. They believed that they should have taken a more detailed introductory Chemistry.

When the self-paced learning of the students is investigated, they claimed that because of this reason, they lost a lot of time studying the concepts instead of doing exercises. So they thought that they did not solve problems sufficiently to master the subjects, as a student stated below:

> Since we cannot do anything during the lectures, we do not realize how fast the concepts are passed. For instance, suddenly we notice that we come to the end of a chapter... and when we study at home, we are overburdened with the concepts. As an example, there are ten chapters in a unit. Five or six of them are finished in a lecture session. When you decide to study those chapters at home, you cannot internalize them if you do not comprehend them well in the lecture. You get tired while trying to learn them alone. You cannot really do anything, for instance, you cannot solve exercise problems, no time is left to do that. You expensed your energy in reading the chapters. Your mind gets tired, too. What is happening? You studied, Okay, but it is still incomplete.... At least I experience these things.

The students stated that they stumbled when solving problems whose solutions did not exist in the textbook. They also added that there were no resources put to their use that they could learn from. They insisted on the fact that their knowledge did not reach a level necessary to solve the problems in the textbook by watching the sample problem solutions in the lectures.

In addition, some students pointed out that effective use of the materials in the course Web site was hindered by their low level of computer literacy. Table 4-25 shows the students' self-evaluation of their computer competencies. More than half of the students thought themselves as intermediate computer users.

Table 4-25
Students' self-evaluation of their computer competencies

Computer Competency Level	Frequency Percent (N=91)
Elementary	20 22%
Intermediate	55 60,4%
Upper Intermediate	12 13,2%
Advanced	2 2,2%
No Answer	2 2,2%

4.6 The Students' Perceptions of Online Assessment in terms of Their Achievement

The students agreed that the e-quizzes did not have any significant benefits for the students compared to traditional paper and pencil quizzes, but it had some advantages for the instructor. Learning the results just after the quiz was pointed out as the advantage of e-quizzes by one out of four students. Besides, one out of five students claimed that taking quizzes in general had forced the students to study regularly. However, the data collected in the questionnaire indicates that only 31,9% of the students agreed, while 38% of them disagreed with the idea that the quizzes encouraged regular study, as shown in Table 4-26. On the other hand, the most important advantage of e-quizzes for the instructor was found to be the e-quiz system generating points automatically for every student.

However, one out of four students did not like to take quizzes via the Internet due to the following reasons: not being able to concentrate on the questions in the laboratory atmosphere, being able to see the answers of other

students from their monitors, the inappropriateness of solving problems in front of a monitor, loosing time while writing the questions on paper and the negative transfer of the habit of solving problems on paper. The students stated that taking quizzes via the computer was not appropriate since quiz problems required too many calculations and required solving on paper. The students also pointed out that since the quizzes were given to two successive groups in the same place, it led to chaos in the laboratory and affected their concentration in a negative way.

One of the participants stated the difficulties of taking quizzes via the computer as following:

> ... All of our concerns are related to writing and drawing. Up to now we are used to doing like that, we solve the problems with paper and pencil. We draft something on paper... the Internet is Okay, there are some advantages of e-quizzes. We learn the result as soon as we finish the quiz, but while solving the problems during the quizzes, as I said I cannot concentrate on the problem. I think we are used to solving questions on the desk. It is a bit difficult in front of a computer screen... I always solve questions on paper by drafting on the question. But transferring the question on the screen to the paper is problematic because the time is limited, there is no extra time given. There is a difference in writing it on paper as a summary in a short time while seeing it only on the screen or seeing the questions directly on paper. This is the disadvantage of e-quizzes.

One out of four students claimed some difficulty about the nature of e-quizzes. Since they consisted of multiple-choice questions, one out of four students indicated that they lost all the points with a little mistake. A student said, "Some students say "I find the answer by chance", though it is possible, I get annoyed with this situation. But on the other hand, assessing the quizzes is easy. You can get the results very quickly".

Table 4-26
Students' opinions about e-quizzes

	SA	A	N	D	SD	No answer
29. The quizzes encouraged me to study regularly every week.	8 8,8%	21 23,1%	11 12,1%	23 25,3%	15 16,5%	13 14,3%
30. The quizzes were of such a good quality that they assessed to what extent I had learned the concepts.	2 2,2%	24 26,4%	9 9,9%	31 34,1%	15 16,5%	10 11%
31. I found the right answers generally by chance.	6 9,9%	22 24,2%	18 19,8%	26 28,6%	9 9,9%	10 11%
32. The quizzes made me realize my deficiencies about the concepts that we learned in the lectures.	3 3,3%	18 19,8%	22 24,2%	27 29,7%	9 9,9%	12 13,2%

Three students stressed that the quizzes did not assess them fairly because of their multiple-choice nature. Since the quizzes did not require the students to show the ways they obtained their solutions, the students thought that the quizzes did not distinguish between the students who learned and those who did not learn the concepts. Moreover, four students stated that they found the answers by chance, 34,1% of the class agreed on this issue, as shown in Table 4-26; three students stated that they found the answers by trial-error method; one student stated that s/he saw the answers from her/his friends' screens.

They also addressed an important aim of quizzes, namely feedback and correction. With current implementation, they stated that they did not get necessary feedback by means of the quizzes, since they could not access the quiz questions again and its solutions were not provided. After the quizzes, letters of the right options for the multiple-choice questions were emailed to their account. But the students said that getting the e-mail informing them about their point and the right option for each question had no significant meaning for them. As an

example they pointed out that they when they finished the quiz and got five out of ten, they did not remember which questions they answered correctly. One of them pointed out the feedback and correction matters below:

> ...The quizzes should be given for research purposes. For example, imagine that there are 10 quizzes in the course Web site, they update it regularly, we exercise those quizzes, we do them interactively, and get the result immediately. This could be done. Otherwise, to take the quizzes once a week via the Internet has no meaning. If we take them on paper, it is the same at the end. Grade wise... giving a grade to every student. You get the results immediately after you finished the quiz. This is a nice thing, but not an additional effect.

The student stated that since the quiz questions and answers were not available on the course Web site after the quizzes, they did not see their mistakes and the correct way to solve the questions of any of the quizzes. Therefore, they wished quiz questions and answers appeared on the course Web site to get feedback about their developing chemical concepts in their minds. As seen in Table 4-27, 72,9% of the class agreed on this expectation. A student stressed this expectation below:

> I wish the solution of the questions were published in the Web site after one of two hours. I expect it for the midterms, too. I wish they published the solutions. There is a facility to do that. It should be done. I think publishing the answers in the Web site is not a challenging task.

Half of the students chose not to agree on taking the quizzes via computer at the same place and at the same time. They proposed that in the case of the quizzes being continually delivered via the Internet, it would be more practical to take the quiz from any location at any desired time during the quiz week. As shown in Table 4-27, 62,7% of the class agreed on this issue. One student stressed that it would be more effective to take quizzes in the traditional manner on paper. In fact, 45,1% of the class stated that they preferred to take quizzes on paper. Most of the students agreed that if the quizzes where delivered in the same place at the same time, it would be more practical to take a paper and pencil quiz

rather than via the Internet. A student illustrated the implementation matters about time in the following manner:

> We go to the labs every Tuesday at 12:40 PM. Students from two large sections are in front of the labs. I think this is very difficult. For instance, ... We have a lab session at 13:40 PM, We take the quiz at 1:00 PM. They rush to the lab as soon as they finish the quizzes... and some of them leave some lessons to take the quiz. There were such cases.

Another student stated the difficulties of taking e-quizzes all together in the labs:

> It is nice to take quizzes every week. You study regularly unit by unit by means of them but when you take it via the computer, you have 10 minutes. We wait there to take the quiz. We cannot access the course Web site. You have to wait. Any problem may arise. A student looses 20% or 30% of the 10 minutes. Therefore, are 10 minutes enough to solve the questions? Or two questions in 10 minutes... how can we solve them? Nor is it possible to concentrate on the questions faced with such a negative situation. For me the quizzes are not very nice.

Table 4-27
Students' expectations about e-quizzes

	SA	A	N	D	SD	No answer
6. I would like to get points from the ways of solution of problems in the quizzes.	41 45,1%	17 18,7%	10 11%	6 6,6%	3 3,3%	14 15,4%
7. I prefer taking the online quizzes from anywhere and anytime.	40 44%	23 18.7%	7 7,7%	6 6,6%	1 1,1%	14 15,4%
8. After the quizzes, I would like to see the quiz questions and answers in the course Web site.	48 52,7%	22 24,2%	3 3,3%	1 1,1%	3 3,3%	14 15,4%
9. I would like to take the quizzes on paper rather than via the Internet.	20 22%	21 23,1%	16 17,6%	14 15,4%	6 6,6%	14 15,4%

They also wished to get points from their way of problem solving. So they wanted the quizzes not to be multiple-choice. As seen in Table 4-27, 63,8% of the class agreed on this issue.

CHAPTER 5

CONCLUSIONS

The findings of the study were presented in detail in the previous chapter under the title of the major themes found. In the light of the findings, a discussion of major findings and implications for further practice and further research were presented in this chapter.

Discussion of the major findings were presented first, following by the implications of the present study for practitioners, i.e. instructors, instructional designers, administrators of educational institutions, and for researchers.

To remember the focus of the study, it is useful to restate the main research question of this study, that is, "What are students' perceptions pertaining to Web-based applications and activities in an introductory Chemistry Course?"

In this respect, this study aimed to find answers to the following sub-questions:

1) What are students' perceptions pertaining to the course Web site?

2) How do students perceive Web-based materials intended to support their learning?

3) In what ways do the students perceive the PowerPoint presentations during lectures and self-paced learning?

4) How do students perceive online assessment in terms of their achievement?

5.1 Discussions

Discussion of the major findings presented in an organization such that each theme found related to main research problem was presented under a unique title.

5.1.1 Discussion of the Perceptions about the Course Web Site

The findings indicated that because of economical difficulties, the students did not prefer connecting to the course Web site to study the materials online at home; rather, they connected to it on campus, although most of them believed that the study environment at home was better than that of the laboratories in the campus.

The interactive materials were the most liked component of the course Web site. In fact, it was because of the fact that these materials contained animations that illustrate challenging concepts visually. They agreed that learning the grades, assignments and the solutions of those assignments were other advantages. PowerPoint presentations used in the lectures were also among the popular sections of the Web site.

The students were pleased with seeing all of their quiz and exam grades together in the Web site, but they would like to see some statistics about grades such as mean scores in order to see where they stand within the group in terms of their grades.

As a feedback mechanism, the most of the students found the assignment problems with its answers to be quite effective. They liked challenging problems in the "Problems" part of the Web site, which helped them learn the concepts

better. However, some students pointed out the imbalance between the difficulty levels of the questions in this component and the ones in the exams; they believed that the exam questions were harder.

The disorganization of administration and maintenance of the Web site frustrated almost all of the students. For all the components of the Web site, old announcements, expired information, and being late in publishing necessary information were some problems indicated about updating the Web site.

However, most of those problems arose from the server security policies of the research institute. The Web server was deployed in the research institute. Since they did not give the opportunity to the instructor to update the pages remotely, the instructor did not make necessary updates related to the course activities such as quizzes and grades on time, the information flow about the updates could not be established in a healthy way, either. But, the students wanted the course Web site to be updated at least once a week. Regular updating was important because they saw the Web site as a communication tool, and naturally, they expect it to function as it promises, and they expect stability in the services of the Web site. They would like to see the necessary information and announcements in the Web site on time. Otherwise, they do not utilize the Web site anymore, since their trust to the Web site decreases.

About the design of the course Web site, the most pointed issue was that the materials in the Web site were only available when they are on the Internet, and they had no chance to download or print them easily. However, the students would like some alternative delivery of the materials placed on the Web site such as CD-ROMs and printed media. Because the Internet is still expensive to use at home, and working in campus labs is not very comfortable though the Internet is available with no payment.

The students wished the Web site would be more attractive for them. To improve it, some students proposed that there should be more experiment

simulation software and Chemistry education games in the Web site. In addition, they would like information about today's Chemistry to take part in the Web site.

Besides, most of the students would like to see more beneficial materials, such as the instructor's own lecture notes, questions and answers of previous final and midterm exams in the Web site. They believe that these materials were necessary in order to master the concepts and be more successful in the exams.

Finally, the students wished the chat room to function in order to discuss sample problem solutions and Chemistry concepts with other students synchronously.

5.1.2 Discussion of the Perceptions about Web-Based Supportive Materials

The results revealed that that the students' perceptions of the Web-based supportive materials, interactive materials in this case, were positive in general. They found the materials to include various and interesting knowledge. At the same time, they were pleased with the materials since they contain animations illustrating the concepts. By means of these materials, the students had been given an opportunity to construct their own knowledge about the chemical concepts covered in the materials.

However, the students agreed the content of the interactive materials was more difficult than that of the lectures and the textbook. Moreover, studying these materials requiring prior knowledge was another frustration about the content of the materials. Besides the difficulty of the content, their language difficulty was also criticized.

For the design issues, printing and downloading matters, ambiguous heading style, small font size, not making the necessary plug-ins available, lack of orientation and directions through the materials were the difficulties about the interactive supportive materials.

Many students claimed the font size to be too small. They wished to see the text with bigger font size and to see more balanced pages with the text and animations.

The students looked for the ways to print and download the interactive materials in the course Web site. They wanted alternative delivery of those materials such as hard copies, CD-ROMs, or being easily downloadable in order not to use the Internet for long hours to study them.

When the findings about the interactive materials were analyzed, the importance of orientation of the learner and giving clear directions about how to use the material, the minimum and optimum computer configuration and necessary plug-ins appears. The minimum configuration of computers for the materials and the Web site were not indicated, and therefore the students experienced some difficulties while studying these materials. For example, the problems about the lack of navigation in information boxes within the text were because of not adjusting the display resolution properly. Since the students were unaware of the requirement of that adjustment, they could not see some portion of the information boxes.

Students indicated that no feedback mechanism existed within the interactive materials. But they needed a component to provide feedback and correction. In this case, we cannot evaluate the interactive materials as tutorials since they do not involve any feedback mechanism. It is not clear to what extent they led to learning. They can be valued as electronic reference materials. If they are revised to include components providing feedback and assessment for the learners, these materials may be called tutorials.

When the reasons for the usage of the interactive materials were investigated, it was seen that the students usually applied the materials by means of an external motivator: the instructor. He encouraged them to study these materials. Besides, he asked questions from the materials' content in the exam to increase its usage. In fact, this was effective on students to increase usage rate.

Similar to the findings of Nicholas and Laudato (1999), that is, students liked online materials and thought that the online environment contributed to their learning (¶ 58), most of the students wanted the existing materials to be improved and interactive materials for all the concepts to be developed. This finding indicates that the students were satisfied with the idea of supportive materials being available on the course Web site.

For the content of the materials, it was found that the students would like to see them in the instructors' lecture notes format. This desire may have originated from their previous educational habits and experiences, since they were heavily accustomed to instructor-centered instruction, and the instructor being the main source of knowledge. It seems to be difficult to change these habits of first-year students. The main problem for these students was to cope with the given freedom of self-guided learning and self-pacing. (Harms, Krahn, and Kurz, 1998, ¶ 21).

Another reason behind this desire was that they found the English text difficult to understand in the materials.

5.1.3 Discussion of the Perceptions about Animations within the Interactive Materials

The most interesting aspect addressing the students as learners was the animations in the interactive materials. Almost all of the students enjoyed the animations within the interactive materials, because those animations made chemical events concrete, as they were 3D, which led to learn deeply in a short time. This finding supports the proposal of Doyle (2001), who sated that animations can enhance understanding by depicting real objects slowed down or speed up.

The students indicated that the animations helped the concepts to fit well into their minds; thus helped them see the logic behind the formulas, and principles. This was mainly because the animations were visual. The advantages

have also been related to the following words: "Animation is able to convey a vast amount of information in a very short period of time and can be a powerful method of reinforcing concepts and topics first introduced to students through text, discussion and other media" (Doyle, 2001, ¶ 4).

Most of the students agreed that the instructor demonstrating the concepts via the animations was very beneficial in the lectures, and this way of teaching was more effective than traditional teaching. Nicholls et. al.(1996) obtained similar results. Following Rieber's description of attention-gaining, presentation, and practice as the three potent ional functions of animation, they found that animation was effective in a number of areas as a supplement to existing instruction, i.e. practice (¶ 45).

It is found that the purpose of animations, which concept they present, what their phases are, and how to use them needed to be given by inserting clear directions in the form of text, tables, or graphs near the animations, in order for learners to grasp the main idea that they present. Most of the students expected to see certain explanations and/or graphics that describe what is going on in the animations.

The students felt the contribution of animations to their learning, so they would like to see animations for each concept in the course content, especially for the ones that were difficult to imagine and learn.

5.1.4 Discussion of the Perceptions about PowerPoint Presentations for Self-Paced Learning

The students would like to see easily downloadable and printable materials in the course Web site. This was important for two main reasons: fist, they do not want to pay extra money for the Internet when studying materials by staying online; second, they would like to have alternative delivery of the materials so that they can chose the one most appropriate for them. This finding verifies Taba (1962), who stated that not all individuals learn most effectively by

the same type of activity. She adds that different individuals need different type of learning activities for their self-development. So instructors should take into consideration alternative learning experiences.

More than half of the students found the design of the presentations to be fine. However, some students indicated that background-text-image color settings should be adjusted in a way that it does not hinder reading and make their eyes tired. The presentations were prepared by the instructor. It seems that not all the visual design principles were considered while designing them. There may have been no time to design it as visually powerful, or the instructor may not have been able to devote time for learning visual design principles or applying them because of his workload.

The PowerPoint presentations took part in the course Web site. For the students the presentations had two practical usages: first, following the lectures when they did not attend the class; second, glancing at the content before quizzes and exams, to make a general review.

For studying purposes, rather than presentations, the students expect to see more extensive lecture notes prepared by the instructor, on the course Web site. This may be because of the fact that almost all of the students found PowerPoint presentations superficial as a supportive course material.

The students tend to compare the textbook and the PowerPoint presentations. Most of the students proposed that PowerPoint presentations were not sufficient alone as supplementary materials. Almost all of the students studied the course with the textbook.

5.1.5 Discussion of the Perceptions about Use of PowerPoint Presentations in the Lectures

The continuous use of PowerPoint presentations in the lectures negatively affected the students. They did not enjoy following PowerPoint slides during the

lectures. They believed that continuing instruction with these presentations does not contribute much to their learning. This may be because of the instructor continuously using a few methods of instruction in the lectures and not alternating the method of instruction when the students had difficulties in learning.

In fact, the new implementations in this course could not be called Web-enhanced instruction, because the web has almost no crucial role for students' learning in the instruction. Instead, it can be concluded that some electronic materials were presented to students as supportive materials on the course web site, and the lectures were given via the PowerPoint presentations.

The students suffered from being passive in the lectures. They stated that they only listened to the instructor and watched the slides, so they did not actively participate to the lectures. A few minutes after the beginning of the instruction, they lost their attention since they were not active, they were not able to take notes, and there was not much instructor-student or student-student interaction in the classroom. Almost all of the students believed that at least they should take notes to participate actively in the instruction besides listening to the instructor and watching the slides. One-way communication made the students bored in the lectures. For of these reasons, the students thought that they did not learn the concepts exactly.

The students pointed to an imbalance between the difficulty levels of sample problems solved in the classroom and those of the questions asked in the exams. They found the exams' questions much harder than the sample problems in the presentations used in the lectures.

The students would like the lectures to be done in the way to which they were accustomed; in other words, in a traditional manner. They are used to instructor-centered instruction which involves the instructor having the responsibility of transforming knowledge to the students by using chalk and blackboard.

However, when evaluating the results, it should be considered that the class size was 143 and interaction rate naturally decreased since the lectures were done in an auditorium. Besides, it may be one of the most important reasons to the reported problems about the lectures that the course content was too loaded: There were too many concepts to cover and it became impossible to give lectures in an interactive way. Similarly, the students relate the instructor selecting this method of instruction –mostly using PowerPoint presentations- to the necessity of covering too many concepts in the lectures.

The students agreed that the instructor added a significant value to the content of the slides with his comments. In addition, the students claimed that the instructor's efforts to make the theme of images and animations more clear contributed much to their learning.

On the other hand, the sample problems to be presented via the PowerPoint presentations frustrated the students very much. They generally complained about not being able to grasp the solutions of the sample problems since the questions and answers to the questions were ready in the presentations and were presented too quickly. This caused them not to comment on the solutions of those sample problems. They proposed that seeing the solutions ready on the slides had no meaning for them. In fact, they suffered from missing the process of solution. The students wish mentally to join the problem-solving process by watching the process and taking their own notes while the instructor is solving sample problems. Therefore, the students would like the instructor to use the blackboard, especially for solving sample problems step by step. Most of the students stated that it would be better to solve the questions on their notebooks while the instructor was solving them on the blackboard.

As Kandies and Stern stated, Web-enhanced courses facilitate students to become more active learners as they take responsibility as co-discoverers of knowledge (2000). It is found that technology-enhanced instruction requires the students to take some responsibilities of instruction such as studying the content

previously. Some students indicated that if they study the content before the instruction, they learn better.

The students stated that feedback and correction did not exist in the lectures. Only after the lectures and in the break times did they have the opportunity to ask their questions directly to the instructor. Although the course had a recitation hour for those with questions, the students wished weekly obligatory recitation hours to be scheduled in order to promote the solving of a greater variety and amount of exercise problems.

When they studied the course individually, they spent a lot of time studying the concepts and had no time to solve extra problems to learn better. They insisted that they did not master the concepts well enough by watching the sample problems on the slides in the lectures. It may be because of that they did not learn the concepts exactly in the lectures.

In conclusion, the students believe that the use of PowerPoint presentations did not contribute much in their learning except for seeing some visuals that illustrated the concepts. Besides, the students seemed to have a tendency to resist new methodology in instruction. They would like the instruction and their learning strategies to continue in the way to which they were accustomed. It seems that they did not realize their new responsibilities coming with the new way of instruction. They need some orientation to clarify their new roles in technology-enhanced instruction.

5.1.6 Discussion of the Perceptions about Online Assessment

Weekly quizzes delivered via the Internet synchronously were called "e-quizzes". They were given via the Internet in a computer lab on campus by dividing the class into two groups and giving the quiz in two successive sessions to these groups. Taking a quiz in this way was found not to bring a significant difference compared to traditional paper-pencil quizzes taken in the classroom, except for learning the points immediately after the quizzes. They stated that this

also made easy the evaluation process since the system, the e-quiz program, automatically calculated the points.

Some students stressed that they did not like to take quizzes via the Internet due to the following reasons: not being able to concentrate on the questions in the laboratory atmosphere, inappropriateness of solving problems in front of a monitor, losing time writing the questions on paper and the negative transfer of the habit of solving problems on paper.

Taking the quizzes in a lab synchronously was the most frequently stated problem, since their concentration was lost with an arising problem like errors in the user code or password, and even being able to see the answers of other students from their monitors, or any other matters lived in the lab.

The observation results also reveal the problems arising from taking quizzes in a computer laboratory, synchronously. The students seemed to not enough computer competencies to take quizzes via the Internet. They did not know how to use the calculator program of the operating system loaded on the computer. Some of them even did not know the address of the course web site. There were also some problems arising from the nature of the e-quiz software. For example, by just pushing the "enter" key, the answers to the quiz are directly sent to the system, without any confirmation. A student sent her answers in this way accidentally. In addition to these, any problem such as password rejection hindered that student who lived the matter taking the quiz via the Internet, and s/he turned to paper and pencil quiz. Such problems generally affected the other students' concentrations around.

Besides the delivery mode, the students pointed out that the quizzes did not provide a real feedback and correction for them, although the quizzes are supposed to provide students with feedback and correction in their learning process, as a kind of formative evaluation. They relate this matter to the nature of the quiz questions. The questions were multiple-choice and selecting the right option was the only criterion to be successful. The students believed that they did

not have the chance to get feedback and correction because their ways of problem solution were not checked and corrected. The students also wished to take points from the ways of problem solution.

As another feedback and correction problem, the students were frustrated by the fact that the questions asked in the quizzes and their correct answers were neither published in the course Web site, nor discussed in the classroom. Thus, they believed that the quizzes did not contribute to their learning while it was supposed to provide feedback and correction.

The students stated that taking quizzes via the computer was not appropriate since quiz problems required solving on paper and many calculations.

Half of the students chose not to agree to take the quizzes via the Internet at the same place and at the same time. They proposed that in the case of the quizzes being continually delivered via the Internet, it would be more practical to take the quiz from any location at any desired time during the quiz week.

There is a lack of orientation in terms of efficient using of the course Web site, interactive materials, and PowerPoint presentations for self-paced learning in the course Web site. As Meyen and Lian (1997) stated, orientation involves establishing the conditions for communication, setting rules and articulating expectations. Orientation is needed by the students especially since they were in their fist grade, unfamiliar to taking such technology-supported courses.

5.2 Implications for Practice

Mariola and Manley (2002) proposed that the necessary ingredients for a successful distance learning course are (a) a sufficient level of comfort with this form of instruction by both faculty and students, (b) the availability of technical

support, (c) frequent communication for monitoring learning, detailed presentation of topics and (d) new means for assessing learning. These issues could be considered while enhancing the courses with the Web as well. Both the instructor and the students should have sufficient computer competency (¶ 26). Technical support for the instructor to maintain the course Web site and to produce materials is also necessary. The instructors giving Web-enhanced courses should communicate with students online especially for giving feedback/correction to students in the form of forum or e-mail. Finally, since the instructional method and students' roles change, the assessment techniques should also be changed.

The course Web site should be developed with a systematic approach. The services which are promised by the Web site, should be given without corruption. In addition, the services should be updated regularly. Otherwise, the students lose their trust towards the Web site and do not want to visit it anymore. The information flow about the course should be provided with some services such as bulletin boards. The communication tools to increase student-student and student-instructor interactions should be available such as a listserv for the course, or a chat room for the students. This will provide for collaboration among the students, and ease in taking feedback and correction from the instructor and the assistants. In fact, not only does Web-based instruction need to follow good instructional design principles, but it needs to conform to good teaching practices and sound Web design principles as well, which also involve regular updating (Rice, McBride and Davis, 1998, ¶ 37).

As far as the interactive materials are concerned, the students believe that these materials should be in a real instructional material format like tutorials. About Web-based instruction, Rice, McBride, and Davis (1998) stated that "Creating good Web-based Instruction is not simply putting lecture notes online nor is it merely creating a virtual library of links to content related sites. It includes ensuring that good instructional, teaching, content, cognitive, visual,

and usability design principles are followed as well as ensuring that it fulfills both teacher and student needs." (¶ 41).

So in order to provide students with supportive materials via the Web site, the instructor should study with a team including programmers, instructional designers, instructional technologists, subject matter experts, and even some students from the target group. Such a team should apply the most proper instructional design model to design, develop and publish those materials to going beyond preparing an electronic reference material. The pilot implementations should be evaluated critically to revise the materials. At the end of such a process, the materials should be presented for the use of the students.

For the online assessment, some software could be adopted or improved to enable the students to take the quizzes anywhere and anytime via the Internet. The feedback and correction strategies should be planned and implemented in a way that they contribute students' learning by diagnosing to what extent the students master a concept rather than only grading them in a competitive way.

For a successful implementation of Web-enhanced instruction, any extensive course management system, or learning management system in the market, should be selected and used. As Nicholas and Laudato (1999) indicated, given a well-supported tool that enables faculty to use Web for on-campus course enhancement, without requiring extensive technical knowledge, faculty will respond positively by implementing the tool (¶ 58). Most of those programs have services to provide pedagogical approaches to the Web-based instruction without burdening to the instructor with coding or planning those services. Providing communication and presenting course materials is effective with those course management system programs.

If the course management system is to be designed and developed starting from zero, a proper software design model, and instructional design model should be adopted in order to develop sound and easily used educational software.

5.3 Implications for Research

This study described students' perceptions about Web-enhanced instruction applied in the General Chemistry course in a state university. The experiences of the students: positive aspects, difficulties lived, usage, and their expectations about the Web site, the Web-based supportive materials, PowerPoint presentations both used in the lectures and for self-paced learning, and online assessment were investigated in depth.

However, in order to generalize the results of this present study to other Web-enhanced courses, the research questions given in the first chapter could be studied with more divergent samples. For instance, similar studies can be carried out with different courses and with different implementations to enhance the methods of course. In this way, differences in students' perceptions to different Web-enhanced courses and different Web-based supportive materials can be investigated, and a comparison between the implementations can be possible.

Moreover, to deeply analyze the perceptions of the students about such new implementations to instruction and the factors affecting their perceptions multiple research methods should be used: using both qualitative and quantitative methods within the same research study. For instance, besides the focus group interviews and the evaluation questionnaire, observation of instruction, and students' self-paced learning, use of think-aloud protocols can be very useful in identifying the factors that affect a successful Web-enhanced instruction or Web-based materials. In addition, a more frequent data collection schedule may be fixed to collect more specific feedback about the new materials and implementations. For example, weekly online questionnaires that consist of two or three questions may be more meaningful and easy for students to answer than a long questionnaire at the end of a term. These methods of data collection can closely monitor the difficulties that the learners face and their expectations as well as other environmental factors on experiencing implementations or use of

materials. They also help the researcher diagnose where the problems are coming from.

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APPENDIX A

INTERIEW GUIDE
(GÖRÜŞME REHBERİ)

Görüşme saati: _____
Görüşme süresi: _____

Arkadaşlar,
Bu dönem Genel Kimya dersinde web olanakları kullanılarak size bazı materyaller size sunuldu.
Dersin web sitesi, web sitesinde bulunan interaktif materyaller ve PowerPoint gösterilerinin ve internet üzerinden yapılan quizlerin etkinliğini araştırdığımız bir çalışma yapmaktayız. Bu konudaki görüşlerinizi almak amacıyla biraraya gelmiş bulunuyoruz. Sizin görüşletiniz, deneyimleriniz ve beklentileriniz değerlendirmenin en önemli kaynağı olup bu derste bundan sonraki uygulamalara ışık tutacaktır.

Görüşmemizde desrin web sitesi, sitede bulunan interaktif materyaller, PowerPoint gösterileri ile dersin işlenişi ve e-quizler hakkındaki görüşlerinizi alacağım.

Genel Kimya Web Sitesi

1. Genel Kimya web sitesine nereden bağlanıyorsunuz? Web sitesindeki materyallere nasıl bir ortamda çalışıyorsunuz?

2. Ne zaman kullandınız?
3. İnternet bağlanız nasıldı? Hızlı/yavaş
4. Web sayfasına bağlandığınız ortamı ortamı tarif eder misiniz, ses, ışık, ısınma, rahatlık açısından?
5. Sizce Genel Kimya web sitesinin ilk aklınıza gelen en iyi yönleri nelerdir?
6. Sizce Genel Kimya web sitesinin en zayıf yönleri nelerdir?

7. Genel Kimya web sitesindeki öğeler hakkında ne düşünüyorsunuz? (My Profile, Grades, Dates/Places, Quiz, Assessment, Syllabus, Lectures, Laboratory, Problems, Contacts, Ask a question, Forum, Chat Room)
8. Genel Kimya web sitesinde dolaşıken karşılartığınız herhangi bir sorun oldu mu? Örnekler verebilir misiniz?
9. Genel Kimya web sitesinin daha etkili ve fonksiyonel olması için önerileriniz nelerdir?
10. Geliştirilse iyi olur dediğiniz öğeler nelerdir?
11. İşe yaramadığını düşündüğünüz öğeler var mı? Nelerdir?

Dersin Web Sitesndeki Destekleyici Materyaller

a. Powerpoint Gösterileri

1. Web sitesinde bulunan Powerpoint gösterileri hakkında ne düşünüyorsunuz?
2. Powerpoint gösterilerini ne amaçlarla kullandınız?
3. Powerpoint gösterilerini nasıl çalışıyorsunuz? Süreç nasıl gerçekleşiyor?
4. PowerPoint gösterilerinde size en çekici gelen şey nedir/ nelerdir?
5. Powerpoint gösterilerinde size en sıkıcı gelen şey nedir?
6. Powerpoint gösterilerini çalışırken herhangi bir güçlükle karşılaştınız mı? Örnekler verebilir misiniz?
7. Sınıfta anlamadığınız bir konuyu Powerpoint gösterilerinden kendiniz çalıştığınızda ne güşündünüz?
8. Dersi iyi öğrendiğiniz bir konuyu PowrpPoint gösterilerinde çalıştığınız da ne düşündüngüz?
9. Powerpoint gösterilerinin bireysel bir çalışma materyali olarak daha etkili olması için
neler yapılmalıdır?

b. İnteraktif materyaller

1. Web sitesinde bulunan İnteraktif materyaller hakkında ne düşünüyorsunuz?
2. İnteraktif materyalleri ne amaçlarla kullandınız?
3. İnteraktif materyalleri nasıl çalışıyorsunuz? Süreç nasıl gerçekleşiyor?
4. İnteraktif materyallerde size en çekici gelen şey nedir/ nelerdir?
5. İnteraktif materyallerde size en sıkıcı gelen şey nedir?
6. İnteraktif materyalleri çalışırken herhangi bir güçlükle karşılaştınız mı? Örnekler verebilir misiniz?
7. İnteraktif materyallerde öğrenmeyi kolaylaştıracak ne gibi şeylere ihtiyaç duyuyorsunuz?

Sonda 1: Çalıştığınız materyallerin amacını anlıyor musunuz?

Sonda 2: Materyallerde herhangi bir konuyu anlamakta güçlük çektiğinizde ne yapıyorsunuz?

Sonda 3: Materyalerde konuya giriş, özet gibi öğeler var mı?

Sonda 4: Konuyu öğrenip öğrenmediğinizi sınayacağız öğeler var mı?

8. Sınıfta anlamadığınız bir konuyu İnteraktif materyallerden çalıştığınızda ne güşündünüz?
9. Dersi iyi öğrendiğiniz bir konuyu İnteraktif materyallerden çalıştığınız da ne düşündüngüz?
10. İnteraktif materyallerin bireysel bir çalışma materyali olarak daha etkili olması için neler yapılmalıdır?

c. *İnteraktif Materyaller içinde Yeralan Animasyonlar*

1. Animasyonlarda en sevdiğiniz yönler nelerdi?
2. Animasyonlarda en sevmediğiniz yönler nelerdi?
3. Animasyonlarda sizi rahatsız eden herhangi bir öğe var mıydı? Örnekler verebilir misiniz?
   - Sonda 1: Animasyonların amacını amacını anlayabildiniz mi?
   - Sonda 2: Animasyonlara ait yazılar okunaklı mıydı?
   - Sonda 3: Animasyonların renklerini ve biçimlerini nasıl buldunuz?
4. Animasyonların sizce öğrenmeye katkısı var mıdır? Neden?
5. Animasyonların anlatılan konuyla ilişkisi hakkında neler düşünüyorsunuz?
6. Sizce Kimya kavramlarını daha iyi öğretebilmek için animasyonlar nasıl hazırlanmalı?
   - Sonda 1: Daha iyi olması için neler yapılmalı?

Dersin İşlenişi

1. Genel Kimya dersinde karşılaştığınız sorunlar oldu mu? Bu sorunlar nelerdir?

e-quizler

1. Dönem boyunca yapılan e-quizler hakında neler düşünüyorsunuz?
   - Sonda 1: Avantajları nelerdir?
   - Sonda 2: Dezavantajları nelerdir?

Sorularım bu kadar. Katkılarınız için çok teşekkürler.

APPENDIX B

THE EVALUATION OF WEB-ENHANCED INSTRUCTION IN GENERAL CHEMISTRY QUESTIONAIRE (GENEL KİMYA DERSİ KAPSAMINDAKİ WEB-DESTEKLİ UYGULAMALARI DEĞERLENDİRME ANKETİ)

A. Genel Bilgiler

1. Cinsiyetiniz : ☐ Erkek ☐ Kadın
2. Bölümünüz : ☐ Kimya ☐ Kimya Öğretmenliği

3. Mezun olduğunuz lise :

_____

4. Bölümünüze girişte geçerli ÖSS (Sayısal) puanınız : _____
5. Bölümünüz ÖSS tercih sıralamanızda kaçıncı tercihinizdi? _____

6. CGPA (Genel Ortalamanız): _____
7. Kimya 105 dersinden hangi notu aldınız? (Harf olarak yazınız.)

_____

8. Kendinizi bilgisayar kullanıcısı olarak hangi düzeyde hissediyorsunuz?
☐ Başlangıç düzeyinde ☐ Orta düzeyde ☐ İleri düzeye yakın ☐ İleri düzeyde

9. Kimya 106 dersinin yaklaşık yüzde kaçına devam ettiniz?
☐ %75 - %100 ☐ %50 - %75 ☐ %25-%50 ☐ %25'ten az

10. Derse devam oranınız düşük ise bunun nedenleri nedir?
☐ Derste konuları anlayamadığım için
☐ Kitaptan kendim çalıştığımda daha iyi öğrendiğim için
☐ Dersler sabah çok erken saatte olduğu için
☐ Derste sağlıklı bir şekilde not tutamadığım için

☐ Ders ağırlıklı olarak PowerPoint ile işlendiği için
☐ Ders ilgimi çekmediği için
☐ Diğer: _____

11. Kimya 105-106 web sitesine nerelerden ve ne sıklıkta bağlandığınızı aşağıdaki tabloda işaretleyiniz.

Web sitesine bağlanılabilecek yerler	Her zaman	Sık sık	Bazen	Nadiren	Hiçbir Zaman
Kampüsdeki bilgisayar laboratuarlarından					
Evdeki bilgisayardan					
Yurt odamdaki bilgisayardan					
İnternet Cafe'lerden					
Diğer: _____					

12. Kimya 105-106 web sitesinde yer alan aşağıdaki her bir öğenin yanındaki boşluğa 1'den 7'ye kadar numara vererek önem sırasına göre sıralayınız. (1=En iyi, 2= Daha az iyi, ...)

__ Lectures
__ Problems
__ Contacts
__ Interactive
__ Grades
__ Ask a question
__ e-Quiz

B. Genel Kimya Derslerini Değerlendirme Anketi

Aşağıdaki ifadelere Genel Kimya dersinin işlenişini ve bu derslerin web sitesini dikkate alarak ne derece katıldığınızı, ifadenin yanında bulunan boşluklara verilen seçeneklerden size en uygun gelen yalnız birini "X" simgesi ile işaretleyiniz.

Görüşler

	Kesinlikle Katılıyorum	Katılıyorum	Kararsızım	Katılmıyorum	Kesinlikle Katılmıyorum
1. Web sitesindeki PowerPoint gösterileri ders çalışırken yararlı oldu.					
2. Powerpoint gösterileri ders çalışma kaynağı olarak yüzeyseldi.					
3. Powerpoint gösterileri tasarım (renklerin seçimi, yazı ve şekil büyüklüğü, vb.) açısından iyiydi.					
4. Dersin PowerPoint gösterileriyle işlenmesinden hoşnut oldum.					
5. Derste, anlamadığım konularla ilgili hocaya soru sorma fırsatım oldu.					
6. Derse uzun süre dikkatimi veremedim.					
7. Hocanın soyut konuları web sitesindeki şekil ve animasyonlarla göstererek anlatması, konuları kavramama yardımcı oldu.					
8. Derste örnek problemlerin nasıl çözüldüğünü anladım.					
9. Dersin Powerpoint gösterileriyle işlenmesi konuları öğrenmemde yararlı oldu.					
10. Derste yeterli düzeyde öğrenci-hoca etkileşimi vardı.					
11. Derste gösterilen metin, resim ve animasyonlar her uzaklıktan açık, anlaşılır ve okunaklıydı.					

	Kesinlikle Katılıyorum	Katılıyorum	Kararsızım	Katılmıyorum	Kesinlikle Katılmıyorum
12. İnteraktif materyaller konuları kavramama yardımcı oldu.					
13. İnteraktif materyalleri severek çalıştım.					
14. Hakkında önbilgim olmayan konuları İnteraktif materyallerden çalışarak rahatlıkla öğrendim.					
15. İnteraktif materyaller tasarım (renklerin seçimi, yazı ve şekil büyüklüğü, vb.) açısından iyiydi.					
16. İnteraktif materyaller işlediğimiz konulardaki eksiklerimi fark etmemde yardımcı oldu.					
17. İnteraktif materyallerde sayfalar tüm alt konulara istediğim an erişebileceğim yapıdaydı.					
18. İnteraktif materyallerde konu anlatımı anlaşılır ve akıcıydı.					
19. Animasyonlar ilgimi çekecek nitelikteydi.					
20. Animasyonların amacını ve çalışma şeklini rahatlıkla anladım.					
21. Animasyonlar, uygulayarak öğrenmemi sağladı.					
22. Animasyonlar soyut kavramları kitaptaki resimlerden daha iyi sergiledi.					
23. Animasyonlar sayesinde Kimya kavramlarını anladığımı hissetim.					
24. Animasyonları açmakta ve kullanmakta zaman zaman sorun yaşadım.					
25. Animasyonların hemen hemen hepsini çalıştırıp izledim.					
26. Animasyonlar tasarım(renk, biçim, büyüklük vb. Özellikler) açısından iyi hazırlanmıştı.					

	Kesinlikle Katılıyorum	Katılıyorum	Kararsızım	Katılmıyorum	Kesinlikle Katılmıyorum
27. Animasyonları çalıştırınca kendimi deney yapmış gibi hissettim.					
28. Quizlerin İnternet üzerinden yapılmasından hoşlandım.					
29. Quizler her hafta düzenli çalışmamı sağladı.					
30. Quizler konuları ne kadar öğrendiğimi ölçecek nitelikteydi.					
31. Quizlerde doğru yanıtı genellikle şans eseri buldum.					
32. Quizler, işlediğimiz konulardaki eksikliklerimi görmemi sağladı.					
33. Web sitesinde linkler sağlıklı bir şekilde çalışıyordu.					
34. Web sitesi düzenli olarak güncellendi.					

Öneri ve Beklentiler

	Kesinlikle Katılıyorum	Katılıyorum	Kararsızım	Katılmıyorum	Kesinlikle Katılmıyorum
1. Powerpoint gösterilerini ve İnteraktif materyalleri rahat bir şekilde diskete/bilgisayarıma kaydedebilmeyi isterim.					
2. Powerpoint gösterilerinin ve İnteraktif materyallerin yazıcıdan çıktısını rahat bir şekilde almak isterim.					
3. Hocanın derste soruları yorum yaparak ve aşama aşama tahtada çözmesini isterim.					
4. Web sitesinde her konu ile ilgili animasyonlar görmek isterim.					

	Kesinlikle Katılıyorum	Katılıyorum	Kararsızım	Katılmıyorum	Kesinlikle Katılmıyorum
5. Dersin not tutabileceğim bir şekilde işlenmesini beklerim.					
6. Quizlerde soruların çözüm yollarından puan almak isterim.					
7. İnternet üzerinden verilen quizleri istediğim yer ve zamanda almayı tercih ederim.					
8. Quizlerden sonra, sorulan soruları ve çözümlerini dersin web sitesinde görmek isterim					
9. Quizleri İnternet'ten almak yerine kağıt üzerinde quiz almayı tercih ederim.					
10. İnteraktif materyallerde konuların daha kapsamlı yer almasını beklerim.					
11. Web sitesinde Kimya ile ilgili güncel bilgilerin yer almasını isterim.					
12. Web sitesinde Kimya ile ilgili deney programlarının ve eğitim amaçlı oyunların yer almasını isterim.					
13. Web sitesindeki materyallerin ve problem çözümlerinin ders notu ve CD şeklinde satılmasını isterim.					
14. Eski ara sınav/final soru ve cevaplarının web sitesinde yer almasını isterim.					
15. Animasyonlarda değişkenleri değiştirdiğimde olup bitenleri anlatan açıklama ya da grafik olmasını isterim.					

Genel Kimya dersi web sitesi, dersler kapsamındaki web-destekli materyaller ve uygulamalar ile ilgili eklemek istedikleriniz:

_____

_____

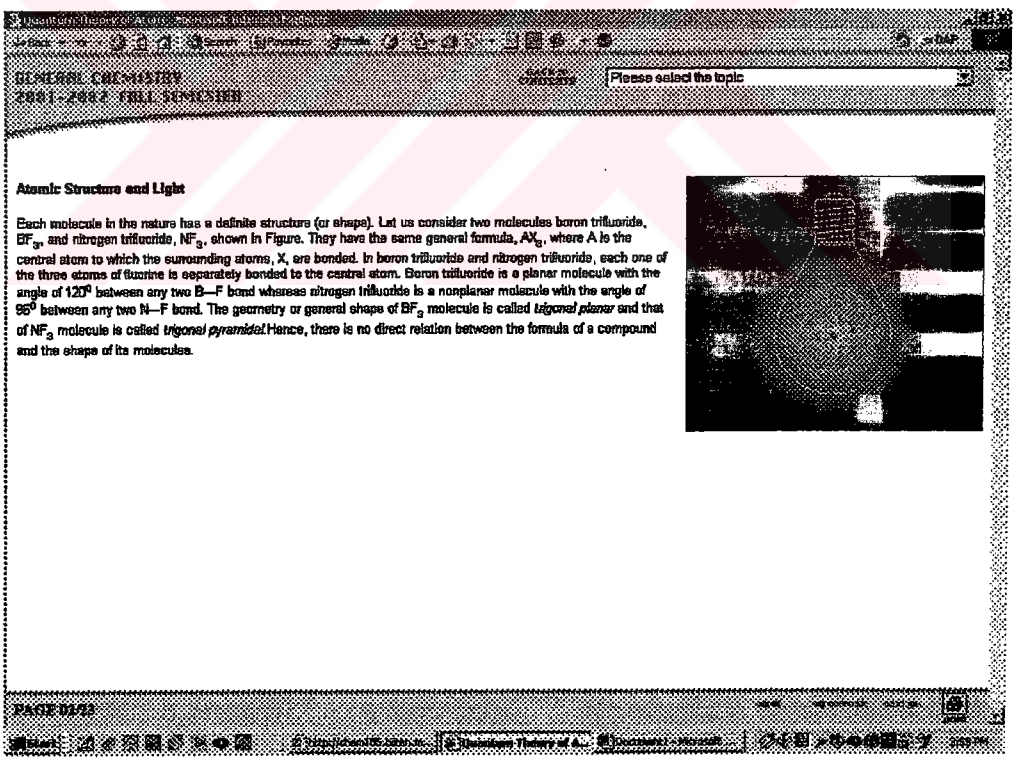
Anket bitti. Katkılarınız için çok teşekkür ederiz.

APPENDIX C

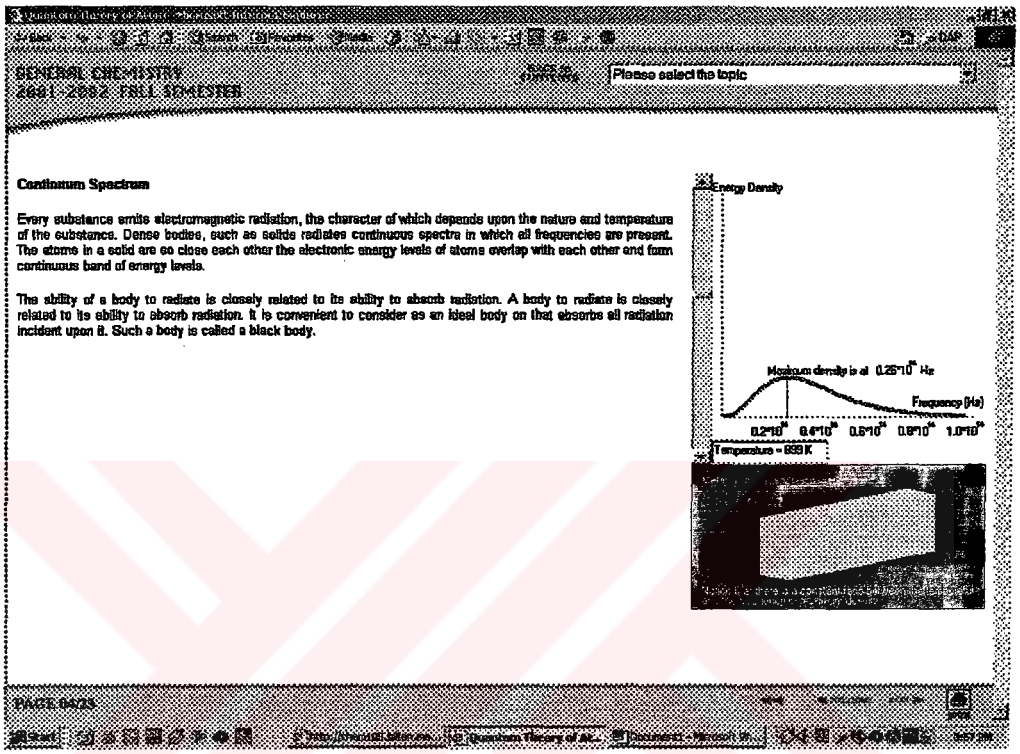
SOME OF ANIMATIONS IN THE INTERACTIVE MATERIALS

Module I: Quantum Theory of Atom

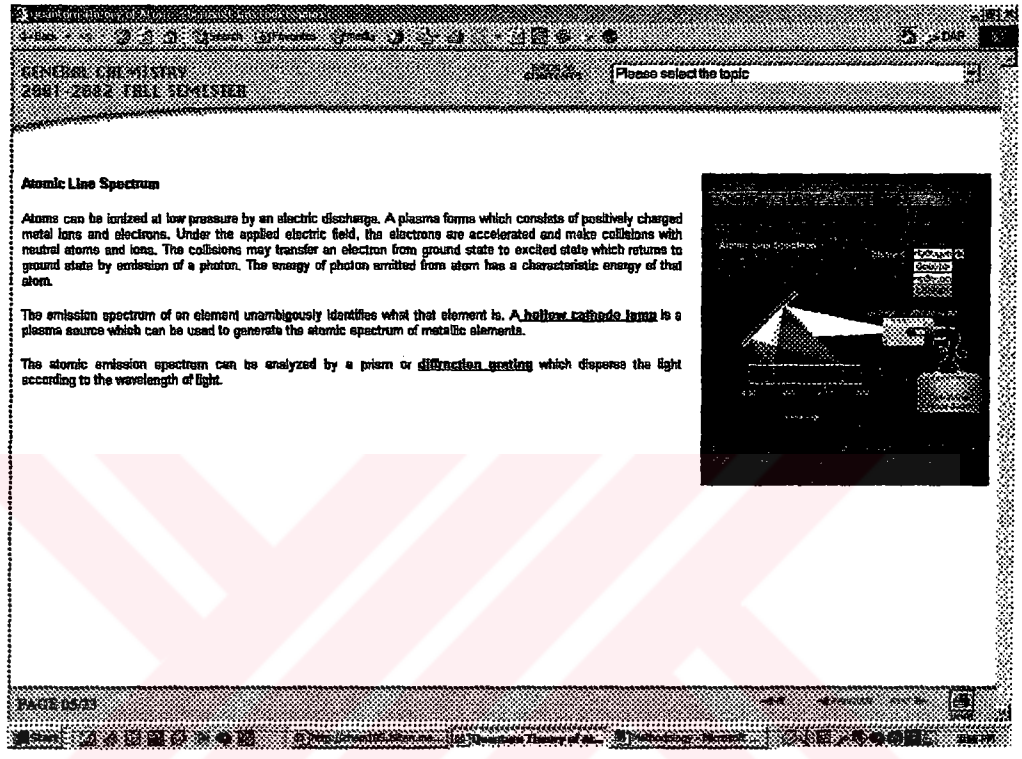
1. Atomic Structure and Light



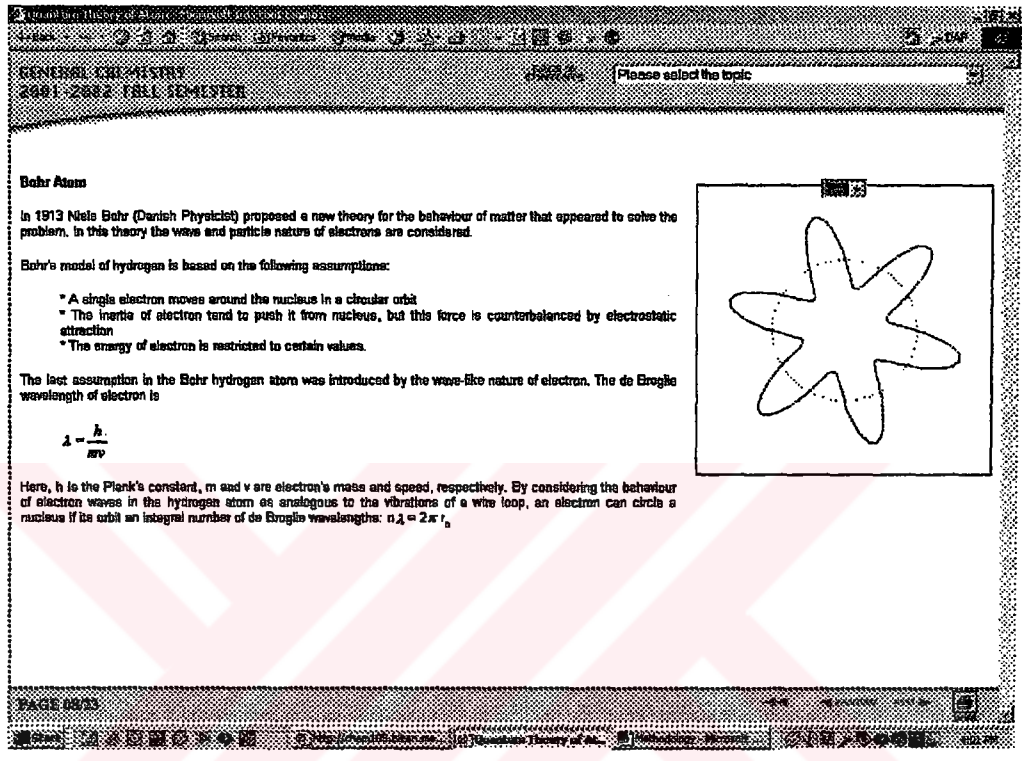
2. Continuum Spectrum



3. Atomic Line Spectrum

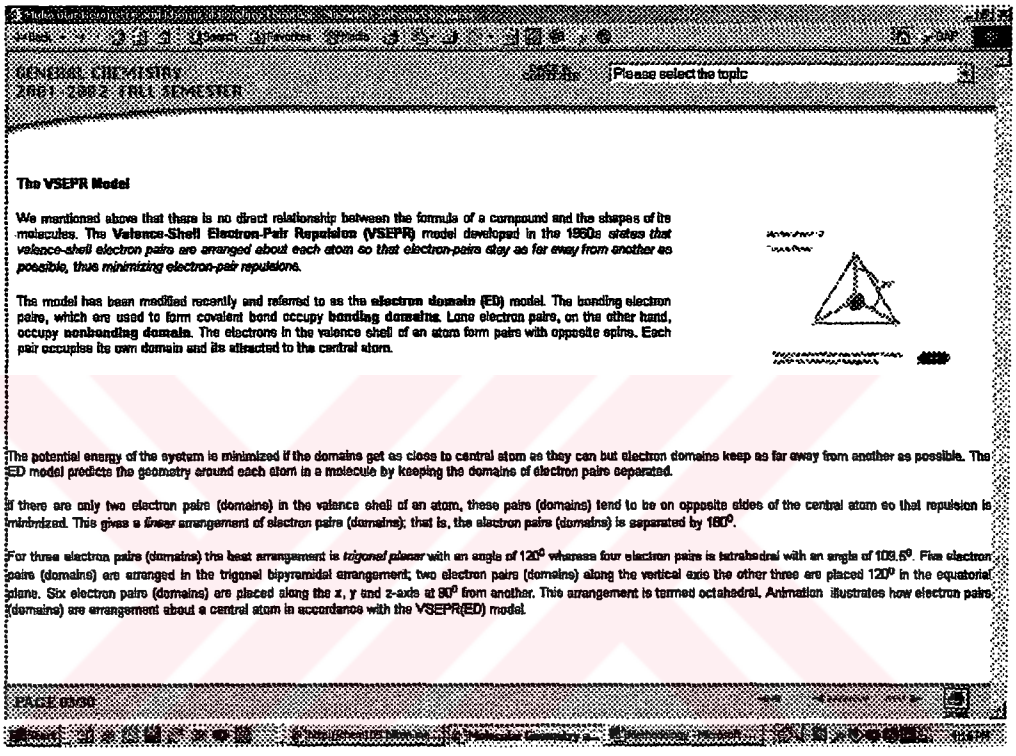


4. Bohr Atom

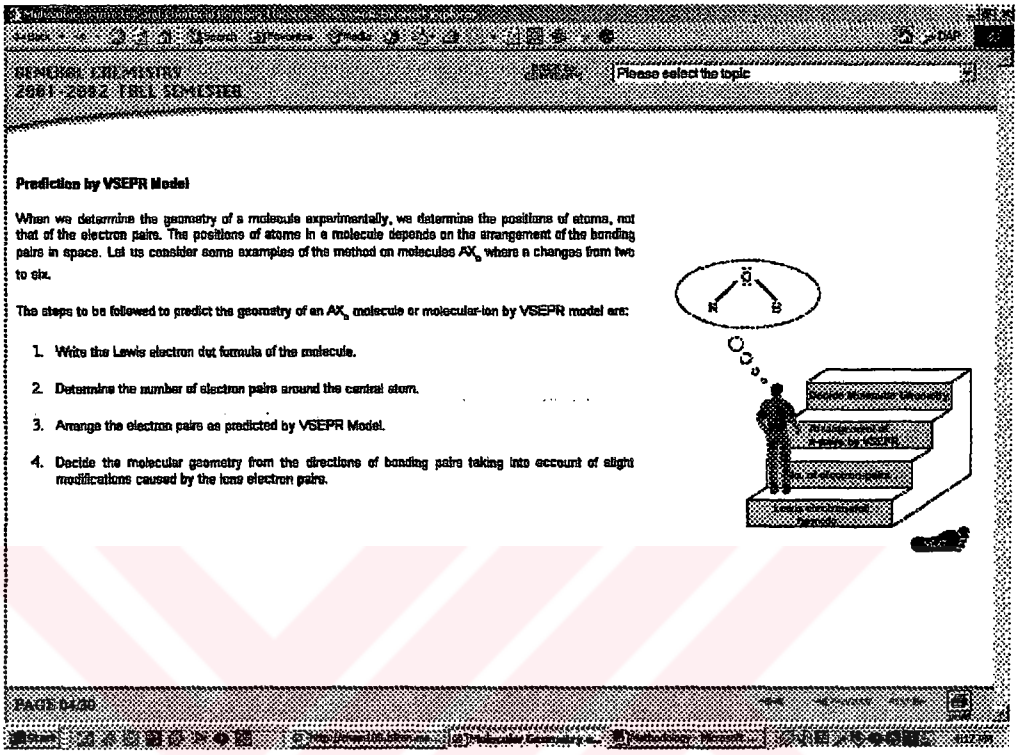

GENERAL CHEMISTRY
2001-2002 FALL SEMESTER
Please select the topic
Bohr Atom
In 1913 Niels Bohr (Danish Physicist) proposed a new theory for the behaviour of matter that appeared to solve the problem. In this theory the wave and particle nature of electrons are considered.
Bohr's model of hydrogen is based on the following assumptions:
* A single electron moves around the nucleus in a circular orbit
* The inertia of electron tend to push it from nucleus, but this force is counterbalanced by electrostatic attraction
* The energy of electron is restricted to certain values.
The last assumption in the Bohr hydrogen atom was introduced by the wave-like nature of electron. The de Broglie wavelength of electron is
$\lambda = \frac{h}{mv}$
Here, h is the Plank's constant, m and v are electron's mass and speed, respectively. By considering the behaviour of electron waves in the hydrogen atom as analogous to the vibrations of a wire loop, an electron can circle a nucleus if its orbit an integral number of de Broglie wavelengths: $n\lambda = 2\pi r_n$
PAGE 03/03

Modul II: Molecular Geometry

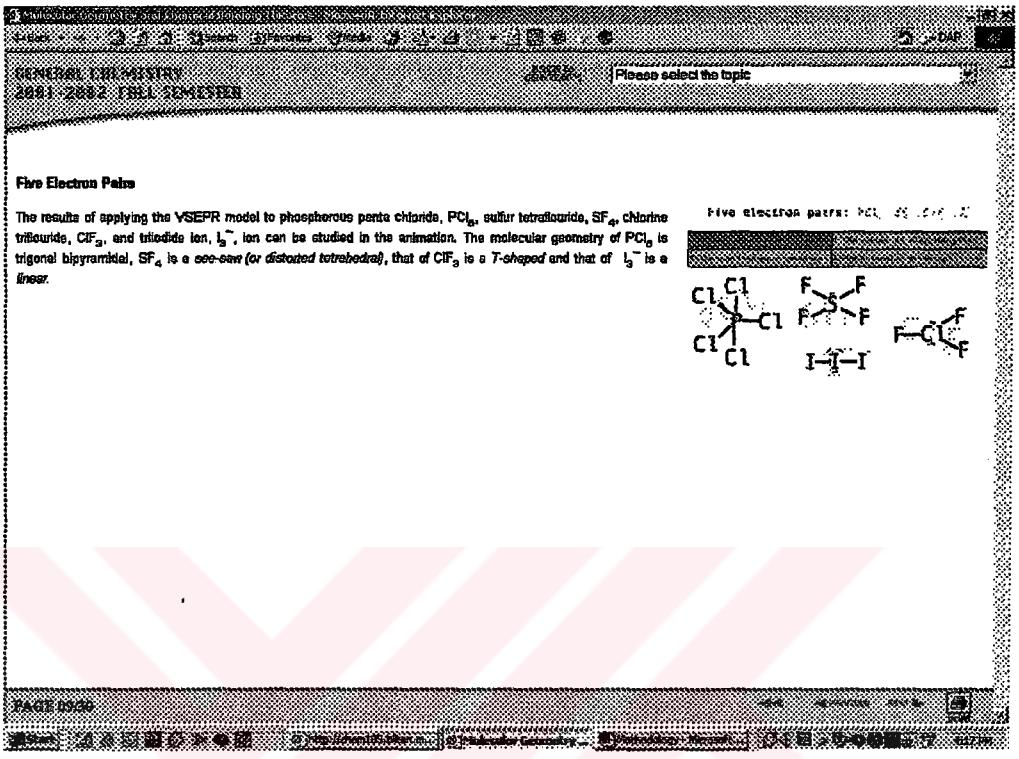
1. VSPER Model



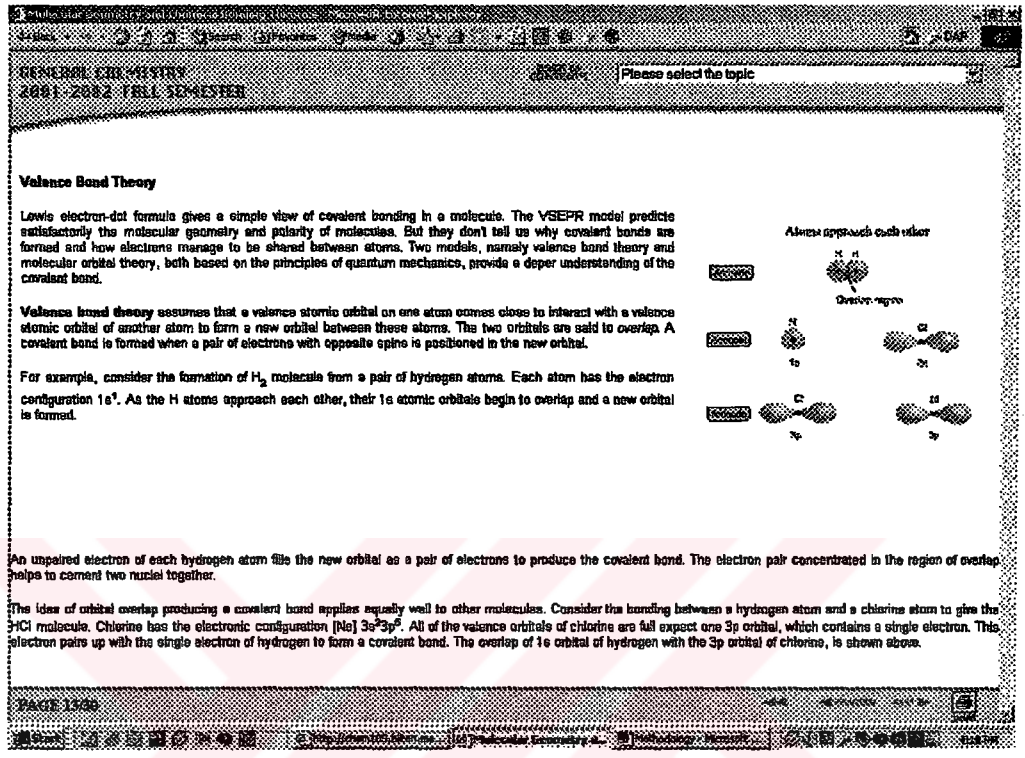
2. Prediction by VSPER Model



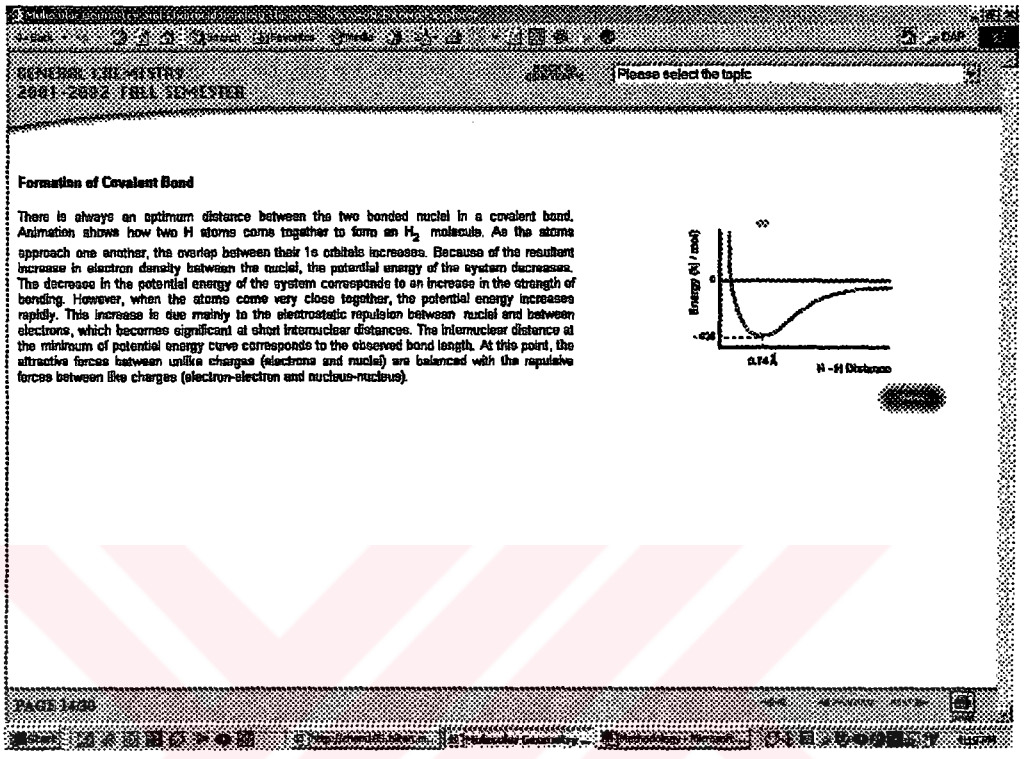
3. Five Electron Pairs



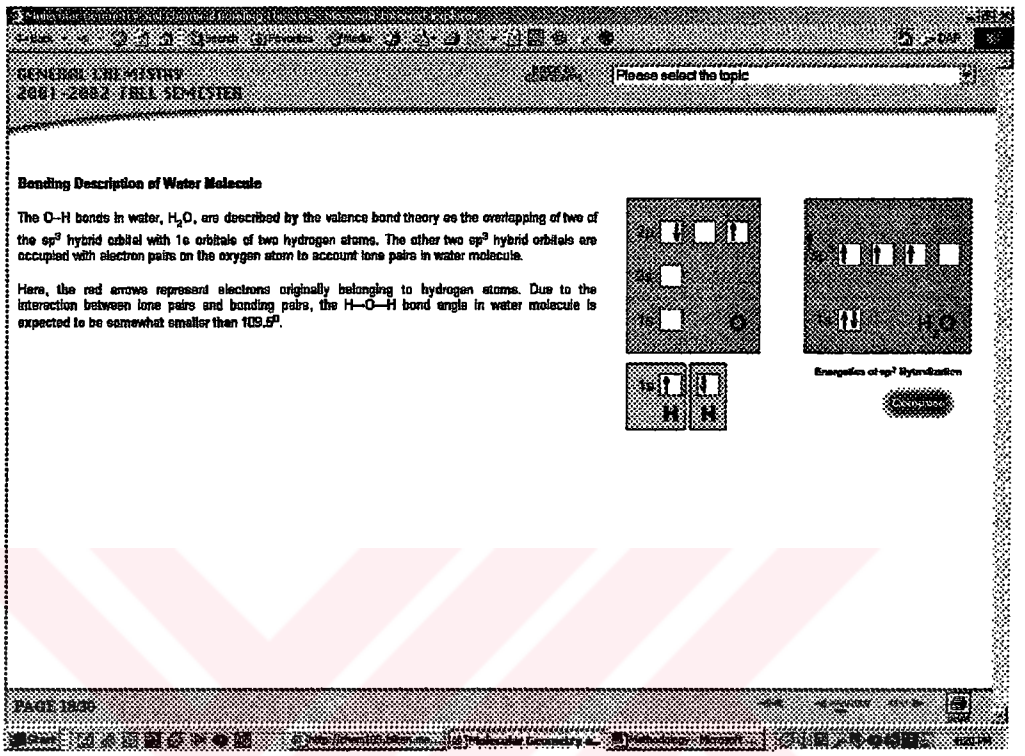
4. Valence Bond Theory



5. Formation of Covalent Bond



6. Bonding Description of Water Molecule



APPENDIX D

QUIZ OBSERVATION FORM

	Student 1	Student 2	Student 3
Was there a problem entering the quiz? -password problem -pc problem			
What did he/she have on the desk for quiz? Paper Pencil Hand calculator			
How did he/she solve the problem? - Wrote the question on the paper - Read the question loudly - Repeated reading - Use hand calculator - Use computer's calculator			
How often did they ask for help?			
Did they satisfy with help?			
Did they solve the problem related to using the program?			
Other			